

**RURAL YOUTHS' CHOICE OF LIVELIHOOD STRATEGIES AND THEIR  
EFFECT ON FOOD SECURITY AND INCOME POVERTY IN RWANDA**

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**A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE  
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## ABSTRACT

Arable land inadequacy and limited livelihood strategies are phenomena posing a challenge on rural food security and chronic poverty in Rwanda. However, literature linking land resources, youth livelihood strategies and livelihood outcomes is scanty. The study examined livelihood strategies pursued by rural youths, analyzes their returns to labour per day, and determines factors influencing youths' choices of livelihood strategies. Furthermore, the relationship between rural youths' choice of livelihood strategies, food security and income poverty altogether were analysed in this study. The study used data from the 2016/17 wave of Integrated Household Living Condition Survey, with a sample of 2811 rural youths. The results from descriptive analyses indicate that rural youths in Rwanda pursue seven livelihood strategies namely agriculture, non-farm wage employment, self-employment, agriculture plus non-farm wage, agriculture plus self-employment, non-farm wage plus self-employment, and agriculture plus non-farm wage plus self-employment. Of these livelihood strategies, non-farm wage plus self-employment, non-farm wage and self-employment are three choices with highest daily return to labour in Rwandan Francs <sup>1</sup>(RWF) as they generated median daily income of RWF 526, 424, and 357 respectively. Although agriculture alone was the most practiced livelihood strategy, it was the least rewarding with a return to labour of RWF 201 per day. Findings from the first stage of METE model revealed that rural youth's choice of livelihood strategies was influenced by age of youth, sex and education of both youth and household head, household size, distance to the nearest urban center, land size, land productivity, access to information through phones. The estimates in the second stage of the METE indicate that non-farm wage, self-employment, agriculture plus self-employment, non-farm wage plus self-employment, agriculture plus non-farm wage plus

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<sup>1</sup> 1usd =RWF 834, Dec ember 2017

self-employment strategies contribute to household food security improvement and poverty reduction when compared to agriculture alone. Based on these findings, this study concludes that agriculture is a necessary but not a sufficient livelihood strategy to sustain the contribution of rural youths' livelihood strategies to their households livelihood. There is therefore a need for the government and development practitioners to support development of rural non-farm activities including agro-processing, distribution, provision of inputs and improving access to market outlets. This should go hand in hand with interventions to enhance agricultural productivity as it necessary not only to motivate youths to engage in agriculture.

**DECLARATION**

I, Kangondo Angelique, do hereby declare to the Senate of Sokoine University of Agriculture that this thesis is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted to any other institution.

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**DEDICATION**

I dedicate this thesis to my whole family for nursing me with affection, love, support, and encouragement and for their dedicated partnership in the success of my life.

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## TABLE OF CONTENTS

<b>ABSTRACT.....</b>	<b>ii</b>
<b>DECLARATION.....</b>	<b>iv</b>
<b>COPYRIGHT.....</b>	<b>v</b>
<b>DEDICATION.....</b>	<b>vi</b>
<b>ACKNOWLEDGEMENTS.....</b>	<b>vii</b>
<b>TABLE OF CONTENTS.....</b>	<b>ix</b>
<b>LIST OF TABLES.....</b>	<b>xii</b>
<b>LIST OF FIGURES.....</b>	<b>xiii</b>
<b>LIST OF APPENDICES.....</b>	<b>xiv</b>
<b>LIST OF ABBREVIATIONS AND ACRONYMS.....</b>	<b>xv</b>
<b>CHAPTER ONE.....</b>	<b>1</b>
<b>1.0 INTRODUCTION.....</b>	<b>1</b>
1.1 Background of the Study.....	1
1.2 Problem Statement and Justification.....	4
1.3 Objectives.....	6
1.3.1 Overall objective.....	6
1.3.2 Specific objectives.....	6
1.4 Hypotheses.....	6
1.5 Scope and Limitation of the Study.....	7

