



**EFFECTS OF RWANDA DAIRY DEVELOPMENT PROJECT (RDDP) ON
IMPROVING LIVELIHOODS OF DAIRY FARMERS IN RWANDA; A CASE OF
NYABIHU DISTRICT IN WESTERN PROVINCE**

AN

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A REPORT OF THE 3-MONTHS INTERNSHIP

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DEDICATION

I dedicate this research to God and to the rural farmers who are trying so well to improve their livelihoods with the limited assets they possess.

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ABBREVIATIONS

AfDB: African Development Bank

AI: Artificial Insemination

DFID: Department for International Development

EDPRS: Economic Development and Poverty Reduction Strategy

EICV: Integrated Household Living Conditions Survey (*Enquête Intégrale sur les Conditions de Vie des Ménages*)

FAO: Food and Agriculture Organization (of the United Nations)

GDI: Gender Development Index

GDP: Gross Domestic Product

GDPPs: Good Dairy Production Practices

GoR: Government of Rwanda

HDI: Human Development Index

HPI: Heifer Project International

MINAGRI: Ministry of Agriculture and Animal Resources

MINECOFIN: Ministry of Finance and Economic Planning

NIS: National Institute of Statistics

NISR: National Institute of Statistics of Rwanda

RDDP: Rwanda Dairy Development Project

SNV: Netherlands Development Organization

SPIU: Single Project Implementation Unit

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EXECUTIVE SUMMARY

The dairy subsector of the agriculture sector in Rwanda is crucial for rural development, poverty reduction, nutrition improvement and food security. It offers a pathway, out of poverty for the large number of households keeping livestock and those who provide services and add value throughout the supply chain. The dairy subsector is the largest segment of the livestock unit in Rwanda, which accounts for 10.5 percent of agricultural gross domestic product (GDP) and also the fastest growing subsector within the agriculture sector.

Dairy farmers in Rwanda have faced many challenges. Some of these challenges are limited access to market, low milk production, loss of milk due to inadequate preservation/storage facilities and knowledge, low access to credit, animal diseases, not enough forage, high cost of having a decent cowshed and effects of climate change. These challenges have effects on the livelihoods of the dairy farmers in Rwanda and the Government of Rwanda (GoR) rising up to this challenges has promoted the development of the dairy industry through a number of projects such as the African Development Bank (AfDB)-funded Development of Dairy Cattle and Livestock Infrastructure Projects and the Phases 1 and 2 of the USAID-funded Rwanda Dairy Competitiveness Program (RDGP) etc. Rwanda Dairy Development Project (RDDP), is one such recent intervention projects the GoR, in partnership with the International Fund for Agricultural Development has initiated. With a thought on desired outcome of the Sustainable Development Goals (SDGs), a set of 17-Goals which emphasizes the development of all sectors in all Countries, which has an ultimate focus on improving the living condition and livelihood of every citizen in all countries without the depletion of National resources so as not to jeopardize the coming generations from meeting their own needs of high and quality living conditions, this study aims at assessing the effects RDDP on improving livelihoods of dairy farmers in Rwanda. The study was guided by some specific objectives; to examine the effect of dairy farm ownership on improving livelihoods of the dairy farmers in Nyabihu district; to assess the influence of access to credit on improving livelihoods of the dairy farmers in Nyabihu district; to assess the effect of the contribution of Rwanda Dairy Development Project on improving livelihoods of the dairy farmers in Nyabihu district; and to identify the best practices in climate adaptation strategies outlined by dairy farmers in Nyabihu district.

RDDP is a follow-up of the intervention projects in Rwanda and the overall goal of RDDP is to contribute to pro-poor national economic growth and improve the livelihood of resource-poor rural households. This is envisaged to be achieved by focusing on food security, nutrition and empowerment of women and youth in a sustainable and climate-resilient dairy value chain development. Specifically, the RDDP seeks to increase competitiveness and profitability of the dairy sector for the provision of quality products from small-scale producers to domestic and regional consumers, thus improving their livelihoods, food security and nutrition whilst building overall resilience.

Purposive sampling was used to select Nyabihu District out of the 12 districts that RDDP covers, 6 sectors were selected on purpose because of the existence of Milk Collection Centres while random selection of respondents was done at both the cooperatives and households levels. This is to ensure the representation of beneficiaries and non-beneficiaries of RDDP. A total of 373 sample size was estimated out of the 24,604 dairy farmers in the district, using the sample size calculator. Analysis was done using descriptive statistics, Chi-square and regression analyses. Results show that on farm ownership, dairy farmers who owned and operated their farms themselves (self-owned) have experienced an increase in their income during RDDP and more farmers have moved from renting and joint owning of farms to owning the farms by themselves due to receiving of cows from the project; Dairy farmers now have easy access to credit for their dairy businesses; Several benefits received from RDDP (Trainings, Vaccinations, Semen, Artificial Insemination and Forage seeds) have helped the farmers to have better farming practices which has improved their monthly income; Climate Change affects their farming business, however they recognized some adaption strategies for Climate Change.

Recommendations were given. Part of which are more dairy farmers should be encouraged to join a cooperative for easier to access credits and loans; more effort should go into sensitizing the farmers about the RDDP and the benefits available and more trainings on climate-smart agriculture should continue as well as more information on climate change and effects should be further easily accessed by dairy farmers.

The Rwanda Dairy Development Project (RDDP) has been of benefit to the dairy farmers in Rwanda while improving their livelihoods. This has been achieved through trainings on best dairy farming practices and access to market. If this much could be achieved in just one year of

implementation, much more would be achieved in the coming years of implementation of RDDP.

CHAPTER ONE

INTRODUCTION

1.1 Problem Statement

Intervention projects are part of the solutions that foster development. The International Fund for Agricultural Development (IFAD) has recognized Agriculture as one of the important sectors of a nation that could drive poverty reduction faster. IFAD has invested in rural people, empowering them to increase their food security, improve nutrition of families and increase their incomes. IFAD began this in 1978 and since then have reached about 464 million people in Sub-Saharan Africa, Asia and many other countries through different (intervention) projects. In Rwanda, IFAD started operations in 1981 and has financed projects in various aspects of rural development worth more than \$200 million. Reports on the projects have shown that with access to finance, markets, technology and information, rural people can lift themselves out of poverty. The Rwanda Dairy Development Project (RDDP) is one of the intervention projects of IFAD in Rwanda. This study is an assessment of the first year of the implementation of RDDP on the livelihoods of dairy farmers in Rwanda.

Dairy farmers have faced many challenges in the Rwanda. Some of these challenges are limited access to market, low milk production, loss of milk due to inadequate preservation/storage facilities and knowledge, low access to credit, animal diseases, not enough forage, high cost of having a decent cowshed and effects of climate change. These challenges have effects on the livelihoods of the dairy farmers in Rwanda. The study explores the effect of these challenges on the livelihoods of dairy farmers in Rwanda and also proposes solutions to the effects. Livelihood here is defined basically on the income of dairy farmers in the study area.

About 3 years ago (2015) Country Leaders gathered at the United Nations Assembly to put thoughts together following the expiration of the Millennium Development Goals (MDGs) and they arrived at a conclusion which was tagged Sustainable Development Goals (SDGs), a set of 17-Goals which emphasizes the development of all sectors in all Countries, with an ultimate focus on improving the living condition and livelihood of every citizen in all countries without depletion of National resources so as not to jeopardize the coming generations from meeting their own needs of high and quality living conditions.

Owing to the above, the Government of Rwanda has promoted the development of the dairy industry through a number of projects such as the African Development Bank (AfDB)-funded Development of Dairy Cattle and Livestock Infrastructure Projects and the Phases 1 and 2 of the USAID-funded Rwanda Dairy Competitiveness Program (RDCP). In addition, SNV Rwanda, Heifer International, ‘Send a Cow’ and the recently-completed Bill and Melinda Gates Foundation-funded East African Dairy Development Project, have supported dairy development in Rwanda. The projects are being implemented in 17 districts selected for the RDCP II across the five milk-sheds in Rwanda. Since the National Dairy Strategy (NDS) was developed after wide consultation of stakeholders, most of the projects supported by development partners fit under the NDS framework which emphasizes the importance of public-private-producer partnerships. These intervention projects are targeted at fostering cordial relationships among rural farmers, increase milk production and productivity in the country as well as increasing the income of the producers.

The study then seeks to answer the following questions:

1. What is the effect of dairy farm ownership on improving livelihoods of the dairy farmers in Nyabihu district?
2. What is the influence of access to credit on improving livelihoods of the dairy farmers in Nyabihu district?
3. What is the effect of the contribution of Rwanda Dairy Development Project on improving livelihoods of the dairy farmers in Nyabihu district?
4. What are the best practices in climate adaptation strategies outlined by dairy farmers in Nyabihu district?

1.2 Objectives of the Study

The overall objective of the study is to assess the effects of the Rwanda Dairy Development Project (RDDP) on improving livelihoods of the dairy farmers in Nyabihu District, Western Province, Rwanda.

1.2.1 Specific Objectives are:

1. To examine the effect of dairy farm ownership on improving livelihoods of the dairy farmers in Nyabihu district.

2. To assess the influence of access to credit on improving livelihoods of the dairy farmers in Nyabihu district.
3. To assess the effect of the contribution of Rwanda Dairy Development Project on improving livelihoods of the dairy farmers in Nyabihu district.
4. To identify the best practices in climate adaptation strategies outlined by dairy farmers in Nyabihu district.

1.4 Justification for the Study

Having stated the challenges facing the dairy farmers in Rwanda, the study would reveal the effects of the challenges on the livelihoods of dairy farmers in the study area. Interactions with the dairy farmers would foster gaining insights into the challenges they face, as well as birthing solutions and recommendations to specific issues. This would be published to the Ministry of Agriculture and Animal Resources (MINAGRI), Rwanda. The findings of the study would inform/influence policies in the dairy sector. Also, the study would serve as baseline for the Rwanda Dairy Development Project (RDDP).

1.5 Scope of the Study

The study was conducted amongst the dairy farmers in the study area. While seeking to know the effects of RDDP on the beneficiaries' livelihoods, non-beneficiaries of the project as at the time of research were also examined. Respondents were picked at random across the four Milk Collection Centres (MCCs) at Nyabihu district.

1.6 Outline of the Study

Chapter one is the introductory chapter and focuses on the problem and objectives of the study being carried out. Information about the International Fund for Agricultural Development (IFAD) is given. IFAD is a funding partner with Government of Rwanda on RDDP. Chapter two contains the background to the study and gives sufficient information on RDDP with an elaborate explanation of the outcomes desired. Chapter three gives a review of the contributions of scholars who have worked on similar conceptual issues. Chapter four gives the description of the study area, methods of data collection and how the data were analysed. Chapter five contains

the findings made with results being discussed and interpreted in relation to livelihoods. Chapter Six then provides the summary of the study, while concluding with some recommendations.

CHAPTER TWO

BACKGROUND OF THE STUDY

2.1 Description of the Rwanda Dairy Development project

The overall goal of RDDP is to contribute to pro-poor national economic growth and improve the livelihood of resource-poor rural households. This will be achieved by focusing on food security, nutrition and empowerment of women and youth in a sustainable and climate-resilient dairy value chain development. Specifically, the project seeks to increase competitiveness and profitability of the dairy sector for the provision of quality products from small-scale producers to domestic and regional consumers, thus improving their livelihoods, food security and nutrition whilst building overall resilience. The Rwanda Dairy Development Project does not have a baseline study as of now.

The specific objectives will aim at the following:

- Sustainably intensify dairy production and productivity among participating smallholder farmers. This shall be achieved through the promotion of improved climate-smart dairy farming practices and access to quality dairy inputs, extension services including veterinary and Artificial Insemination (AI) services; appropriate green technologies, as well as business and financial services, following a hub model approach.
- Increase incomes by at least 80% among participating smallholder farmers from dairy farming through a combined effect of the increased milk production and improved market access. This shall be achieved through the development of 30 dairy hubs; establishment and strengthening of dairy farmer organizations; and facilitation of linkages to markets and dairy value chain actors, such as milk collectors, processors, transporters, traders, and investors in milk quality through public-private-producer partnerships (4Ps).

Four development outcomes are expected:

- Smallholder dairy farming productivity and supply of quality milk to domestic and regional markets enhanced and milk consumption at household level increased;
- Organizational capacity, and enterprise skills of smallholder dairy farmers and their cooperatives enhanced;

- Infrastructure for collection, handling, processing and marketing of milk and other dairy products expanded and its utilization improved and tailored to adverse climate risks; and
- A conducive policy and institutional environment for the development of smallholder dairy industry fostered and strengthened.

2.2.1 Situational Analysis of Rwanda Dairy Development Project

The dairy subsector of the agriculture sector in Rwanda is crucial for rural development, poverty reduction, nutrition improvement and food security. It offers a pathway, out of poverty for the large number of households keeping livestock and those who provide services and add value throughout the supply chain. The dairy subsector is the largest segment of the livestock in Rwanda, which accounts for 10.5 percent of agricultural gross domestic product (GDP) and also the fastest growing subsector within agriculture. In recognition of the importance of the dairy sector, the Government of Rwanda has made significant investments in the industry over the past decade aimed at transforming it from subsistence to a business-oriented, modern sector capable of meeting the Country's demand for dairy products and producing surpluses for the regional market. (RDDP, 2016).

The Government has spearheaded the development of the dairy industry through projects such as the African Development Bank-funded Livestock Infrastructure Support Project and the Rwanda Dairy Competitiveness Programme I and II, funded by the United States Agency for International Development (USAID). Other projects by the Netherlands Development Organisation, Heifer International Project International (HPI), Send-a-Cow and the East Africa Dairy Development Programme, funded by the Bill & Melinda Gates Foundation have supported dairy development in Rwanda. The results of these investments are clearly visible today, which include the transformation of the national cattle herd from 600,000 cattle, dominated by local breeds with low milk production potential in the 1990s to an increase of 1.35 million national cattle herd today, including 54 per cent improved dairy breeds. In tandem with this transformation of the sector, annual milk production increased from 50,000 metric tons in 2000 to 731,000 metric tons in 2015. Per capita milk consumption has also steadily increased from below 20 litres per year in the 1990s to 64 litres per year in 2015. The current "farm gate" value of annual milk production is approximately RwF 117.0 billion (USD 162.4 million). The dairy

subsector is the largest segment of the livestock sector in Rwanda, which accounts for 10.5% of agricultural GDP and is the fastest growing sub-sector within agriculture.

Rwanda Dairy Development Project (RDDP) is a follow-up of other previous projects for the development of dairy sector in Rwanda. The project is burdened with the overall goal of contributing to pro-poor national economic growth and improve the livelihood of resource-poor rural households. Specifically, the project seeks to increase competitiveness and profitability of the dairy sector for the provision of quality products from small-scale producers to domestic and regional consumers, thus improving their livelihoods, food security and nutrition whilst building overall resilience.

2.2.2 Cost of Project and Financing

The Rwanda Dairy Development Project (RDDP) started in 2016 and it is expected to run for 6 years. The project is estimated to cost about US\$65.1 million which is financed by:

- i. International Fund for Agricultural Development (IFAD) with US\$44.7 million (69 per cent of the total cost) through a highly concessional loan of US\$43.6 million and a grant of US\$1.1 million;
- ii. Heifer Project International with US\$4 million (6 per cent of the total cost);
- iii. The private sector/banks with US\$6.6 million (10 per cent of the total cost);
- iv. The Government of Rwanda with US\$3.9 million (6 per cent) in the form of tax exemptions;
- v. Beneficiaries for US\$5.9 million (9 per cent).

Agriculture is a key sector in Rwanda which contributed 33% of the total Gross Domestic Product (GDP) in 2014 (NISR, 2015). The sector also provides employment to over 80% of the labour force, 90% of the country's food requirements and over 95% of the country's exports. Out of the five sub-sectors constituting agriculture, food crops dominate the sector accounting for 68.8% of total agricultural GDP.

The dairy subsector is crucial for rural development, poverty reduction, health, nutrition and household food security in the country. It offers a way out of poverty for the large number of households keeping livestock, and for those who provide services and value addition throughout the supply chain. The current "farm gate" value of annual milk production is approximately Rwf

117.0 billion (USD 162.4 million). The dairy subsector is the largest segment of the livestock sector in Rwanda which accounts for 10.5% of agricultural GDP. It is also the fastest growing sub-sector within the nation's agriculture. The project area covers 12 districts in the four Provinces of Rwanda: East (Nyagatare, Rwamagana, and Kayonza), North (Gicumbi, Burera, and Musanze), West (Nyabihu, Rubavu and Rutsiro) and South (Nyanza, Huye, and Ruhango).