1.6	Organization of the Thesis.....	8
<b>CHAPTER TWO.....</b>		<b>9</b>
2.0	<b>LITERATURE REVIEW.....</b>	<b>9</b>
2.1	Rural Livelihood Strategies.....	9
2.2	Determinants of Choice of Livelihood Strategies.....	12
2.3	Analysis of Choice of Livelihood Strategies.....	15
2.4	Effect of Choices of Livelihood Strategies on Poverty and Food Security.....	18
2.5	The Choice of Instrumental Variable.....	20
<b>CHAPTER THREE.....</b>		<b>22</b>
3.0	<b>METHODOLOGY.....</b>	<b>22</b>
3.1	Conceptual Framework.....	22
3.2	Data and Selection of Sample of Rural Youth.....	25
3.2.1	Data.....	25
3.2.2	Study sample selection.....	27
3.2.3	Variables included in the analysis.....	29
3.3	Analytical Tools.....	32
3.3.1	Descriptive analyses.....	32
3.3.2	Factor analysis.....	33
3.3.3	Multinomial endogenous treatment effects model.....	34
3.3.4	Model specification.....	36
3.3.5	Outcome variables.....	38

3.3.6	Description of explanatory variables used in the model.....	40
3.3.6.1	Description of variables of the first stage of METE model.....	40
3.3.6.2	Description of variables of the second stage of METE model.....	41
<b>CHAPTER FOUR.....</b>		<b>43</b>
<b>4.0</b>	<b>RESULTS AND DISCUSSION.....</b>	<b>43</b>
4.1	Rural Youths' Choice of Livelihood Strategies in Rwanda.....	43
4.2	General Characteristics of the Sampled Rural Youth and Their Choice of Livelihood Strategies.....	46
4.3	Return to Labour and Choice of Livelihood Strategies.....	49
4.4	Results of Multivariate Factor Analysis.....	52
4.5	Factors Influencing the Choice of Livelihood Strategies.....	53
4.6	Choice of Livelihood Strategy Choices and Food Security.....	59
4.7	Rural Youths' Choice of Livelihood strategies and Household Income Poverty.....	60
4.8	Effect of Rural Youths' Choice of Livelihood Strategies on Livelihood Outcomes.....	61
<b>CHAPTER FIVE.....</b>		<b>66</b>
<b>5.0</b>	<b>CONCLUSION AND RECOMMENDATIONS.....</b>	<b>66</b>
5.1	Conclusion.....	66
5.2	Recommendations.....	68
5.3	Suggestion for Improvement of the Integrated Household Living Conditions Survey Dataset.....	70

**REFERENCES.....71**

**APPENDICES.....84**

## LIST OF TABLES

Table 1:	Number of rural youth distribution per region and district.....	28
Table 2:	Choice packages of livelihood strategies.....	36
Table 3:	Variable description.....	42
Table 4:	Livelihood strategies chosen by rural youth.....	43
Table 5:	Main crops and livestock produced in Rwanda.....	44
Table 6:	General characteristics of rural youth and their choice of livelihood strategies.....	48
Table 7:	Return to labour from each choice of livelihood strategy (RWF per day)....	51
Table 8:	Median differences in return to labour per day among choices.....	51
Table 9:	Rotated Component Matrix results.....	53
Table 10:	Determinants of choice of livelihood strategies for rural youth.....	58
Table 11:	Youth choices of livelihood strategy and household food security.....	59
Table 12:	Rural youth's choice of livelihood strategy and household poverty status....	60
Table 13:	Estimates of the effect of youths' choice of livelihood strategies on household food security and income poverty.....	63