2.3 Stylized Facts about the Rwandan Dairy Sector

2.3.1 Cattle population

Livestock, particularly dairy cattle is historically an integral part of the production systems in Rwanda. The country has made tremendous strides in rebuilding its livestock sector in the last two decades after the 1994 genocide during which an estimated 80% of cattle and 90% of small ruminants were decimated. Total cattle population has increased more than twice from the pre-1994 level of 600,000 heads. It now stands at 1,349,792, comprising 615,631 (45%) local breeds (mainly Ankole), 439,414 (33%) dairy cross-breeds, and 294,747 (22%) dairy pure breeds. Currently, the dairy sub-sector contributes to regional milk supply largely through informal exports to Burundi and the Democratic Republic of Congo (DRC).

2.3.2 Milk production

In tandem with the growth in cattle population, milk production has increased from 50,000 MT in 2000 to about 731,000 MT in 2015. The increased milk availability and per capita milk consumption has risen from below 20 litres/year in the 1990s to 64 litres/year in 2015. This impressive performance has been achieved through strong commitment of the government to the implementation of dynamic livestock intensification program as outlined in the National Dairy Strategy 2013-2017. Large investments have been made to increase milk production and productivity including the importation of improved dairy cattle which is distributed to resource-poor families under the Girinka and Igikumba cy'umudugudu programmes. The program also includes improved accessibility to artificial insemination (AI), animal health and animal husbandry services to farmers and establishment of Milk Collection Centres (MCCs) and dairy cooperatives to enhance market accessibility and food safety in the supply chain.

2.4 Stylized Facts on Poverty and Livelihood in Rwanda

2.4.1 Economy

The Economy of Rwanda has experienced an upward movement since 2001 maintaining an average GDP growth of about 8% and an increase in the per capita income from \$191 in 2001 to \$720 in 2015. The success continues to be driven by stable macro-economic and market-oriented policies, improved regulatory frameworks and relatively transparent interactions between government and the private sector. Rwanda is recently ranked high by the World Bank as the 3rd Country in Africa in respect of ease of doing business and 45th worldwide.

Poverty is still a key challenge in Rwanda despite the economic success recorded in the past few years. Poverty in the Country is clearly a rural phenomenon as about 43% of the population live in poverty. This group of poor rural dwellers who comprise mostly of women from households with little or no land obtain more than half of their income working on other peoples' farms. The urban population also shares 22% of the total national poverty estimates.

2.5 Poverty and Inequality

Over the period between the surveys household consumption grew at 3% per annum per adult equivalent, while poverty fell from 60.4% in 2000/01 to 56.9% in 2005/06, a reduction of 3.5 percentage points. There were important regional dimensions to this: the poverty headcount fell substantially in Eastern Province, fell by smaller amounts in Northern Province and the City of Kigali, and actually rose slightly in Southern Province. Calculations show that 68% of the total reduction of poverty was accounted for by poverty reduction in Eastern Province. An important part of the story was an increase in inequality as measured by the Gini coefficient. The level of inequality was already high in 2000/01, with a Gini coefficient of 0.47, and this rose to 0.51 in 2005/06. The high initial level of inequality, and the fact that inequality worsened over this period, were important factors making the consumption growth less effective in terms of poverty reduction– in more technical terms, lowering the growth elasticity of poverty reduction. Inequalities rose in Southern and Western provinces in particular. Even though the consumption growth rate was positive in Southern Province, poverty also rose. (NIS, 2007)

An analysis of household income shows that the proportion derived from farming fell by almost 9% over the period, while income from other sources increased, particularly from small non-

farm businesses and agricultural wage labouring. Some 65% of households now derive the majority of their livelihoods from farming their own land, compared with 72% in EICV1. It is these agriculturally dependent households where poverty has reduced the most, with the exception of a very small proportion of households who derive their income from non-labour sources. Poverty levels have risen for households who derive their incomes from mainly non-agricultural sources, as has the proportion of households concerned. This suggests that there is increased competition for non-agricultural work and there is some evidence that wage rates have declined in real terms. However the levels of poverty are much lower for non-agricultural households than for farmers.

The poorest households of all are those who derive the majority of their incomes from agricultural wages, with over 90% of them poor, there was a very small improvement in their poverty levels over the period. (NIS, 2007)

Moreover, with recent surveys, it has been discovered that poverty has reduced from 44.9% in 2011 to 39.1% in 2014 and extreme poverty from 24.1% to 16.3%. This follows similar reduction between 2006 and 2011 where poverty dropped from 56.7% to 44.9% and Extreme poverty from 35.8% to 24.1%. Likewise, inequality reduced with both the Gini coefficient dropping from 0.49 in 2011 to 0.45 in 2014 and the ratio of the wealthiest 10% to the poorest 10% dropping from 6.36 to 6.01 during the same period (NISR, 2014).

2.6 Logical framework of RDDP

	Indicators			Means of Verification			Assumptions
	Name	Baseline	End target	Source	Frequency	Responsibility	
Goal: Contribute to pro-poor national economic growth and improve the livelihoods of poor rural households	<input type="checkbox"/> Number of female- and male-headed households that experience an increase in household assets	-	80% of project beneficiaries	National statistics, household surveys incl. poverty & gender studies	Baseline and completion	SPIU	Income from milk sales will be used on household improvements
	<input type="checkbox"/> Number of children 0-5 years suffering from chronic malnutrition in project area (stunting)	TBD	5% reduction compared to baseline data				Income from increased sales accompanied by nutrition education and behaviour change will lead to greater availability of and access to a diversified diet and nutrient-rich crops/ food items.
Development Objective: To increase competitiveness and profitability of the dairy sector for the provision of quality products from smallscale producers to domestic and regional consumers, thus improving their livelihoods, food security and nutrition whilst building overall resilience	<input type="checkbox"/> Volume and value of milk sold from targeted small-holder dairy farmers annually st	Volume: 43 560 MT; Value: USD 9.3m	Volume: 95 040 MT; Value: USD 22.8 m	National Statistics	Baseline, midterm, completion	SPIU	Increased production will lead to sales and domestic consumption
	<input type="checkbox"/> Volume of milk exported and penetration in the East Africa Community dairy market	15,038,406 litres/year (2014-2015)	30-35 million litres by 2022 (4-5% penetration in the East Africa Community dairy market for Rwanda from the current 1%)	National Statistics (NISR, Statistical Year Book)	Baseline, midterm, completion	SPIU	Export data for dairy products are more reliable (considering that most of the milk currently exported to Congo DRC and Burundi is not recorded)
	<input type="checkbox"/> Increased income among participating smallholder farmers from dairy farming	-	80% of project beneficiaries	National statistics, household surveys incl. poverty & gender studies	Baseline and completion	SPIU	Incomes increase through a combined effect of increased milk production and improved market access
Outcomes: Smallholder dairy farming productivity and supply of quality milk enhanced and milk consumption at household level increased	<input type="checkbox"/> Average kg of milk produced per cow per day during one lactation period	Crossbreeds: 5.5 kg/day Local breed: 2.1 kg/day	Cross-breeds: 9 kg/day; Local breed: 2.4 kg/day; Pure breeds: 15 kg/day	MCC records	Continuous	SPIU / RAB / MINAGRI	Improved dairy practices will improve milk productivity regardless of breed purity
	<input type="checkbox"/> Average consumption of milk at household level increased	64 litres/person / Year	100 litres/person/ year	National Statistics	Baseline, midterm, completion	SPIU / RAB / MINAGRI	Increased and safer dairy production, consumption and education campaigns will lead to domestic consumption
Enhanced organizational capacity and enterprise skills of dairy cooperatives	<input type="checkbox"/> Number (and %) of MCCs serving targeted farmers in milk collection and marketing, dairy input supply, animal health and extension services and financial services	38% (25 out of 65 category 1 MCCs)	90%	MCC records Thematic study	Continuous Quarterly and completion	Service provider SPIU / Rwanda cooperatives agency	Well-functioning MCCs intend to provide multiple services to farmers beyond mere milk collection and marketing

*Volume of milk sold to market annually = (kg per lactation period excl. milk intake of calves and own household consumption)

	Indicators			Means of Verification			Assumptions
	Name	Baseline	End target	Source	Frequency	Responsibility	
Expansion and improved utilization of milk collection and processing infrastructure	<input type="checkbox"/> Number of dairy farmers using a formal milk collection system (by gender)	30%	80%	Thematic study	Mid-term and completion	Service provider SPIU / Rwanda cooperatives agency	Farmers have adequate incentive to supply to formal sector
	<input type="checkbox"/> % of installed capacity of milk collection and processing facilities functional and utilized	45%	80%	MCC reports	Quarterly	Service provider	Sufficient access to services is available, e.g. to technicians, facilities, etc.
Enhanced policy and institutional environment for development of the smallholder dairy industry	<input type="checkbox"/> Stakeholder satisfaction with policy and regulatory framework	n/a	90%	Thematic study	Baseline, midterm and completion	SPIU	All relevant stakeholders are consulted and heard
Enhanced climate-smart dairy value chain and strengthened community resilience	<input type="checkbox"/> GHG emissions (CO ₂ e/kg milk) avoided or sequestered by the climate smart dairy production intensification approach (RIMS)	TBD	TBD	Thematic study using ExAct methodology at baseline and completion	Baseline and completion	SPIU / RAB / RVC / MINAGRI	Climate-smart technologies will offset the carbon footprint of the dairy sector despite eventual increase in livestock population
Outputs: Developing farmer capacity in good dairy production practices	<input type="checkbox"/> Number of households adopting technologies that reduce or sequester greenhouse gas emissions (RIMS)	n/a	60 000	Service provider report	Quarterly	Service providers	L-FFS will lead to improved animal husbandry practices, leading to improved animal health, improved feeding and improved hygiene generally as well as natural resource base
Strengthening animal health services	<input type="checkbox"/> Number of households receiving facilitated animal health services, incl. AI and % of success (RIMS)		80% of project beneficiaries, incl. 60% AI conception rate	Service provider report	Quarterly	Service provider	Strengthening animal health services will result in more people accessing services. Private vet and insemination services will improve animal genetic resources and sustainability of services
Supporting informal sector to comply with milk quality standards	<input type="checkbox"/> Number of milk zones, kiosks and bars that have been established or upgraded and certified for milk handling	n/a	2 000	Authority in charge of animal product inspection	Quarterly	Implementing partner	The ministerial order on milk standards will be effectively implemented and informal sector allowed to upgrade to the level of required standards
Strengthening of value chain	<input type="checkbox"/> Number of processors supported by project in improved processing, product diversification, packaging, certification and marketing	-	30	Service provider report	Quarterly	Service provider	Dairy cooperatives and unions with category 1 MCCs will want to invest in processing. Existing processors are willing to engage with project.
Supporting organizational development of cooperatives	<input type="checkbox"/> Number of cooperatives with new bankable enterprise development plans	-	60	Service provider report	Quarterly	Service provider	Cooperatives are interested in operational and business development
Improving access to financial services	<input type="checkbox"/> % financing gap of enterprise development plan	-	10%	Service provider report	Quarterly	Service provider	Financial institutions are ready to invest in dairy cooperatives
Strengthening policy development	<input type="checkbox"/> Number of national policies (laws and regulations) developed to strengthen dairy industry.	n/a	5 enabling laws and regulation developed 1 national policy developed	Rwanda Standards Board records (tbd)	Bi-annually	SPIU	Budget for policy implementation is availed by government and capacity for operationalization exists at local level

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

Scholars have given Livelihoods various definitions but I would like to submit to the working definition given by Chambers and Conway (1992) in the early 90s stating that ‘A livelihood comprises the capabilities, assets (including both material and social resources) and activities for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base’ (Scoones, 2009)

The concept of livelihoods has been in the fore of research since the 19th Century with many strands evolving, from village studies, household economics and gender analyses, farming systems research, agro-ecosystem analysis, rapid and participatory appraisal, studies of socio-environmental change, political ecology, sustainability science and resilience studies (and many other strands and variants). These strands have offered diverse insights into the way complex, rural livelihoods intersect with political, economic and environmental processes from a wide range of disciplinary perspectives, drawing from both the natural and social sciences. (Scoones, 2009)

The livelihoods approach was seen as an integrated perspective accepted with enthusiasm and commitment from both the people and government (of the United Kingdom), which was committed to doing something about it. The perspective was rather seen as not the old world of natural resources specialists (archetypically concerned with soils not people) and economists (with their interest in growth and trickle down), but a new, integrated perspective centered on normative, political commitments to banish poverty – and later supported by widespread public campaigns, at least in the UK, from Jubilee 2000 to Make Poverty History. (Scoones, 2009)

There were of course strong detractors, but many realized the opportunities of opening up debates – as well as the implications for funding flows. The NGO community was important too, bringing fresh ideas and field experiences for elaborating a livelihoods approach from Oxfam, CARE and others. The United Nations Food and Agriculture Programme (FAO) too became interested, as did the United Nations Development Programme (UNDP), creating a diverse array of livelihoods approaches (Carney *et al.* 1999).

A whole professional cadre of livelihoods advisors was built up in DfID and other organizations, and soon comparative assessments of different approaches across agencies emerged, highlighting the differences in interpretation and application of different versions of ‘the SL framework’ (Hussein 2002). Livelihoods approaches now seemed to be applied to everything: livestock, fisheries, forestry, agriculture, health, urban development and more.

The adopted framework follows a key concept illustrated that household livelihoods are based on the use of assets in livelihood strategies and activities. This is within a vulnerability context, and livelihoods are also mediated and affected by ‘policies, institutions and processes’. Ultimately activities lead to outcomes which are hopefully improvements of the existing condition in various ways (Allison and Springate-Baginski, 2009).

The fundamental social and economic unit is considered as the *household*, conceived as the social group which resides in the same place, shares the same meals and makes joint or coordinated decisions over resource allocation and income pooling.

Households depend on a range of productive *assets* or *capitals* (Allison and Springate-Baginski, 2009), which they may either own privately, or access as common property, or even use as open access resources. These capitals are categorized into five distinct types:

Human capital: this refers to the household members’ ‘capabilities’ in terms of the number of members and their age, health, education, knowledge, skills, and capacity for work. Indigenous technical knowledge relating to milking, feeding, caring and detection of the heat period of a cow, etc.

Physical capital: this refers at household level to the physical equipment and tools that are used in production. At the most basic level it can include the house, farmland for planting forages, feeds, livestock, milking can(s), and so on. At community level it also includes access to infrastructure such as road networks, access to market, joint milk sheds, Milk Collection Centre(s), clinics, schools and so on.

Natural capital: expanse of land for the cultivation of food crops and grass/forage biodiverse ecosystems they support are seen as ‘natural capital’, in the sense that they are productive assets which provide a range of ecosystem services to households. Households may privatize areas through clearance for cultivation, and communities may also evolve customary institutions

around common access and use of ‘natural capital’ such as fisheries in order to ensure sustainable off take levels. Forms include fish stocks, areas of river or lake leased or accessed by license, agricultural or forest land owned or accessed and so on.

Financial capital: households’ savings, credit (and debt, which is negative capital), insurance and so on. The Rwanda Dairy Development Project has made provision for Grants for farmers who can present a well-structured business plan.

Social capital: the kinship networks, associations, membership organizations and peer-group networks that people can use in difficulties or turn to in order to gain advantage.

Households employ the productive capitals discussed above, in combination with their labour allocation in livelihood strategies, in order to generate incomes and wellbeing. In particular, the focus on ‘capitals’ and the ‘asset pentagon’ kept the discussion firmly in the territory of economic analysis. There was of course important discussion about how assets could be combined, substituted and switched, with different portfolios emerging over time for different people in different places, and linking changes in natural capital (‘the environment’) with social and economic dimensions was an important step forward. A broader view of assets was also advocated. Bebbington (1999, 22), for example, saw assets as ‘vehicles for instrumental action (making a living), hermeneutic action (making living meaningful) and emancipatory action (challenging the structures under which one makes a living)’. (Scoones, 2009)

Vulnerability context, reflects the ever-present risk of seasonal fluctuations (e.g. shortage of water during the dry season, which affects milk production), other shocks, and underlying trends in livelihood conditions that are beyond the household’s control. Shocks include disease outbreaks amongst the cows, failure of produced milk to pass the alcohol test, lack of cold chain, fuel-price hikes (which impedes transportation of milk to the collection centre) and currency devaluations. At a household level, illness or death of a family member (Allison and Springate-Baginski, 2009).

Livelihoods are formed within social, economic and political contexts. Institutions, processes and policies, such as markets, social norms, and land ownership policies affect our ability to access and use assets for a favorable outcome. As these contexts change they create new livelihood obstacles or opportunities. Then, the framework points to the households’ livelihood outcomes, in terms of their state of *wellbeing*. A livelihood is sustainable if people are able to maintain or

improve their standard of living related to wellbeing and income or other human development goals, reduce their vulnerability to external shocks and trends, and ensure their activities are compatible with maintaining the natural resource base.

To this end, in assessing the effect of the Rwanda Dairy Development Project on the livelihood of dairy farmers, I would be looking at getting data on:

- Household and collective capital assets
- Income levels
- Vulnerability context
- Policies, governance, institutions and markets, and the different ways in which they affect livelihoods

3.2 Review of Conceptual Issues

The concept of Sustainable and improving Livelihood is an attempt to go beyond the conventional definitions and approaches to poverty eradication. These had been found to be too narrow because they focused only on certain aspects or manifestations of poverty, such as low income, or did not consider other vital aspects of poverty such as vulnerability and social exclusion. The Sustainable Livelihood Approach has been adopted for this research. Tao and Wall, (2009) highlighted that Sustainable Livelihood Approach (SLA) forces a wider perspective through its very design, and is especially relevant in situations where people may have multiple contributions towards their livelihood rather than just a single source of income. SLA also forces a consideration of interactions and trade-offs. McLennan and Garvin (2012) employed an SLA to explore livelihoods in North-West Costa Rica and showed how intervention was necessary to help mitigate the negative effects of locally-felt trade-offs between conservation on the one hand and use of resources on the other.

SLA has been set out by some scholars in a somewhat mechanical cause-effect terminology, it can be considered in many different ways. Krantz (2001) argues that there are two ways of using SLA. One way is the approach taken by DFID which sees SLA as a framework for analysis, while another way is the use to facilitate the planning of concrete projects and programmes, which has been employed by agencies such as UNDP and CARE.

I could agree with the findings of Farrington (2001) who presents a more nuanced view of the different dimensions of SLA:

1. As a set of principles guiding development interventions (whether community led or otherwise). The fundamental assumption of which is that an intervention has to be evidence-based rather than instigated in top-down fashion without adequate knowledge of the community. SLA can thus be seen as a loose checklist of points that need to be considered before an intervention is planned.
2. As a formal analytical framework to help understand what ‘is’ and what can be done. The framework helps aid an appreciation of the capitals which are available to households, their vulnerability and the involvement of institutions.
3. As an overall developmental objective. In this case development is seen as the improvement of livelihood sustainability, perhaps by making capital less vulnerable or by enhancing the contributions that some capitals can make or even by improving the institutional context.

Morse and McNamara (2013) opined that SLA has certainly helped establish the principle that successful development intervention, especially if led internally, must begin with a reflective process of deriving evidence sufficiently broad in vision and not limited to what may seem like a good technical fix. This is to say that before development can take place there must be some idea what needs to be done, along with the why and what of how it must be done. It does imply a necessary degree of humility in that it suggests there is much to be learnt and understood before help is offered; this has to be built upon a partnership with beneficiaries rather than seeing them just as passive recipients. (Morse and McNamara, 2013)

SLA is an example of the multiple-capital approach where sustainability is considered in terms of available capital which are natural, human, social, physical and financial capital; as well as an examination of the vulnerability context (trends, shocks and stresses) in which these capitals (or assets) exist. The five principal capitals often suggested as important to livelihood are presented in Fig. 1. For example the man-made physical capitals could be buildings and machinery and the natural (non man-made) capitals are soil, water, crops and so on. However some are less immediately obvious, such as social networks, knowledge and good health. All are important although clearly the extent of their importance will change from household to household and over time (Morse and McNamara, 2013). Attempts have been made to link these livelihood

capitals to a measure of poverty; with the assumption being that they provide a multidimensional and inverse proxy for poverty (less capital equates to greater poverty; Erenstein 2011)

Networks (Social Capital) were built in an opportunistic fashion but were nonetheless critical to survival. Korf (2004) came to a conclusion regarding the importance of social networks after using SLA to explore livelihoods in Sri Lanka after a war, especially linkages with key holders of power. Grant (2001) refers to social capital in terms of ‘bonding’ and ‘bridging’, with bonding influencing the ability of a group to act together while bridging is the ability of a group to collaborate with others. Though being in a social network may not always yield positive dividends, for dairy farmers in Rwanda, this has been helpful to improve their livelihoods to a great extent.

Vulnerability and Institutional Context

Once these capitals have been identified and assessed for the contribution they make (or could make) it is necessary to explore the vulnerability context in which they exist; what are the trends (over time and space), shocks and stresses? Shock tends to denote a more sudden pressure on livelihood (Morse and McNamara, 2013). For example, a severe flood and drought can seriously affect natural and physical capital in a short period of time. This is one of the various environmental shocks dairy farmers at Rwanda encounter. A locust swarm can devastate a crop in a matter of hours. Morse and McNamara (2013) said that stress is a term used to denote a longer-term pressure. Example is an economic downturn which can take place over some years, which, eventually lead to unemployment. It may be a challenge to predict stress and shocks, but historical trends and modelling can provide clues. Historical legacy could indeed be very important within SLA (Scoones and Wolmer 2003). It is not only a matter of knowing what is happening now but also what the trends are and will be in the future. Some assets may change little over time (e.g. land and buildings) while others such as cash and social networks can be dependent upon movement of people in and out of the household.

Vulnerability to shocks can also vary. Looking at the example of drought’s impact upon natural capital, drought will cause a reduction in crop yields, but may have little or no effect on other

capitals. However, in the longer term, a severe drought could impact on a wide range of capitals, including social and human as people emigrate (Morse and McNamara, 2013). Similarly, flooding may damage physical and natural capital while having little impact on the others. Climate change as a longer-term trend is being seen as an important factor that can effect such vulnerability for some populations and SLA provides a framework to understand this and how people might adapt (Elasha et al. 2005;Iwasaki et al. 2009; Simon and Leck 2010; Siddiqi 2011; Below et al. 2012).

But these authors also make the important point that vulnerability can vary at low scales. Hence capitals will vary in their resilience to different types of shock and the intensity of that shock, and this can vary over relatively small spatial scales; even within a village (Morse and McNamara, 2013).

Institutions

It is necessary to examine the policy and institutional context within which these capitals exist, including the legal context and what rights may, or may not, exist (Ashley et al. 2003). While some capitals may be vulnerable to certain shocks, authorities may have been able to act and limit any damage which occurs or perhaps provide recompense. While assets may be damaged by flooding there may be publically owned structures in place to reduce the likelihood of the disaster occurring. Similarly, for example, there may be publically funded extension services available which can supplement the knowledge base of farmers or provide advice and help with irrigation systems. It is not only government services that need to be considered, they may be non-governmental or even private agencies at hand that can provide support for livelihoods. It is also not only a matter of considering each institution in isolation that really matters but also the ways in which they do, or do not work together (Morse and McNamara, 2013).

The importance of institutions is often reiterated within the sustainable livelihood literature, and in a variety of contexts. Institutions influence the natural access to many of the capitals as well as peoples' opportunities and choices. They can help govern social relations and power structures at many scales. Challies and Murray (2011), for example, highlight the importance of institutional support for small-scale raspberry growers in Chile by improving their capacity to comply with

safety and quality standards and hence gain and retain market access via the global value chain. Such access to global markets underpins the sustainable livelihood of these growers.

Cherni and Hill (2009), in the context of energy supply in Cuba, make the interesting point that the institutional context is a two-way street even if the SLA does tend to focus on households and communities. Thus policies that help the livelihoods of the poor can also help governments achieve their own policy targets.

3.3 Review of Theoretical Issues

Development has many meanings according to literatures, Cowen and Shenton (1998) have made an interesting case for two basic forms which are: Immanent development and Intentional development. He described Immanent development as ‘what people are doing anyway’, denoting a broad process of advancement in human societies driven by a host of factors including advances in science, medicine, the arts, communication, governance etc. This is said to be facilitated by processes such as globalization (an international integration) which helps share new ideas and technologies. Intentional development has been called ‘Interventionist’ development. This is described as a focused and directed process whereby government and non-government organizations implement development projects and programmes (typically a set of related projects) to help the poor. The projects are usually time and resource bound, but have an assumption that the gains achieved would continue after the project had ended Cowen and Shenton (1998).

Projects within intentional development will typically have a ‘blueprint’ which sets out what has to be done, by whom and when, allied with some notion as to what the project is trying to achieve with the resources and time at the team’s disposal. These objectives, methods and outcomes may be set out in formats such as a logical framework.

Immanent development has been around for as long as the human race but Intentional development is a newer process dating after the Second World War. The Rwanda Dairy Development Project (RDDP) could be classified as intentional development.

Critics have however argued that Intentional development has by and large not been very successful (Rahnema and Bawtree 1997; Pieterse 1998; Hart 2001; Toner and Franks 2006), with Africa often cited as the classic example of failure (Mathews 2004). They point out that despite major investment by the developed world development projects have often failed to generate positive and sustainable outcomes for the people who were meant to benefit. In Rwanda, RDDP has, in a short time of implementation, caused an increase in the income of dairy farmers.

3.4 Review of Empirical Issues

In Kenya at least 800,000 smallholder farmers depend on dairy farming for their livelihoods. As a result, dairy production improves household nutrition and provides extra income. Family labor, dairy farming generates jobs in wage labor and mobile milk trading for a further 365,000 people. These jobs benefit the poorest people in urban and rural areas (IFAD, 2013).

Farmers experience frequent droughts, excessive rains in the wet season and subsequent crop failures and decline in livestock productivity which increases their vulnerability to poverty (Zagst, 2011).

According to Wambugu and Franzel, 2012, the smallholder farming systems in Kaptumo, Kenya are characterized by low land and livestock productivity due to unreliable and inadequate rainfall, infertile soils, poor agronomic practices, undeveloped marketing channels and lack of agricultural inputs.

In the study of land use changes patterns and livelihood dynamics on the slopes of Mt. Kilimanjaro in Tanzania, Soini (2005) reported that as land scarcity hinders expansion of agriculture, farm size seriously decreased, common resources have become scarce, and prices of coffee in the world market remain low, farmers are trying to intensify and diversify their farm production. He also pointed out that population pressure and the ensuing expansion of farmland, together with climate changes affecting the water supplies, have caused changes in farmers' livelihoods

Within rural communities' different individuals have various potential access to alternative activities and therefore diverse income sources (i.e. farm income, off-farm income and nonfarm income), this has varying impacts on poverty and income distribution. Total household income is disaggregated into different categories of income sources or activities, which reflect features of

resources required to generate them, their seasonality accessibility to them depending on assets and skills, and their location either nearby or remote (Ellis and Mdoe, 2003).

In the study by Tefera (2007) aimed at determining the effect of the goat credit project on women farmers' welfare through a credit-in-kind approach, it was observed that women acquired assets and diversified their livelihoods by purchasing and raising poultry, cows, oxen, and donkeys. The women farmers became more economically empowered, which enabled them to gain greater control over their resources, which in turn increased their capacity to participate in social activities and household decision making. The goat credit project brought about substantial changes by enhancing food security and diversifying the livelihoods of women farmers.

Bahamondes (2003) used household surveys of three farming communities in Chile to illustrate how income from nonfarm employment and government credit programmes. The study examined household asset levels, how asset levels affect the 16 choice of agricultural practices and how those practices affected natural resource status. In that study he found that human capital, physical capital in the form of land and livestock, access to non-farm employment, and access to agricultural credit and technical advice largely explain the adoption of irrigated forage production and woodlot planning with resultant increases in vegetative cover.

According to Kardasian (2012), climate change, will have a greater negative impact in the dairy industry in the future. Climatic events such as rising temperatures and atmospheric carbon dioxide concentrations will change the prices of dairy farms inputs, including; feed, fuel, and electricity. Higher temperatures cause heat stress for dairy cows, leading to a reduction in milk yields.

While climate change may negatively affect dairy farms, it also helps dairy farmers plan how to mitigate by calculating impacts specific to their farms, allowing them to understand the impacts of climate change and plan for the future (Backlund, 2009).

Feed comprises almost 50% of a dairy farmer's budget. Additionally, climate change is expected to increase fuel and electricity costs (Peter, 2014).

Bruckner (2008) indicated that climate change has an impact on the increase or decrease in animal disease risk. Examples of diseases which were related to climate change included avian influenza which spread over 4 continents since the beginning of the new millennium; bluetongue which spread across Europe; and the Rift Valley fever which spread in Africa as a result of severe floods.

CHAPTER FOUR METHODOLOGY

4.1 Conceptual/Analytical Framework

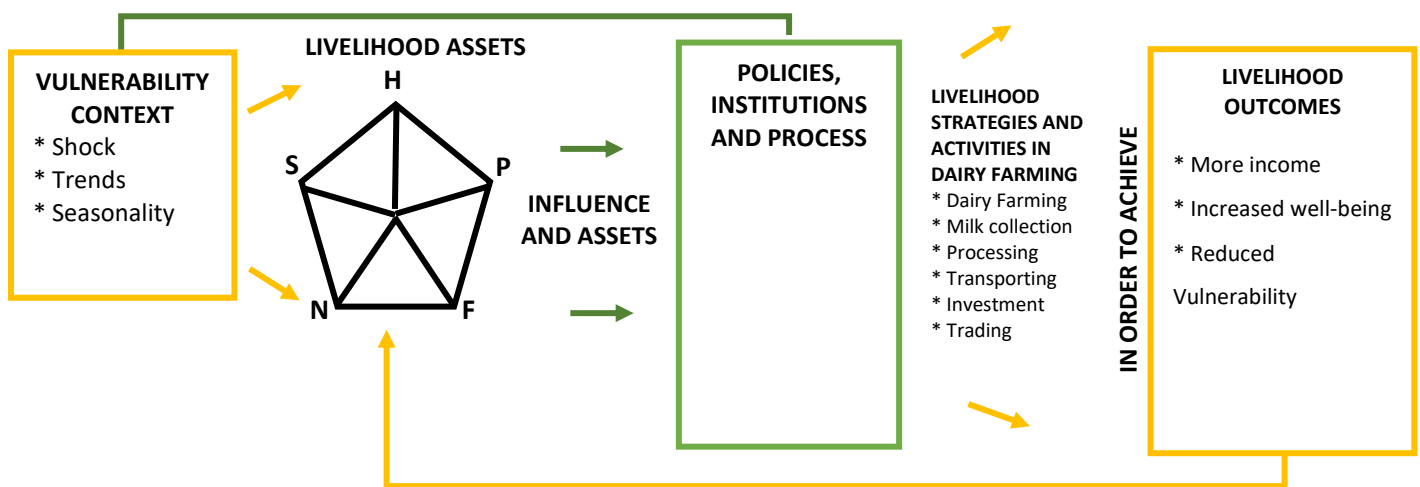


Figure 1: The Sustainable Livelihoods Framework

Legend: H: Human; P: Physical; F: Financial; N: Natural; S: Social

Source: Department for International Development (DFID)

4.2 Analysis of Objectives

S/N	Objectives	Data Required	Analytical Technique
1	To examine the effect of dairy farm ownership on improving livelihoods of the dairy farmers in Nyabihu district	Farm ownership: Self-owned, Inheritance, Rent, Jointly Owned; and Monthly income before and during RDDP	Descriptive statistics (frequency count, tables and charts) and cross-tabulation
2	To assess the influence of access to credit on improving livelihoods of the dairy farmers in Nyabihu district	Monthly income before and during RDDP; and Response to access to credits from cooperative groups	Descriptive statistics (frequency count, tables and charts) Chi-square test and Cross-tabulation
3	To assess the effect of the contribution of Rwanda Dairy Development Project on improving livelihoods of the dairy farmers in Nyabihu district	Monthly income before and during RDDP; and Response to benefits from RDDP	Descriptive statistics (frequency count, tables and charts) Chi-square test and Cross-tabulation
4	To identify the best practices in climate adaptation strategies outlined by dairy farmers in Nyabihu district	Response to Climate change adaptation practices	Descriptive (frequency count, tables and charts) Cross-tabulation and Chi-square test



Figure 2: Map of Rwanda

Source: Google

4.2 Statements of Hypotheses

H₀: there is no significant relationship between the benefits of RDDP and improved livelihoods of the dairy farmers in Nyabihu district.

H₁: there is a significant relationship between the benefits of RDDP and improved livelihoods of the dairy farmers in Nyabihu district.

4.3 Sampling Design

Multi-stage sampling technique was adopted in this study.

Stage 1: Selection of the one District out of the 12 Districts the Rwanda Dairy Development Project covers. RDDP covers Nyagatare, Rwamagana, Kayonza, Gicumbi, Burera, Musanze, Nyabihu, Rubavu, Rutsiro, Nyanza, Huye and Ruhango, all across the 4 Provinces. Nyabihu district was selected on purpose.

Stage 2: Calculating the Sample size from the total population of dairy farmers at Nyabihu district.