**LIST OF FIGURES**

Figure 1: Sustainable Livelihood Framework.....10

Figure 2: Conceptual framework of the study.....24

**LIST OF APPENDICES**

Appendix 1:	Marginal effects of Agriculture.....	84
Appendix 2:	Test for IIA assumptions: Suest-based Hausman test.....	84
Appendix 3:	Hausman tests of IIA assumption.....	85
Appendix 4:	Conversion factors of tropical livestock unit (TLU).....	85
Appendix 5:	Conversion factors for Adult –Equivalents.....	85
Appendix 6:	KMO and Bartlett's Test.....	86
Appendix 7:	Percentage of variance.....	86
Appendix 8:	Multicollinearity test: factors influencing the choice of livelihood.....	86
Appendix 9:	Results of Sensitivity Analysis.....	87
Appendix 10:	Falsification test for food security.....	87
Appendix 11:	Falsification test for poverty.....	88

### LIST OF ABBREVIATIONS AND ACRONYMS

AE	Adult Equivalent
CAPI	Computer-Assisted Personal Interviewing
EA	Enumeration Areas
EDPRS	The Economic Development and Poverty Reduction Strategies
EICV	<i>Enquête Intégrale sur les Conditions des Vie des Ménages</i>
FAO	Food Agricultural Organization
IFAD	International Fund for Agricultural Development
IIA	Independent of Irrelevant Alternatives
IITA	International Institute of Tropical Agriculture
IV	Instrumental Variables
KMO	Kaiser-Meyer-Olkin
METE	Multinomial Endogenous Treatment Effect
MINAGRI	Ministry of Agriculture and Animal Resources
MNL	Multinomial Logit
NGOs	Non-Governmental Organizations
NISR	National Institute of Statistics of Rwanda
PCA	Principal Component Analysis
PPS	Probability Proportional to Size
RPHC	Rwanda Populationn and Housing Census
RWF	Rwandan Franc
SDG	Sustainable Development Goals
SSA	Sub-Saharan Africa
TLU	Tropical Livestock Unit



UKAID	United Kingdom Aid
UN	United Nations
USAID	United States Agency for International Development
VIF	Variance Inflation Factor

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background of the Study

Rural population in Sub-Saharan Africa (SSA) combines a diverse set of income generating and social activities which constitute a portfolio of livelihood activities to enhance livelihood outcomes (Khatiwada *et al.*, 2017). Most of rural people depend directly and indirectly on agriculture as their livelihood strategy (Sosina *et al.*, 2019). However, agricultural productivity in SSA remains low largely because production is constrained by low use of purchased productivity enhancing inputs, poor soil quality, and fragmented land holdings (Challa *et al.*, 2019). In addition, the sector is dominated by small-scale rural farmers whose activities are characterized by low productivity, volatile market prices, credit constraints, supply shocks and high transaction costs. As a result, rural farmers experience low return to land and labour, food insecurity and instinctive income poverty.

The characteristics of agriculture and rural small-scale farmers in SSA reported in the literature (Bezu and Holden, 2014; Challa *et al.*, 2019; Holden, 2018) are attributable to the growing trend of rural youths' persistent shunning of agriculture in favor of alternative livelihood opportunities in rural non-farm sectors or urban areas. For example, it is reported that the non-farm sector contributes between 30 percent and 50 percent of the rural household income in SSA (Gecho, 2017). This has developed a common consensus in the livelihood literature (Bezu and Holden, 2014; Holden, 2018; Yeboah *et al.*, 2019) that the declining number of rural youths' participation in agriculture in SSA is due to the fact that the non-farm sector gives higher return to labour than agriculture (Allen *et al.*, 2016).

Non-farm activities provide additional income by relaxing financial constraints, allowing individuals and households to spend on their basic needs, including food (Etea *et al.*, 2019). With high per capita income, non-farm activities ease liquidity constraints by enabling greater investments, consumption over time and reduction of the risk of intra-year food availability. Theoretically, rural non-farm sector absorbs a growing rural labour dominated by youths and slow down rural-urban migration as it helps the youth to combat poverty and achieve food security through its higher growth multiplier effect on the economy.