Stage 3: Selection of Sectors under the chosen district. Nyabihu district has 12 sectors, namely, Bigogwe, Jenda, Jomba, Kabatwa, Karago, Kintobo, Mukamira, Muringa, Rambura, Rugera, Rurembo and Shyira. 6 Sectors (Bigogwe, Jenda, Kabatwa, Karago, Mukamira and Rambura) were selected from the 12 sectors on purpose.

Stage 4: Getting, training and deploying of enumerators to the selected sectors for data collection with the use of well-structured interview guide.

Stage 5: Respondents were selected randomly at cooperative, the Milk Collection Centres (MCCs), as well as different households. Respondents comprised of dairy farmers who have benefited from the project and likewise farmers who are yet to benefit from the project.

The study employed survey method under which data were collected from different respondents at different locations once through survey interview guide.

4.4 Study Population

Out of the 12 districts which the Rwanda Dairy Development Project (RDDP) cover, Nyabihu was selected on purpose in the Western Province of Rwanda. Nyabihu district is one of the first districts to enjoy the early implementation of RDDP and this is as a result of the many challenges which dairy farmers have faced in times past. A total of 24,604 dairy farmers were recorded to exist in Nyabihu district as at the time the study was carried out. This number constituted the beneficiaries and non-beneficiaries of the RDDP.

4.5 Sample Size and Data Collection Method

The total population of the dairy farmers in Nyabihu was subjected to calculation on sample size calculator online (Survey Systems, 2018) using confidence level of 95%. The sample size was given as 383 people who were selected randomly across six (6) out of the twelve (12) sectors in Nyabihu district namely Bigogwe, Jenda, Kabatwa, Rambura, Mukamira and Karago.

Questionnaires were used to gather primary data from the respondents while secondary data were gathered from various publications about RDDP, national statistics as well as publications from other scholars on dairy farming and livelihood. Interviews were conducted also for qualitative data.

4.6 Validity and Reliability of Research Instrument

To ensure validity of research instrument, a face test was carried out while a pre-test was also done before the data collection exercise. The pre-test led to a rework of the questionnaire before the main study was conducted.

4.7 Data Analysis

The data collected for the study were both primary and secondary involving quantitative and qualitative data. SPSS IBM 21 and MS Excel spreadsheet were used to analyze quantitative data.

The effect of dairy farm ownership on improving livelihoods of the dairy farmers in Nyabihu district – Cross-tabulation of farm ownership and monthly income.

The influence of access to credit on improving livelihoods of the dairy farmers in Nyabihu district – cross-tabulation of access to credit and monthly income.

The effect of the contribution of Rwanda Dairy Development Project on improving livelihoods of the dairy farmers in Nyabihu district – cross-tabulation of RDDP's benefit and monthly income

The best practices in climate adaptation strategies outlined by dairy farmers in Nyabihu district – frequency distribution of the responses of respondents to climate change adaptation strategies.

The effect of climate adaptation strategies on improving livelihoods of the dairy farmers in Nyabihu district -

Data were presented in illustrative tables and graphs (bars charts and pie charts).

CHAPTER FIVE
RESULTS AND DISCUSSION

5.1 Demographic Characteristics of Respondents

Our findings of the age Distribution of Dairy Farmers in Nyabihu District indicates that larger percent (about 33 percent) of the population are between the ages of 31 and 40, which illustrates that the dairy sector in Rwanda are actively engaged by population in their active productive years. It is also interesting to note that older population (more than 2 percent over 70 years) are also involved in dairy farming. This may suggest that the dairy sector is sustainable in terms of labour force. The mean age of respondents is given as 45.38 years. This is shown in the figure 5.1.

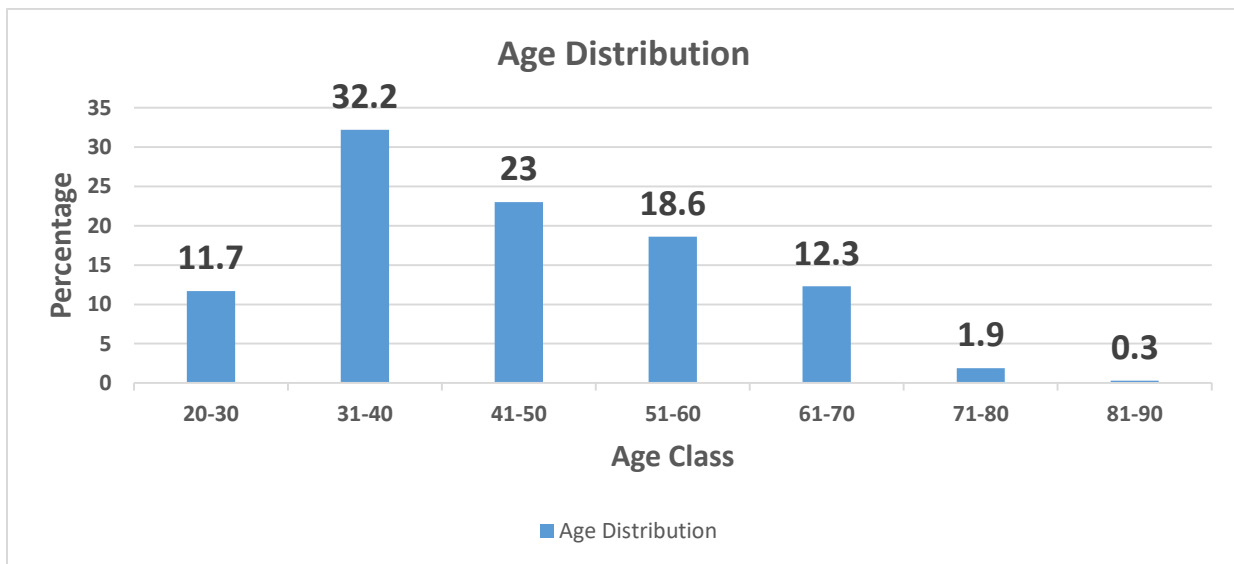


Figure 5.1: Age Distribution of Respondents

Source: Field Survey, 2018

We further found that more than half (52.5%) of the respondents have primary education and 24.3% also having secondary school education. The Net Attendance Rate (NAR) in Primary school for Nyabihu district was 89.2% in 2012 (NISR, 2012), which was even higher than the National NAR given at 87.9% in 2013 (EICV4, 2013). While the net attendance rate in secondary school in Nyabihu was at 23.5% in 2012 (NISR, 2012), and NAR of National was 23% in 2013. **This means that more than half of the Nyabihu children abandon schooling after their primary education to pick up some economic activities. However, the current rise in the secondary school net attendance is primarily driving the increases in secondary school attendance in the rural areas of Rwanda (EICV4, 2013).**

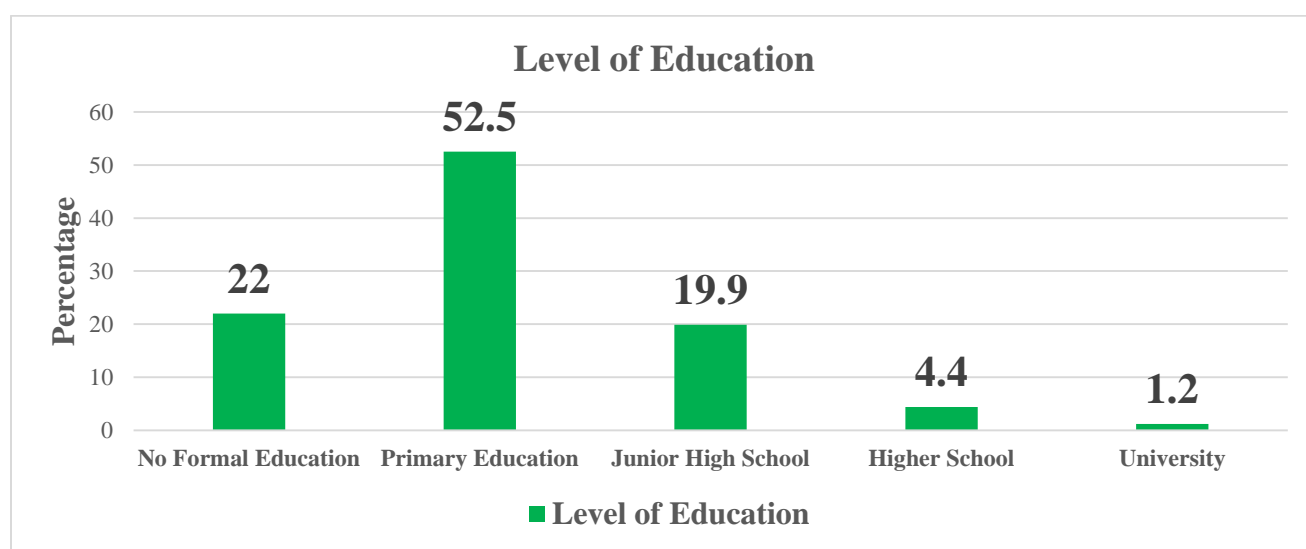


Figure 5.2: Level of Education of Respondents

Source: Field Survey, 2018

In terms of marital status, majority (76.9%) of the respondents are married. **This suggests that there is a possibility of having household help in the dairy business.** Figure 5.3 explains more.

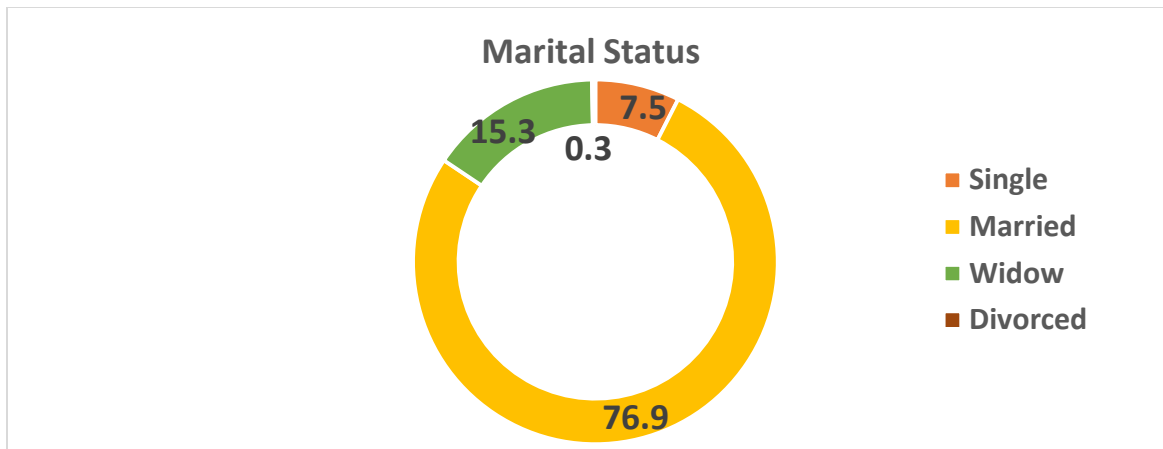


Figure 5.3: Marital Status of Respondents

Source: Field Survey, 2018

As for Gender distribution, results show that 71.9 percent of the respondents are male while 28.1 percent are female. It would have been thought that dairy farming is for Men, but RDDP seeks to increase Women’s participation and EICV4 (2013) revealed that more female headed households than male-headed households have received an animal from other social protection schemes, hence this percent of women almost reaching 50% involvement. **This might keep rising as RDDP progresses.**

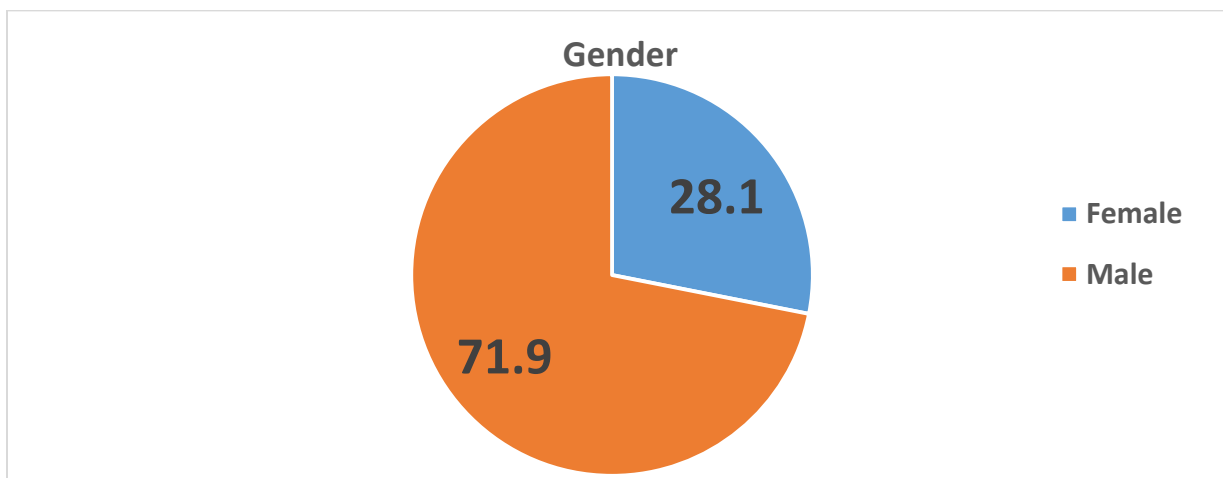


Figure 5.4: Gender of Respondents

Source: Field Survey, 2018

For the beliefs of the respondents, it was found out that majority (97%) of the respondents are Christians while 1.8% are Muslims and 1.2% did not state their religion. NISR (2012), attested that Christianity is the predominant religion in Nyabihu District with more than 95%, Muslims represent 0.7% of the resident population, 3.7% of the resident population are without religion.

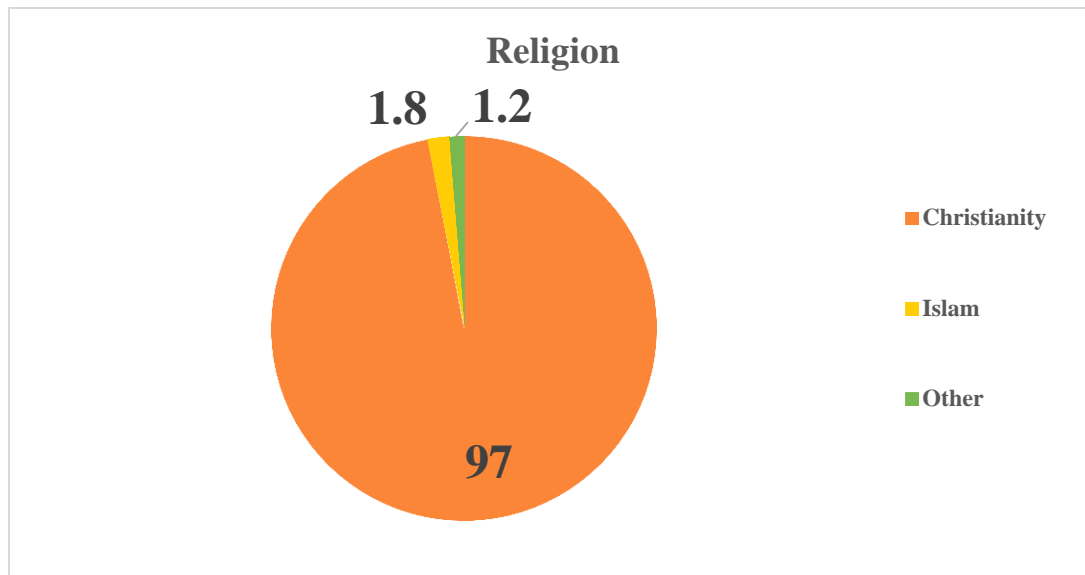


Figure 5.5: Religious Affiliation of the Respondents

Source: Field Survey, 2018

For household leaders, results of previous surveys showed that raising cattle in Rwanda is far more common among male-headed households than female-headed ones (53% compared to 41%). (EICV, 2013). In Nyabihu, male-headed households are also the majority (80.5%) leaving 19.5% for the female-headed households. The percentage of households raising cattle has risen nationally by three percentage points, from 47% to 50%, which is driven by an increase in Kigali City, Southern and Western Provinces (where Nyabihu is located).

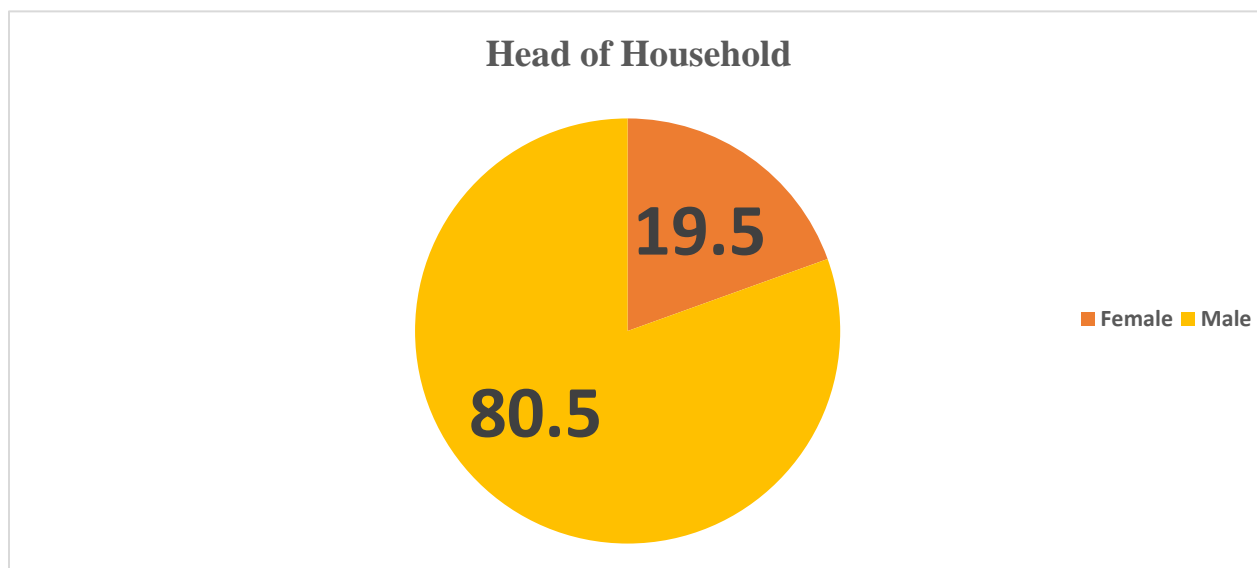


Figure 5.6: Head of Household

Source: Field Survey, 2018

5.3 Effect of Dairy Farm Ownership on Improving Livelihoods of the Dairy Farmers

There was an increase of more than 4 point percentage in the self-owned pattern of ownership amongst the respondents (from 81.4% to 85.8%), showing that more people now own their dairy farming business compared to periods before RDDP. **This suggests more people may have got cows from RDDP.** There may also have been this indication because there were decrease in percentage points in the ownership patterns of both Rent (from 2.9% to 2.1%) and jointly owned (from 3.3% to 2.1%). Earlier surveys (EICVs) indicated that the percentage of livestock-owning households rearing cattle increased over the years (34.4%, 47.3% and 50.4%).

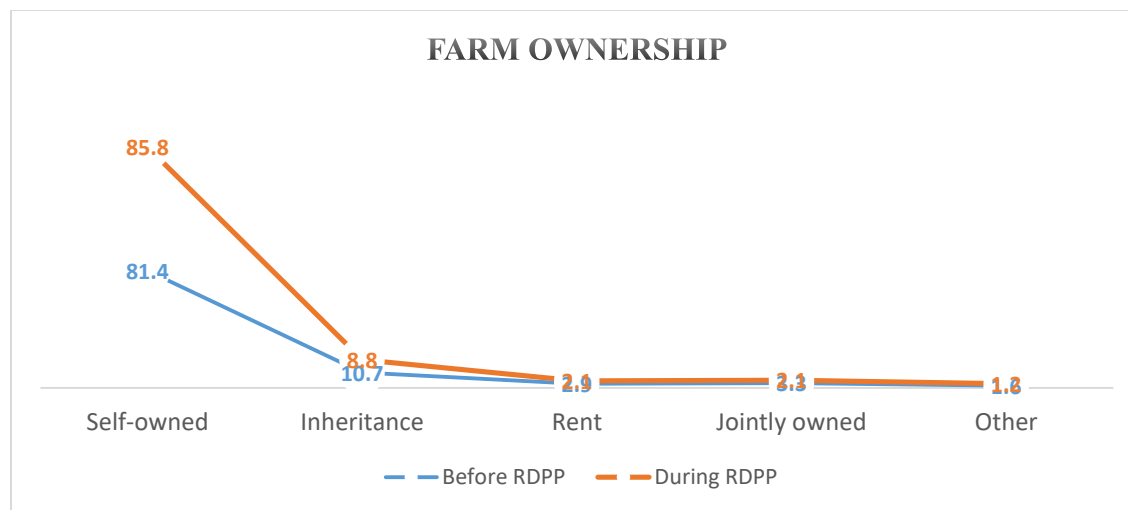


Figure 5.7: Farm Ownership before and during RDDP

Source: Field Survey, 2018

Comparing the income of Self-owned farm ownership pattern before and during the RDDP, it is evident that dairy farmers who own their farms make more income during RDDP. However, in the category of monthly income (0-20000RwF) was it seen that self-owned farmers made more income before RDDP to the same category during RDDP. Subsequently, in other higher categories of monthly income, self-owned farmers make more income than other forms of farm ownership. **This may suggest that the project has been beneficial to self-owned farmers or sole proprietors in the dairy business in Rwanda.** Figure 5.8 explains more.

Table 5.1 shows the increasing trend of average monthly income of the farmers according to the forms of farm ownership. All forms of farm ownership have increasing trends.

Table 5.1: Average Monthly Income (RwF) of Respondents and Form of Farm Ownership before and during RDDP

Forms of Farm Ownership	Average Monthly Income before RDDP (RwF)	Average Monthly Income during RDDP (RwF)
Self-owned	41,054	63,244
Inheritance	124,500	243,200
Rent	94,333	169,114
Jointly-owned	28,920	133,714
Other	25,200	54,000

Source: Field Survey, 2018

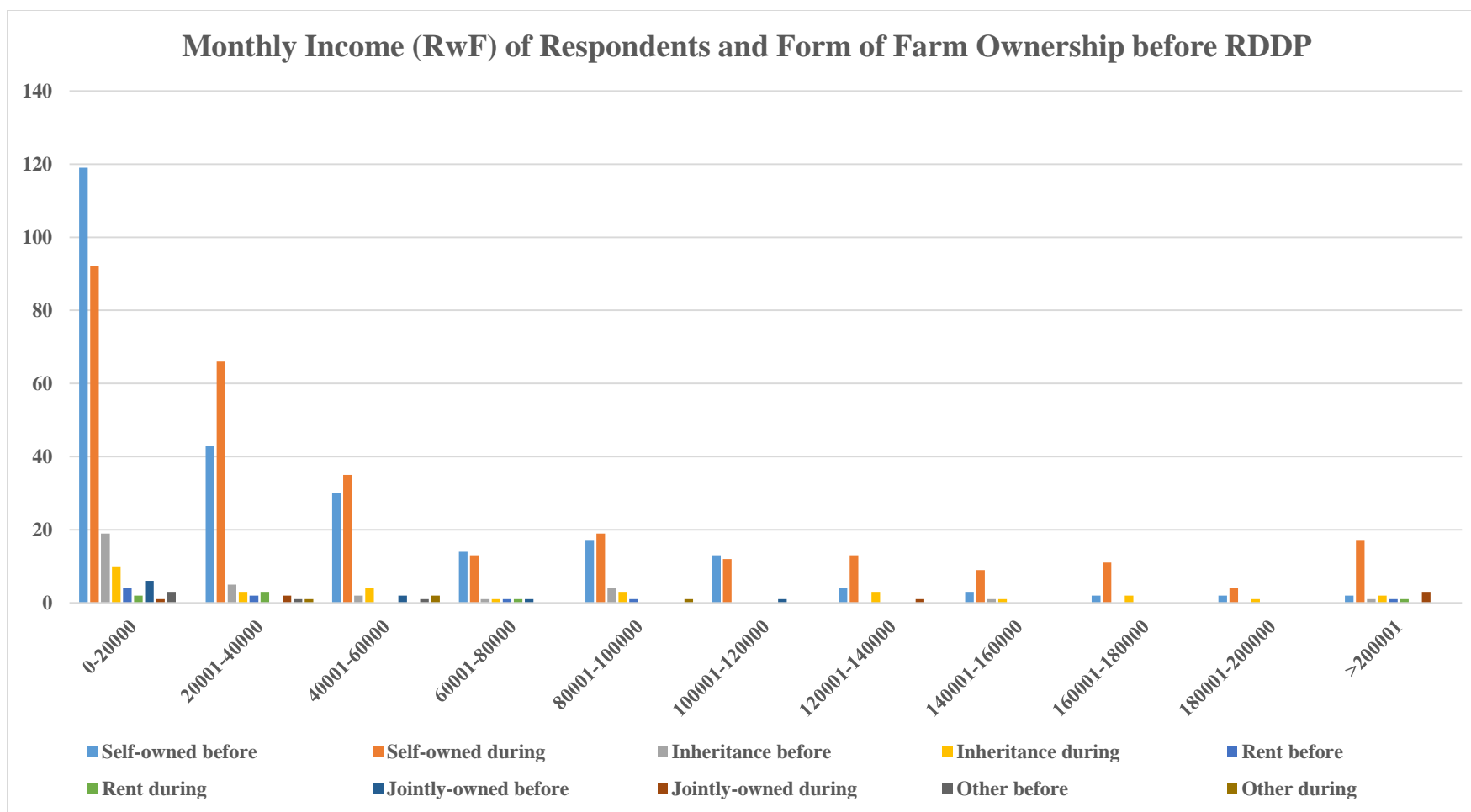


Figure 5.8: Monthly Income (RwF) of Respondents and Form of Farm Ownership before and during RDDP

Source:

Field

Survey,

2018

With the use of cross-tabulation, a detailed information of the relationship between forms farm ownership and monthly income was given before the implementation of RDDP. Self-owned form of farm ownership ranked highest at the 0-20000 RwF category of monthly income. Chi-square test was done at 5% probability, a result of no significance was given. Table 5.2 explains more.

Table 5.2: The relationship between Monthly Income and Forms of Farm Ownership of the Respondents before RDDP

	Form of Farm Ownership before RDDP					Total
	Self-owned	Inheritance	Rent	Jointly Owned	Other	
0-20000	119	19	4	6	3	151
20001-40000	43	5	2	0	1	51
40001-60000	30	2	0	2	1	35
60001-80000	14	1	1	1	0	17
80001-100000	17	4	1	0	0	22
100001-120000	13	0	0	1	0	14
120001-140000	4	0	0	0	0	4
140001-160000	3	1	0	0	0	4
160001-180000	2	0	0	0	0	2
180001-200000	2	0	0	0	0	2
>200001	2	1	1	0	0	4
Total	249	33	9	10	5	306

Source: Field Survey, 2018

Chi-Square Tests: Value 23.765 at 0.981 significance

With the use of cross-tabulation, a detailed information of the relationship between forms farm ownership and monthly income was given during the implementation of RDDP. Self-owned form of farm ownership still ranking highest at the 0-20000 RwF category of monthly income, although with a reduction in frequency (from 119 to 92), giving room for an increase in the frequency at other higher categories of monthly income, 20001-40000 (from 43 to 66) and 160001-180000 (from 2 to 11). Chi-square test was done at 5% probability, a result of no significance was given. Table 5.3 explains more.

Table 5.3: The relationship between Monthly Income and Forms of Farm Ownership of the Respondents before RDDP

	Form of Farm Ownership during RDDP					Total
	Self-owned	Inheritance	Rent	Jointly Owned	Other	
0-20000	92	10	2	1	0	105
20001-40000	66	3	3	2	1	75
40001-60000	35	4	0	0	2	41
60001-80000	13	1	1	0	0	15
80001-100000	19	3	0	0	1	23
100001-120000	12	0	0	0	0	12
120001-140000	13	3	0	1	0	17
140001-160000	9	1	0	0	0	10
160001-180000	11	2	0	0	0	13
180001-200000	4	1	0	0	0	5
>200001	17	2	1	3	0	23
Total	291	30	7	7	4	339

Source: Field Survey, 2018

Chi-Square Tests: Value significance 40.421 at 0.452 significance

5.4 Influence of Access to Credit on improving Livelihoods of the dairy farmers

Majority (69.3%) of the respondents before RDDP had no access to financial assistance from savings and loans group but there is access to financial assistance during RDDP (from 30.7% to 51.5%). **This may be due to better organization of dairy farmers into cooperative groups.** RDDP also comes with grants for dairy farmers, however, only few have benefitted from the grants. Informal lenders remain the most common source of credit (EICV4, 2013).

Table 5.4: Access to financial assistance from savings and loans group before and during RDDP

	Before RDDP		During RDDP	
	Frequency	Percent	Frequency	Percent
Yes	99	30.7	168	51.5
No	223	69.3	158	48.5
Total	322	100.0	326	100

Source: Field Survey, 2018

On the influence of access to financial assistance on monthly income (RwF) of dairy farmers in Nyabihu district before and during RDDP, a cross-tabulation of access to financial assistance and monthly income of dairy farmers reveals that dairy farmers who have access to financial assistance make more income monthly than those who do not have access to financial assistance both before and during RDDP. **However, there is a tremendous increase across the categories of monthly income of farmers who have access to financial assistance during RDDP, especially at category 160001-180000 (from 0-11).** Some of the things highlighted by the respondents to use the financial assistance for, ranges from purchase of improved breeds of cows, feed amongst many other things. Figures 5.9, 5.10 and Tables 5.5, 5.6 explain more.

For the relationship between access to financial assistance from savings and loans group and monthly income of respondents before RDDP, the Chi-square test result shows that there is a significant relationship.

Table 5.5: Relationship between access to financial assistance from savings and loans group and monthly income of respondents before RDDP

	Have you been accessing financial assistance from your savings and loans group before RDDP		Total
	Yes	No	
0-20000	30	140	170
20001-40000	15	32	47
40001-60000	17	18	35
60001-80000	9	8	17
80001-100000	9	13	22
100001-120000	10	4	14
120001-140000	3	1	4
140001-160000	2	2	4
160001-180000	0	2	2
180001-200000	1	1	2
>200001	3	1	4
Total	99	222	321

Source: Field Survey, 2018

Chi-Square Tests: Value 44.048 at 0.000 significance

For the relationship between access to financial assistance from savings and loans group and monthly income of respondents during RDDP, the Chi-square test result shows that there is a significant relationship.

Table 5.6: Relationship between access to financial assistance from savings and loans group and monthly income of respondents during RDDP

	Have you been accessing financial assistance from your savings and loans group during RDDP		Total
	Yes	No	
0-20000	31	69	100
20001-40000	33	38	71
40001-60000	15	25	40
60001-80000	10	4	14
80001-100000	18	5	23
100001-120000	7	4	11
120001-140000	14	2	16
140001-160000	7	3	10
160001-180000	10	3	13
180001-200000	4	1	5
>200001	19	4	23
Total	168	158	326

Source: Field Survey, 2018

Chi-Square Tests: Value 53.725 at 0.000 significance

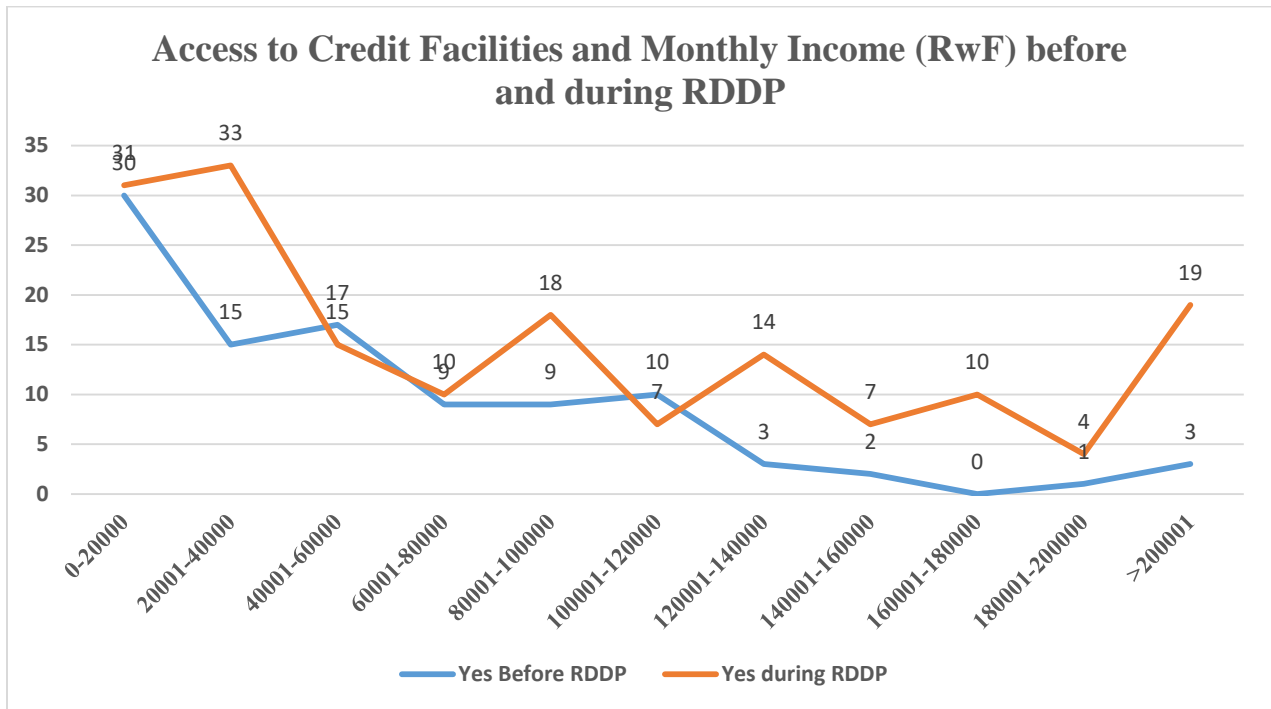


Figure 5.9: Access to Credit Facilities and Monthly Income (RwF) before and during RDDP

Source: Field Survey, 2018

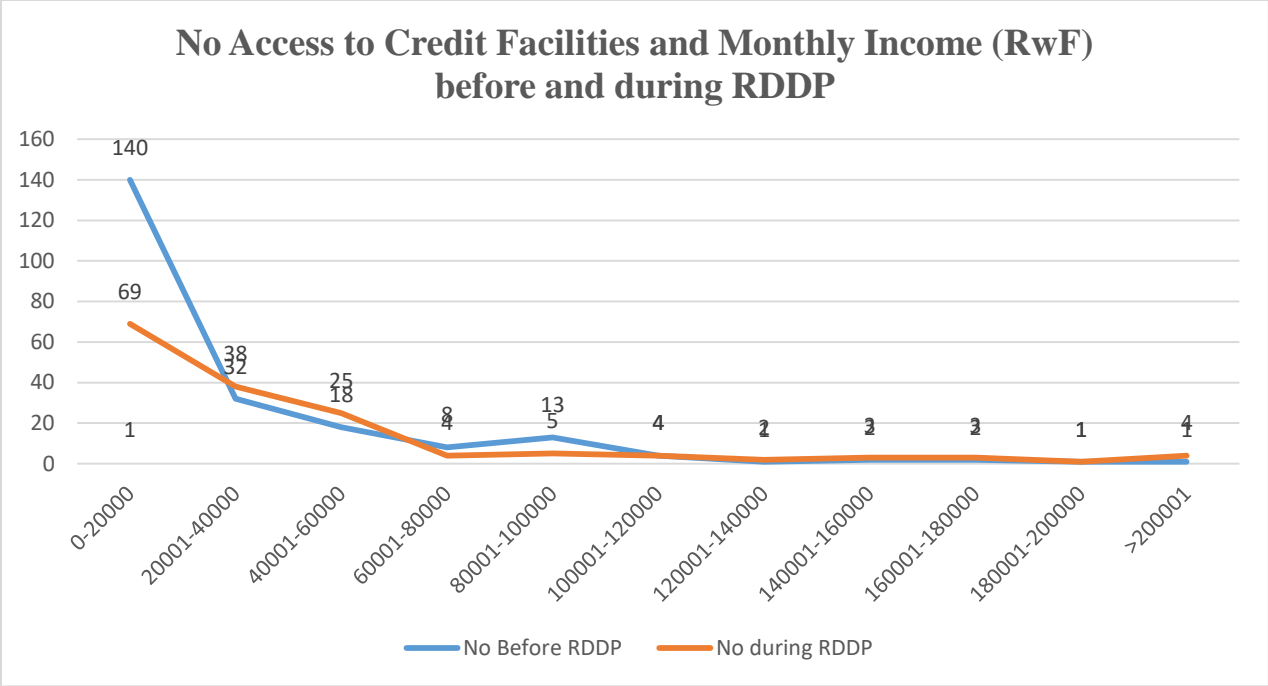


Figure 5.10: No access to Credit Facilities and Monthly Income (RwF) before and during RDDP
Source: Field Survey, 2018

5.5 Effect of the contribution of Rwanda Dairy Development Project on improving livelihoods of the dairy farmers

When asked if they have benefited from RDDP, majority (87.8%) responded in affirmation that they have benefited or are currently benefiting from the project (figure 13). Trainings and Vaccines (70.4% and 69.8) topping the list of benefits, Cow/Heifer was the least benefited (figure 5.10). Trainings and sensitization about the project are given high priority. However, 12.2% of the respondents said they have not benefited from RDDP, giving the reason that they have not heard about the project. This may be because the project is still in its early stage of implementation.

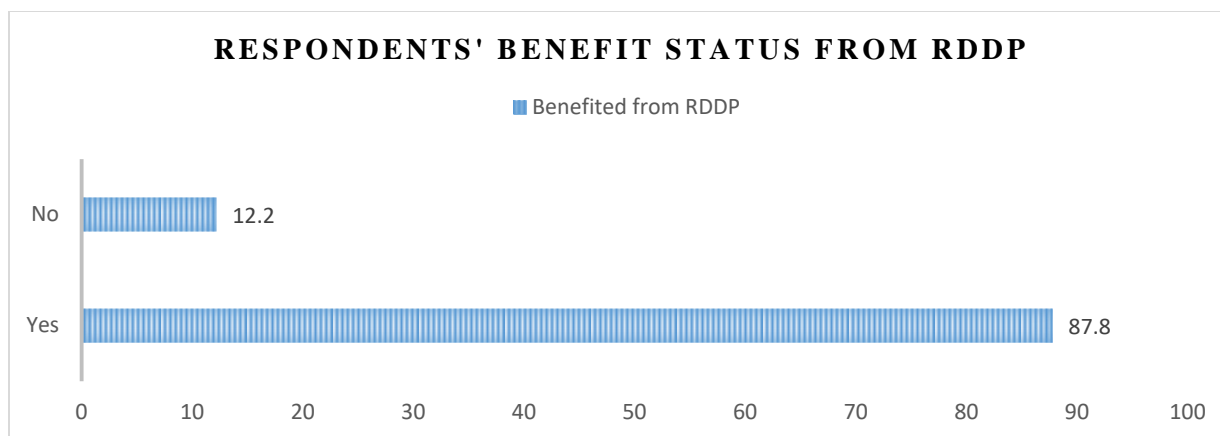


Figure 5.11: Respondents' Benefit Status from RDDP

Source: Field Survey, 2018

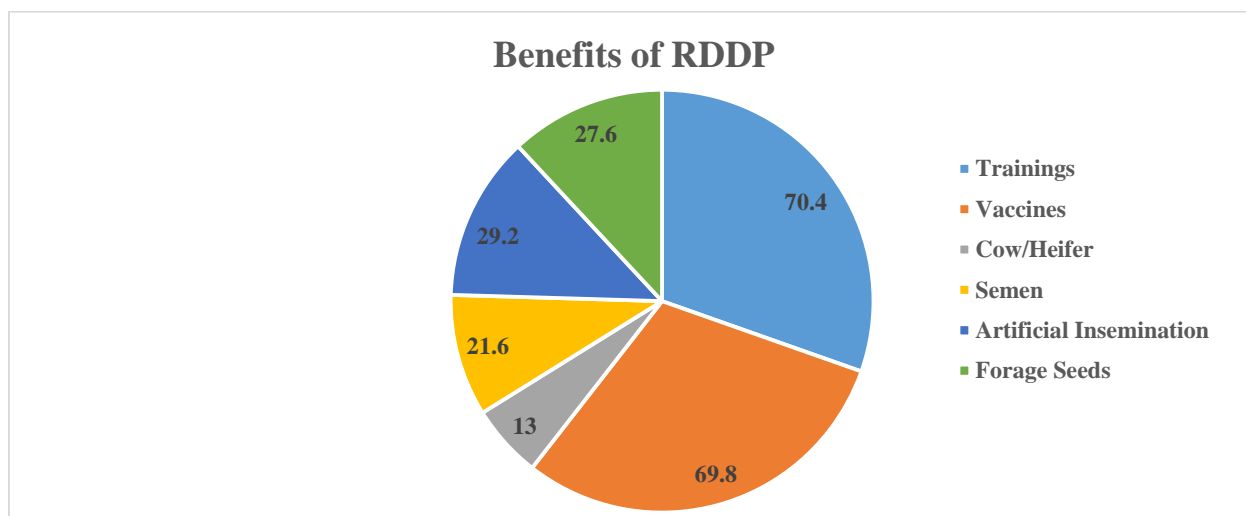


Figure 5.12: Benefits of RDDP

Source: Field Survey, 2018

Benefits of RDDP enjoyed or enjoying? Cow/Heifer

Comparing the rate at which male- and female-headed households have received animals from schemes, EICV4 (2013) revealed that more female headed households than male-headed households have received an animal from other social protection schemes. This hold true for this study also. Female-headed households (23.4%) have received a Cow from RDDP more than the male-headed households (9%) in the study area. Table 5.7 reveals more.

Table 5.7: Benefits of Cow/Heifer according to household heads

	Female		Male	
	Frequency	Percentage	Frequency	Percentage
Yes	15	23.4	24	9
No	49	76.6	242	91.0
Total	64	100	266	100

Source: Field Survey, 2018

Chi-square Test: Value 10.286 at 0.001 significance

Before RDDP, a large number of dairy farmers make between 0-20000 RwF monthly from milk production. During RDDP, however, respondents who benefit from the project have experienced increase in monthly income. This is evident in the categories of income, especially in the category of monthly income of above 200000 RwF (from 2 farmers to 20 farmers) before to during RDDP, as shown in Figure 5.13. **One of the major benefits instrumental to the contribution of increased income (improved livelihood) of dairy farmers in the study area is the opportunity to sell milk readily at Milk Collection Centres (MCC) at regulated price per litre, which is higher than the prices being sold per litre at retail prices to random buyers.**

However, for dairy farmers who have not benefited from RDDP, majority of them have their monthly income between 0-20000 and 20001-40000 RwF, as shown in figure 16.

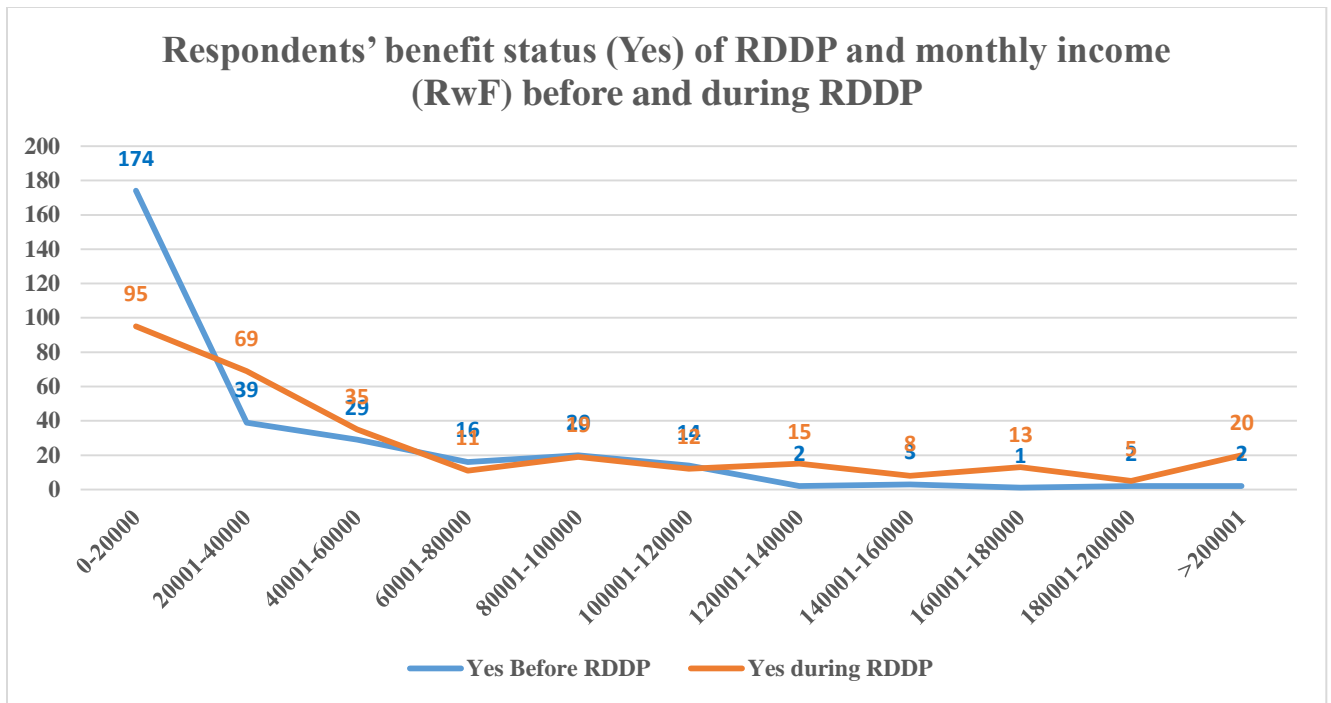


Figure 5.13: Benefits of RDDP

Source: Field Survey, 2018

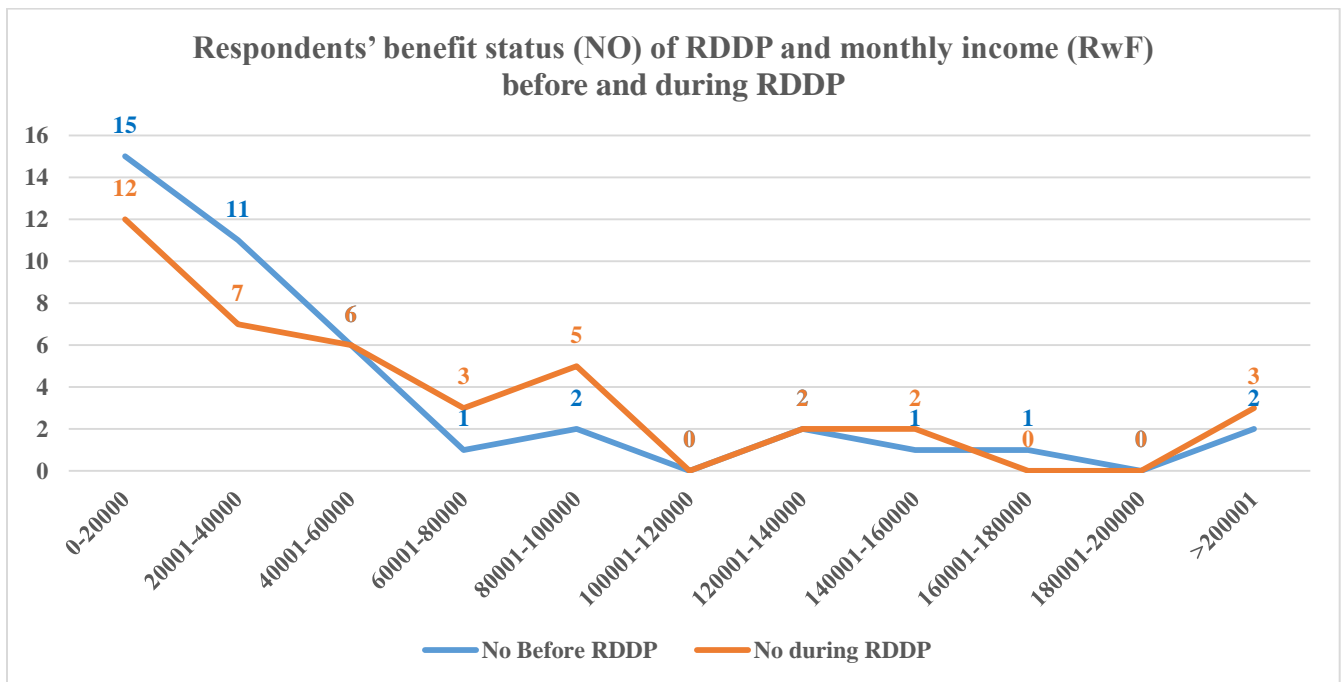


Figure 5.14: Benefits of RDDP

Source: Field Survey, 2018

5.6 Best practices in Climate Adaptation Strategies outlined by dairy farmers

Households in Rwanda identified climate change most frequently as the main environmental issue affecting their plot(s). The main sources of information were meetings and trainings and radio or TV. Environmental destruction for dwellings is more common in Western Province, Northern Province and Southern Province, and affecting a lower percentage of dwellings in Eastern Province and Kigali City (EICV4, 2013). Hence respondents at Nyabihu district have highlighted climate change adaptation practices.

When asked how they cope whenever there is reduction in water availability for their cows, close to half of the total respondents (49.2%) said water harvesting is their adaptation practice while 34.9% said water is got from borehole to feed the cows. Table 5.8 explains further.

Table 5.12 shows the adaptation practices of respondents when there is reduction in grazing land. Higher percentage (44%) of the respondents store forages for dry season feeding, some (29.2%) feed their cows with agroforestry leaves by planting the trees earlier. Others (25.1%) prefer to feed cows with concentrates, while only few (1.6%) engage the use of hydroponics technology to plant forages.

For increase in Temperature (Table 5.16), large percentage (57.4%) of the farmers prefer to plant agroforestry trees for dual purposes of creating shed for their cows during hot period and feeding also. Other farmers engage in the use of vaccinations (22.6%) and construction of sheds (19.4%).

On adaptation practices for floods (Table 5.20), majority (58.1%) of the farmers said they would rather take their cows away from the flooded areas while some others (42.7%) said they would put integrated watershed management measures such as terraces, agroforestry trees, and water ways in place against the floods.

Table 5.8: Climate Adaptation Practices – Reduction in water availability

	Frequency	Percent
Water harvesting	124	49.2
Borehole	88	34.9
Waste water treatment	35	13.9
Other	5	2.0
Total	252	100.0

Source: Field Survey, 2018

For relationship between the climate adaptation practices by the rural farmers in Rwanda and gender, results revealed that more female than male get water from water harvesting (73 to 49) and Borehole (65 to 21) whenever there is reduction in water availability for their dairy business need. Chi-square test done at 5% gave a significant result at 0.053.

Table 5.9: Climate Adaptation Practices – Reduction in water availability and Gender

Climate Adaptation Practices – Reduction in water availability	Gender of Respondent	
	Male	Female
Water harvesting	49	73
Borehole	21	65
Waste water treatment	8	27
Other	1	4
Total	79	169

Source: Field Survey, 2018

Chi-square Test: Value 7.700 at 0.053 significance

For relationship between the climate adaptation practices by the rural farmers in Rwanda and academic qualification, results revealed that more farmers who attained Primary Education get water from water harvesting (72) and Borehole (49) whenever there is reduction in water availability for their dairy business need. Chi-square test done at 5% gave a significant result at 0.006.

Table 5.10: Climate Adaptation Practices – Reduction in water availability and Highest Educational Qualification

Climate Adaptation Practices – Reduction in water availability	Highest Educational Qualification				
	No Formal Education	Primary Education	Junior High School	Higher School	University
Water harvesting	28	72	16	4	0
Borehole	16	49	21	1	0
Waste water treatment	8	16	7	3	1
Other	1	0	4	0	0
Total	53	137	48	8	1

Source: Field Survey, 2018

Chi-Square Tests: Value 27.645 at 0.006 significance

Relationship between the climate adaptation practices by the rural farmers in Rwanda and Marital Status, results revealed that more farmers who are married get water from water harvesting (97) and Borehole (69) whenever there is reduction in water availability for their dairy business need. Chi-square test done at 5% gave a significant result at 0.000.

Table 5.11: Climate Adaptation Practices – Reduction in water availability and Marital Status

Climate Adaptation Practices – Reduction in water availability and Marital Status	Marital Status		
	Single	Married	Widow
Water harvesting	3	97	24
Borehole	7	69	12
Waste water treatment	2	26	7
Other	3	1	1
Total	15	193	44

Source: Field Survey, 2018

Chi-Square Tests: Value 31.070 at 0.000 significance

Table 5.12: Climate Adaptation Practices – Reduction in grazing land

	Frequency	Percent
Storage of forages for dry season feeding	107	44.0
Feeding of Concentrates	61	25.1
Use of Hydroponics technology	4	1.6
planting of agroforestry trees	71	29.2
Total	243	100.0

Source: Field Survey, 2018

Relationship between the climate adaptation practices by the rural farmers in Rwanda and gender, results revealed that more female than male adopt storage of forages for dry season feeding (71 to 36), planting of agroforestry trees (57 to 14) and feeding of Concentrates (39 to 20) to cows whenever there is reduction in grazing land for their dairy business need. Chi-square test done at 5% gave a no significant result at 0.113.

Table 5.13: Climate Adaptation Practices – Reduction in grazing land and Gender

Climate Adaptation Practices – Reduction in grazing land	Gender of Respondent	
	Male	Female
Storage of forages for dry season feeding	36	71
Feeding of Concentrates	20	39
Use of Hydroponics technology	0	3
Planting of agroforestry trees	14	57
Total	70	170

Source: Field Survey, 2018

Chi-Square Tests: Value 5.981 at 0.113 significance

Relationship between the climate adaptation practices by the rural farmers in Rwanda and educational qualification, results revealed that farmers who attained Primary Education ranked highest in the adoption of storage of forages for dry season feeding (63), planting of agroforestry trees (32) and feeding of Concentrates (27) to cows whenever there is reduction in grazing land for their dairy business need. Chi-square test done at 5% gave a no significant result at 0.087.

Table 5.14: Climate Adaptation Practices – Reduction in grazing land and Highest Educational Qualification

Climate Adaptation Practices – Highest Educational Qualification	Highest Educational Qualification				
	No Formal Education	Primary Education	Junior High School	Higher School	University
Storage of forages for dry season feeding	19	63	22	2	0
Feeding of Concentrates	21	27	8	2	1
Use of Hydroponics technology	0	4	0	0	0
Planting of agroforestry trees	14	32	19	5	1
Total	54	126	49	9	2

Source: Field Survey, 2018

Chi-Square Tests: Value 19.081 at 0.087 significance

Relationship between the climate adaptation practices by the rural farmers in Rwanda and Marital Status, results revealed that married farmers ranked highest in the adoption of storage of forages for dry season feeding (79), planting of agroforestry trees (58) and feeding of Concentrates (45) to cows whenever there is reduction in grazing land for their dairy business need. Chi-square test done at 5% gave a no significant result at 0.222.

Table 5.15: Climate Adaptation Practices – Reduction in grazing land and Marital Status

Climate Adaptation Practices – Reduction in grazing land and Marital Status	Marital Status			
	Single	Married	Widow	Divorced
Storage of forages for dry season feeding	7	79	20	1
Feeding of Concentrates	2	45	14	0
Use of Hydroponics technology	0	4	0	0
Planting of agroforestry trees	8	58	5	0
Total	17	186	39	1

Source: Field Survey, 2018

Chi-Square Tests: Value 11.843 at 0.222 significance

Table 5.16: Climate Adaptation Practices – Increase in Temperature

	Frequency	Percent
Taking vaccination	35	22.6
construction of sheds	30	19.4
Planting of agroforestry trees	89	57.4
Other	1	.6
Total	155	100.0

Source: Field Survey, 2018

Relationship between the climate adaptation practices by the rural farmers in Rwanda and gender, results revealed that more female than male adopt taking vaccination (26 to 9), construction of sheds (25 to 4) and planting of agroforestry trees (62 to 26) as a mitigation against increase in temperature which affects their dairy business. Chi-square test done at 5% gave a no significant result at 0.130.

Table 5.17: Climate Adaptation Practices – Increase in Temperature and Gender

Climate Adaptation Practices - Increase in Temperature and Gender	Gender of Respondent	
	Male	Female
Taking Vaccination	9	26
Construction of Sheds	4	25
Planting of agroforestry trees	26	62
Other	1	0
Total	40	113

Source: Field Survey, 2018

Chi-Square Tests: Value 5.647 at 0.130 significance

Relationship between the climate adaptation practices by the rural farmers in Rwanda and educational qualification, results revealed that farmers who attained primary education adopt taking vaccination (22), construction of sheds (14) and planting of agroforestry trees (43) as a mitigation against increase in temperature which affects their dairy business. Chi-square test done at 5% gave a no significant result at 0.719.

Table 5.18: Climate Adaptation Practices – Increase in Temperature and Highest Educational Qualification

Climate Adaptation Practices – Increase in Temperature and Highest Educational Qualification	Highest Educational Qualification				
	No Formal Education	Primary Education	Junior High School	Higher School	University
Taking vaccination	8	22	3	1	0
Construction of sheds	6	14	7	1	0
Planting of agroforestry trees	18	43	24	4	0
Other	0	1	0	0	0
Total	32	80	34	6	0

Source: Field Survey, 2018

Chi-Square Tests: Value 6.205 at 0.719 significance

Relationship between the climate adaptation practices by the rural farmers in Rwanda and educational qualification, results revealed that more farmers who are married adopt taking vaccination (28), construction of sheds (28) and planting of agroforestry trees (65) as a mitigation against increase in temperature which affects their dairy business. Chi-square test done at 5% gave a significant result at 0.023.

Table 5.19: Climate Adaptation Practices – Increase in Temperature and Marital Status

Climate Adaptation Practices – Increase in Temperature and Marital Status	Marital Status				
	Single	Married	Widow	Divorced	Single
Taking vaccination	0	28	7	0	0
Construction of sheds	1	28	1	0	0
Planting of agroforestry trees	9	65	15	0	0
Other	0	0	1	0	0
Total	10	121	24	0	0

Source: Field Survey, 2018

Chi-Square Tests: Value 14.648 at 0.023 significance

Table 5.20: Climate Adaptation Practices – Floods

	Frequency	Percent
Take Cows away from the flooded area	86	58.1
Putting in place the integrated watershed management measures such as terraces, agroforestry trees, water ways	61	41.2
Other	1	.7
Total	148	100.0

Source: Field Survey, 2018

Relationship between the climate adaptation practices by the rural farmers in Rwanda and gender, results revealed that more female than male resolve to taking Cows away from the flooded area (57 to 26) and putting in place the integrated watershed management measures such as terraces, agroforestry trees, water ways construction of sheds (45 to 16) as a mitigation against floods which affect their dairy business. Chi-square test done at 5% gave a no significant result at 0.243.

Table 5.21: Climate Adaptation Practices – Floods and Gender

Climate Adaptation Practices – Floods	Gender of Respondent	
	Male	Female
Take Cows away from the flooded area	26	57
Putting in place the integrated watershed management measures such as terraces, agroforestry trees, water ways	16	45
Other	1	0
Total	43	102

Source: Field Survey, 2018

Chi-Square Tests: Value 2.826 at 0.243 significance

Relationship between the climate adaptation practices by the rural farmers in Rwanda and educational qualification, results revealed that more farmers who attained primary education resolve to taking Cows away from the flooded area (53) and putting in place the integrated watershed management measures such as terraces, agroforestry trees, water ways construction of sheds (28) as a mitigation against floods which affect their dairy business. Chi-square test done at 5% gave a no significant result at 0.538.

Table 5.22: Climate Adaptation Practices – Floods and Highest Educational Qualification

Climate Adaptation Practices – Floods and Highest Educational Qualification	Highest Educational Qualification				
	No Formal Education	Primary Education	Junior High School	Higher School	University
Take Cows away from the flooded area	10	53	18	3	0
Putting in place the integrated watershed management measures such as terraces, agroforestry trees, water ways	12	28	15	5	1
Other	0	1	0	0	0
Total	22	82	33	8	1

Source: Field Survey, 2018

Chi-Square Tests: Value 6.983 at 0.538 significance

Relationship between the climate adaptation practices by the rural farmers in Rwanda and Marital Status, results revealed that more married farmers resolve to taking Cows away from the flooded area (68) and putting in place the integrated watershed management measures such as terraces, agroforestry trees, water ways construction of sheds (45) as a mitigation against floods which affect their dairy business. Chi-square test done at 5% gave a no significant result at 0.192.

Table 5.23: Climate Adaptation Practices – Floods and Marital Status

Climate Adaptation Practices – Floods and Marital Status	Marital Status				
	Single	Married	Widow	Divorced	Single
Take Cows away from the flooded area	6	68	12	0	0
Putting in place the integrated watershed management measures such as terraces, agroforestry trees, water ways	6	45	10	0	0
Other	0	0	1	0	0
Total	12	113	23	0	0

Source: Field Survey, 2018

Chi-Square Tests: Value 6.100 at 0.192 significance

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATION

6.0 Summary

The study was carried out in Nyabihu district of the Western Province of Rwanda with the aim of assessing the Rwanda Dairy Development Projects as it affects the livelihoods of the dairy farmers in Rwanda. Out of the population of dairy farmers in Nyabihu district, about 350 were randomly selected across 6 sectors through their cooperatives. It was discovered that RDDP has contributed to the improving livelihoods of the dairy farmers in Nyabihu district.

For farm ownership, dairy farmers who owned and operated their farms themselves (self-owned) have experienced an increase in their income during RDDP and more farmers have moved from renting and joint owning of farms to owning the farms by themselves due to receiving of cows from the project.

Dairy farmers now have easy access to credit for their dairy businesses. This has helped the farmers to purchase of improved breeds of cows and sufficient feed when there is scarcity of forages. The improved breeds of cows bought produce more milk than the local breeds. This has further increased the production and sale of milk, thereby increasing the income farmers make on a monthly basis.

Several benefits received from RDDP (Trainings, Vaccinations, Semen, Artificial Insemination and Forage seeds) have helped the farmers to have better farming practices which has improved their monthly income. These benefits are given to farmers free.

The farmers attested to the fact that Climate Change affects their farming business, however they recognized some adaption strategies for Climate Change. Some of the major Climate Change adaptation practices are cultivation of forages when there is reduced grazing lands for cows. RDDP provided forage seeds to dairy farmers. While some farmers buy concentrates for their cows and some few store forages till dry season to feed their cows. A lot of farmers opt for water harvesting when there is reduced water while some fetch water from community boreholes.

6.1 Conclusion

The Rwanda Dairy Development Project (RDDP) has been of benefit to the dairy farmers in Rwanda while improving their livelihoods. This has been achieved through trainings on best

dairy farming practices and access to market. If this much could be achieved in just one year of implementation, much more would be achieved in the coming years of implementation of RDDP.

6.2 Recommendations

A lot of the dairy farmers now have access to credit. Some of the dairy farmers are yet to join a cooperative group. I would like to suggest that more dairy farmers should be encouraged to join a cooperative. The cooperative groups have made it easier to access credits and loans. Also, many of the farmers do not know about the grant available from RDDP, I would suggest that farmers be made aware of the grant from RDDP, and be taught on how to access the grant.

Despite the large percent of dairy farmers who have benefited from RDDP, about 12.2 percent of the respondents said they have not benefited from RDDP because, they have not heard of the project. I would like to suggest that more effort should go into sensitizing the farmers about the RDDP and the benefits available.

Dairy farmers in Rwanda have adopted climate adaptation strategies, I suggest that more trainings on climate-smart agriculture should continue. Also more information on climate change and effects should be further easily accessed by dairy farmers.

6.3 Limitation to the Study

The study was faced with limitation of communication with the respondents. With the training and use of enumerators who could communicate both with the researcher and the respondents, the limitation was reduced.

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APPENDIX 1

A RESEARCH ON EFFECT OF RWANDA DAIRY DEVELOPMENT PROJECT (RDDP) ON IMPROVING LIVELIHOODS OF DAIRY FARMERS IN RWANDA; A CASE OF NYABIHU DISTRICT IN WESTERN PROVINCE

Questionnaire Number: _____ G.P.S. Location/Aho haherereye: _____ Date/Italiki: _____

District/Akarere: _____ Sector/Umurenge: _____ Village/Umudugudu: _____

Dear Respondent,

I am a Masters Student of the department of Sustainable Development Practice at the Centre for Sustainable Development, University of Ibadan, Ibadan, Nigeria. This survey is aimed at assessing the effect of Rwanda Dairy Development Project (RDDP) on improving livelihoods of dairy farmers in Nyabihu District. This questionnaire is designed to elicit information from dairy farmers who have benefitted from the RDDP. Information obtained will be treated with strict confidentiality.

Thank you for your cooperation.

Section A: Socio-demographic Characteristics of Respondents/Imyirondoro y'ubazwa

	QUESTIONS/ STATEMENTS	RESPONSE			CODING
100	What was your age at last birthday? /Ufite imyaka ingahe?	_____ years/imyaka			
101	What is your highest Educational qualification? /Wize amashuri angahe?	1. No Formal Education/sinize		1 <input type="checkbox"/>	
		2. Primary/amashuri abanza		2 <input type="checkbox"/>	
		3. Secondary/amashuri yisumbuye		3 <input type="checkbox"/>	
		4. HND/University degree/kaminuza		4 <input type="checkbox"/>	
		5. Other, specify/Ikindi kivuge _____		5 <input type="checkbox"/>	
102	Marital Status/Irangamimerere	1. Single/Ingaragu		1 <input type="checkbox"/>	
		2. Married/Yarashatse		2 <input type="checkbox"/>	
		3. Widow/Umupfakazi		3 <input type="checkbox"/>	
		4. Divorced/Yatandukanye n'uwu bashakanye		4 <input type="checkbox"/>	
103	Religious Affiliation/Imyemerere ye	1. Christianity/Umukirisitu		1 <input type="checkbox"/>	
		2. Islam/Umuyisilamu		2 <input type="checkbox"/>	
		3. Other, specify/ikindi kivuge _____		3 <input type="checkbox"/>	
104	Gender/Igistina	1. Female/Gore		1 <input type="checkbox"/>	
		2. Male/Gabo		2 <input type="checkbox"/>	
105	Head of Household	1. Female/Gore		1 <input type="checkbox"/>	
		2. Male/Gabo		2 <input type="checkbox"/>	
106	Household Size	Female/Gore	Male/Gabo	Total	

Section B: Pattern of dairy farm ownership and milk production activities

	QUESTIONS/ STATEMENTS	BEFORE RDDP		DURING RDDP		CODING
200	What is your form of dairy farm ownership	1. Self-owned	<input type="checkbox"/>	1. Self-owned	<input type="checkbox"/>	
		2. Inheritance	<input type="checkbox"/>	2. Inheritance	<input type="checkbox"/>	
		3. Rent	<input type="checkbox"/>	3. Rent	<input type="checkbox"/>	
		4. Jointly owned	<input type="checkbox"/>	4. Jointly owned	<input type="checkbox"/>	

		5. Other, specify _____	5. Other, specify _____	
201	Does this ownership pattern have any effect on your dairy business?	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/>	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/>
202	If Yes, explain			
203	What breed of Cow are you using?	1. Local <input type="checkbox"/> 2. <input type="checkbox"/> roved	1. Local <input type="checkbox"/> 2. <input type="checkbox"/> roved	1 <input type="checkbox"/> 2 <input type="checkbox"/>
204	What quantity of milk do you produce per day?	_____	_____	
205	How do you produce this quantity of milk	1. Milking by Self <input type="checkbox"/> 2. Milking by hired la <input type="checkbox"/> r	1. Milking by Self <input type="checkbox"/> 2. Milking by hired la <input type="checkbox"/> r	
206	Are you a member of any dairy farmers' cooperative?	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/>	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/>
207	Do you belong to any savings and loans group?	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/>	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/>
208	Have you been accessing financial assistance from your savings and loans group?	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/>	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/>
209	If No, where else have you received financial assistance?			
210	How have you used the assistance given to you? Explain			
211	How much were you given at that time?	_____	_____	
212	Do you have access to market?	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/>	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/>
213	Where do you sell the milk?/Amata uyagurisha he? (You can tick more than one options as it applies)	1. To neighbours/Mubaturanyi <input type="checkbox"/> 2. In milk collection centres (MCC)? Ku ikusanyirizo <input type="checkbox"/> 3. To the ambulant dealers/Ku bamanyi <input type="checkbox"/> 4. To processing units/Uruganda (ikaragiyo ry'amata) <input type="checkbox"/> 5. I don't sell milk/sinyagurisha <input type="checkbox"/>	1. To neighbours/Mubaturanyi <input type="checkbox"/> 2. In milk collection centres (MCC)? Ku ikusanyirizo <input type="checkbox"/> 3. To the ambulant dealers/Ku bamanyi <input type="checkbox"/> 4. To processing units/Uruganda (ikaragiyo ry'amata) <input type="checkbox"/> 5. I don't sell milk/sinyagurisha <input type="checkbox"/>	
214	Indicate your income from sales of milk as shown			

Section C: Contribution of Rwanda Dairy Development Project (RDDP) to dairy farmers' income

301	Have you benefited or currently benefiting from the Rwanda Dairy Development Project?/Wigeze ubona inyungu zivuye RDDP?	1. Yes/Yego 2. No/Oya	1 <input type="checkbox"/> 2 <input type="checkbox"/>
302	If Yes/Yego, what are the benefits of the Rwanda Dairy Development Project you have enjoyed or enjoying?/Niba ari Yego, niyihe nyungu wabonye/ukibona muri RDDP? (Please tick as many as apply to you)	1. Trainings/Amahugurwa 2. Vaccines/Inkingo 3. Cow/Heifer/Inka/Inyana 4. Semen/Intanga 5. Artificial Insemination/Bagutereye intanga 6. Financial Services 7. Forage Seeds/Umurama w'ubwatsi bw'inka 8. Other, specify/Ikindi kivuge _____	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/>
303	If No/Oya, why?/Niba ari Oya kubera iki?		

304	If No/Oya, what do you suggest?/Niba ari Oya,ese kuri wowe wumva hakorwa iki?		
305	Are you aware of grants from the Rwanda Dairy Development Project to interested Dairy Farmers?/Ese waba uziko RDDP itanga inkunga?	1. Yes/Yego 2. No/Oya	1 <input type="checkbox"/> 2 <input type="checkbox"/>
306	Have you benefited from the grants/Ese bigeze baguha kuri iyo nkunga?		

307	Number of Cows before RDDP			
	Local Breed		Improved Breed/Inka za	
	A. Male (M)/ (Ibimasa)	B. Female (F) (Imbyeyi)	1. Male (M)/ (Ibimasa)	2. Female(F) (Imbyeyi)
Cows/(Inka)				
Total				

307B	Number of Cows	
	Local Breed	
	A. Male (M)/ (Ibimasa)	B. Female (F) (Imbyeyi)
Cows/(Inka)		
Total		

308	Litres of Milk produced per day before RDDP			
	Local Breed		Improved Breed/Inka za	
	Morning/ mu gitondo	Evening/ ni mugoroba	Morning/ mu gitondo	Evening/ ni mugoroba
Litres				
Total				

308B	Litres of Milk produced per day	
	Local Breed	
	Morning/ mu gitondo	Evening/ ni mugoroba
Litres		
Total		

	Question	Before RDDP	During RDDP (in the last one year)
309	How much do you make in a month from milk production?/Winjiza amafaranga angahe ku kwezi?	_____	Cows/(Inka) 1 <input type="checkbox"/> 2 <input type="checkbox"/> Total
310	How many litres of milk do you sell a day?/Ese ugurisha litiro zingaha k'umunsi?	_____	Local Breed Morning/ mu gitondo <input type="checkbox"/> Evening/ ni mugoroba <input type="checkbox"/> Litres Total
311	At what price do you sell your milk per litre?/litiro y'amata uyigurisha angahe?	_____	Total
312	Where do you sell the milk?/Amata uyagurisha he? (You can tick more than one options as it applies)	1. To neighbours/Mubaturanyi <input type="checkbox"/> 2. In milk collection centres (MCC)? Ku ikusanyirizo <input type="checkbox"/> 3. To the ambulant dealers/Ku bamamyi <input type="checkbox"/> 4. To processing units/Uruganda (ikaragiyo ry'amata) <input type="checkbox"/> 5. I don't sell milk/sinyagurisha <input type="checkbox"/>	1. To neighbours/Mubaturanyi <input type="checkbox"/> 2. In milk collection centres (MCC)? Ku ikusanyirizo <input type="checkbox"/> 3. To the ambulant dealers/Ku bamamyi <input type="checkbox"/> 4. To processing units/Uruganda (ikaragiyo ry'amata) <input type="checkbox"/> 5. I don't sell milk/sinyagurisha <input type="checkbox"/> Total
313	Have you experienced any milk loss?/Ese wigeze uhura n'igihombo cy'amata?	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/>	1. Yes/Yego <input type="checkbox"/> 2. No/Oya <input type="checkbox"/> Total
314	If Yes/Yego, estimate the quantity lost per day (in litres)/Niba igisubizo ari Yego, gereranya umubare wa litiro waba warahombye umwaka ushize.	_____	307B Increase 1 <input type="checkbox"/> Decrease 2 <input type="checkbox"/> Total
315	List the main causes of milk losses (You can tick more than one options as it applies)/Vuga ibintu by'ingenzi bituma umukamo wangirika	1. Lack of milk handling skills/Ubumenyi budahagije mu gutereka amata <input type="checkbox"/> 2. Lack of proper milk handling equipment/Kutagira ibikoresho byabugenewe <input type="checkbox"/> 3. Delayed delivery to buyers/Gukererwa kugera ku	1. Lack of milk handling skills/Ubumenyi budahagije mu gutereka amata <input type="checkbox"/> 2. Lack of proper milk handling equipment/Kutagira ibikoresho byabugenewe <input type="checkbox"/> 3. Delayed delivery to buyers/Gukererwa kugera ku Total

		<i>baguzi</i> <input type="checkbox"/> 4. Lack of cooling facilities/ <i>Kubura ibikoresho bikonjesha</i> <input type="checkbox"/> 5. Other / <i>Indi mpamvu</i> _____	<i>baguzi</i> <input type="checkbox"/> 4. Lack of cooling facilities/ <i>Kubura ibikoresho bikonjesha</i> <input type="checkbox"/> 5. Other / <i>Indi mpamvu</i> _____	
316	Do you reserve milk for household use?/Ese ubikira amata umuryango wawe?	1. Yes/ <i>Yego</i> <input type="checkbox"/> 2. No/ <i>Oya</i> <input type="checkbox"/>	1. Yes/ <i>Yego</i> <input type="checkbox"/> 2. No/ <i>Oya</i> <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/>
317	If Yes/ <i>Yego</i> , how many litres do you reserve?/Niba ari <i>Yego</i> ,ese ubasigira litiro zingaha?	_____	_____	Increase 1 <input type="checkbox"/> Decrease 2 <input type="checkbox"/>
318	Are there any Milk collection Centre (MCC) available in your area/ <i>Ese muri aka gace haba hari ikusanyirizo?</i>	1. Yes/ <i>Yego</i> <input type="checkbox"/> 2. No/ <i>Oya</i> <input type="checkbox"/> 3. Does not know/ <i>Ntabwo abizi</i> <input type="checkbox"/>	1. Yes/ <i>Yego</i> <input type="checkbox"/> 2. No/ <i>Oya</i> <input type="checkbox"/> 3. Does not know/ <i>Ntabwo abizi</i> <input type="checkbox"/>	1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/>
319	If yes do you take your milk there? <i>Niba rihari, mwaba mujyanayo amata yanyu?</i>	1. No/ <i>Oya</i> <input type="checkbox"/> 2. All milk taken there/ <i>Amata yose ajalanwayo</i> <input type="checkbox"/> 3. A big portion of milk is taken there/ <i>Igice kinini cy'amata nicyo kijanwayo;</i> <input type="checkbox"/> 4. Only a small part is taken there/ <i>Agace gato k'amata kajanwayo</i> <input type="checkbox"/>	1. No/ <i>Oya</i> <input type="checkbox"/> 2. All milk taken there/ <i>Amata yose ajalanwayo</i> <input type="checkbox"/> 3. A big portion of milk is taken there/ <i>Igice kinini cy'amata nicyo kijanwayo;</i> <input type="checkbox"/> 4. Only a small part is taken there/ <i>Agace gato k'amata kajanwayo</i> <input type="checkbox"/>	
320	If No, indicate the main reasons? <i>Niba amata atajyanwayo, ni izihe mpamvu z'ingenzi? Byinshi birashoboka</i>	1. Far away from home/ <i>Ni kure cyane</i> 2. High cost of transport / <i>Kuyagezayo birahenze cyane</i> 3. Insufficient capacity/ <i>Ikusantirizo ni rito</i> 4. Own improved method of milk handling/ <i>Afite uburyo bwe bwiza bwo kubika amata</i> 5. Other/ <i>indi mpamvu</i> _____	1. Far away from home/ <i>Ni kure cyane</i> 2. High cost of transport / <i>Kuyagezayo birahenze cyane</i> 3. Insufficient capacity/ <i>Ikusantirizo ni rito</i> 4. Own improved method of milk handling/ <i>Afite uburyo bwe bwiza bwo kubika amata</i> 5. Other/ <i>indi mpamvu</i> _____	
321	Indicate current Household main practices in milk handling/packaging? / <i>Mukoresha ubuhe buryo bw'ingenzi mu kubika/gutwara amata ku isoko?</i>	Packaging practices/Uburyo bwo kubika 1. Jerrycan or plastic bucket/ <i>Ijerekani cg indobo ya plastike</i> 2. Cans / <i>Ibicuba by'ibyuma bitagwa ingese</i>	Packaging practices/Uburyo bwo kubika 1. Jerrycan or plastic bucket/ <i>Ijerekani cg indobo ya plastike</i> 2. Cans / <i>Ibicuba by'ibyuma bitagwa ingese</i>	
322	Indicate current Household main practices in transportation to market?/Mbwira uburyo ukoresha ujjana umukamo wawe ku isoko?	Transportation/Uburyo bwo gutwara 1. Humans/ <i>Ku mutwe</i> 2. Using bicycles/motorcycles/ <i>Igare/ipikipiki</i> 3. Using ordinary cars/ <i>Imodoka isanzwe</i> 4. Using trucks in cooled tanks/ <i>Kuyatwara mu modoka ifite ibyuma bikonjesha</i> 5. No Milk transport/ <i>Ntayo atwara</i>	Transportation/Uburyo bwo gutwara 1. Humans/ <i>Ku mutwe</i> 2. Using bicycles/motorcycles/ <i>Igare/ipikipiki</i> 3. Using ordinary cars/ <i>Imodoka isanzwe</i> 4. Using trucks in cooled tanks/ <i>Kuyatwara mu modoka ifite ibyuma bikonjesha</i> 5. No Milk transport/ <i>Ntayo atwara</i>	

Section D: Climate adaptation strategies

401	<p>Has your Dairy farming activities been affected by Climate variability/change in the last 5 years?Ese ibikorwabyawe byubuhinzi,byaba bayaragizwe ho ingaruka n imihindagurikire y ikirere mu myaka 5 ishize.</p>	<p>1. Yes/<i>Yego</i> 2. No/<i>Oya</i></p>	<p>1 2</p>
403	<p>If Yes, which of the following applies? <i>(You can tick more than one options)/Niba ari yego,nibihe byagizweho n'ingaruka?</i></p>	<p>1. Reduction in water availability for cow drinking/<i>Kugabanuka ry'amazi y'inka</i> 2. Reduced grazing land productivity/<i>Igabanuka ry'ubwatsi bw'inka.</i> 3. Increase in Temperature (warm days)/<i>kwiyongera kubushyuhe</i> 4. Floods/<i>imigezi</i> 5. Drought/<i>Impeshyi</i> 6. Death of Cow as result of thunderstorm/severe drought?/<i>Gupfa kw'inka</i> 7. Other, specify/<i>ibindi bivuge_____</i></p>	<p>1 2 3 4 5 6</p>
404	<p>What are the practices adopted to cope with the change in weather?/<i>Nizihe ngamba zashyizweho mu guhangana nimihindagurikire y'ikirere.</i></p> <p>1. Reduction in water availability for cow drinking/<i>kugabanuka kw'amazi inka zinywa</i> 2. Reduced grazing land productivity due to drought</p> <p>3. Increase in Temperature (warm days)</p> <p>4. Floods</p> <p>5. Death of Cow as result of thunderstorm/severe drought</p> <p>6. Other _____</p>	<p>1. a. Water harvesting/<i>umusaruro w'amazi</i> b. Borehole/<i>Kano</i> c. Waste water treatment/<i>amazi bagize meza</i> d. Other, specify/<i>ibindi bivuge</i> _____</p> <p>2. a. Storage of forages for dry season feeding b. Feeding of Concentrates c. Use of Hydroponics technology d. planting of agroforestry trees e. Other, specify _____</p> <p>3. a. Taking vaccination b. construction of sheds c. planting of agroforestry trees d. other, specify _____</p> <p>4. a. Take Cows away from the flooded area b. putting in place the integrated watershed management measures such as terraces, agroforestry trees, water ways c. Other, specify _____</p> <p>5. a. Taking Insurance for animal b. Other, specify _____</p> <p>6. _____</p>	
405	<p>Waste management practices</p>	<p>1. Cow waste are disposed into the river 2. Cow waste are used for making compost 3. Cow waste are directly used as manure 4. Cow waste are used to produce biogas</p>	<p>1 2 3</p>

		5. Other, specify _____ _____ _____	4
406	Do you encounter any challenge of milk transportation related to roadblocks due to landslide or flooding?	1. Yes/Yego 2. No/Oya	1 2
407	Do you experience spoilage of milk in the period of warm days (with temperature increase) during transportation?	1. Yes/Yego 2. No/Oya	1 2
408	Have you had milk rejection due to climate change impact (electricity cut off, flooding of the MCC)?	1. Yes/Yego 2. No/Oya	1 2

APPENDIX 2

Photo Gallery

Sensitization about the purpose of the research at the Milk Collection Centre, Bigogwe Sector. Pre-test of the research instrument was also done.



Training of the enumerators for data collection

I was assisted by the Manager of the Cooperative and Mr. Alexandre (MINAGRI, Nyabihu) and Mr. Prosper Espervier.



Data Collection



With the Managers of MCCs at Mukamira and Arusha respectively



Preliminary presentation of research findings



Checking through the equipments available at the MCCs



With my on-site Supervisor, Mr. Alexis Ndagijimana