Being one of the SSA countries, Rwanda is not exempted from the prevailing youths exit from agriculture to other livelihood strategies. Apparently, high annual population growth rate of about 2.4%, fragile and fragmented small-scale landholdings and hilly landscape constrain agricultural production in Rwanda (Allen *et al.*, 2016). For example, land size per household dropped from 2 ha in 1960 to 0.7 ha in 1990 (Bizoza, 2014). In 2001, about 60 % of the households in Rwanda had less than 0.5 ha, while in 2016 one household controlled an average of 0.33 ha (Allen *et al.*, 2016; MINAGRI, 2018). This is happening while agriculture provides 86 % of jobs and contributes 90 % of food and income in the country (Rachel *et al.*, 2019).

The decline in agricultural land carrying capacity is one of the reasons that forces rural farmers to take up diverse non-farm economic activities to sustain and improve their wellbeing (Gecho, 2017; Issahaku and Abdulai, 2020; Kosec *et al.*, 2017). The effect of the declining size of land holding in Rwanda is threefold. First, it increases pressure on land use rendering agriculture less attractive to youth, the dominant segment of the population because they have limited access to land. Second, the available land size

traditionally owned by inheritance is not able to accommodate household needs for land (FAO, 2014). Third, the low land productivity in rural areas makes rural people vulnerable to food insecurity. It is therefore, common to witness declining number of rural youths participating in agriculture in a quest for better livelihood strategies. However, although non-farm activities are reported to account for a significant share of farmers' incomes across rural Africa (Barrett *et al.*, 2001; Gecho, 2017), such income accounts for a relatively small share in Rwanda because there are few income sources beside agriculture (Nilsson, 2016). Therefore agriculture remains critical to Rwanda.

The agriculture sector in Rwanda has a huge potential to improve rural households' incomes, food and nutrition security and reduction of poverty. In other words, diverse production systems such as crop production and livestock keeping are assumed to enhance food and nutrition security through consumption of food from own production. Also, production diversity improves people's dietary diversity through access to a diverse variety of foods. Similarly, rural farmers obtain income through the sale of farm produce, animal products and others.

According to USAID (2018), food insecurity is one of the dimensions of poverty and one of the measures to address food insecurity is external food aid. However, Hjelm and Williams (2016) argue that households relying on food aid fail to pursue food access strategies that are sustainable making food access a chronic problem. On the other hand, the World Bank and various NGOs encourage diversification into non-farm activities within sustainable livelihood framework as a model to alleviate poverty and address food insecurity (Ersado, 2006 ). The choice of livelihood strategies among rural households in Rwanda and elsewhere are determined by a number of socio- economic, demographic

institutional and other factors (Maniriho and Nilsson, 2018). However, according to Bezu *et al.* (2010) the decisions to engage in non-farm livelihood strategies is a result of push and pull factors. The push factors are represented by poor performance of the agricultural sector as a sufficient and reliable source of livelihood. The pull factors include returns to factors supplied in the off-farm sector, wage or salary in non-farm wage employment and profits in self-employment (Barrett *et al.*, 2001). Studies linking land resources, rural youths' choice of non-farm livelihood strategies instead of pursuing agriculture and their livelihood outcomes are limited. This study seeks to determine factors that determine youths' choices of livelihood strategies and their effect on household food security and income poverty with the assumption that individuals or households choose one or a combination of livelihood options that gives maximum satisfaction.

## **1.2 Problem Statement and Justification**

As indicated in section 1.1, a combination of phenomena gives impetus to youths' choice of livelihood strategies. For example, being small, mostly rural and dependent on agriculture (Allen *et al.*, 2016), Rwanda is expected to have a consolidated concentration of livelihood activities in agriculture and in rural areas as a whole. However, this is not the case. According to NISR (2016 ) and NISR (2018a), approximately 18 % of youths in Rwanda have exited from agriculture in search of better livelihoods in other sectors. The literature (Allen *et al.*, 2016; Bizoza, 2014; Nilsson, 2016) is consistent that there is a mismatch between the landscape of youths' livelihood activities in agriculture which is the economic sector on which the country depends, and youths' livelihood activities in other sectors. Similarly, the fact that over 71 % of the population in Rwanda is youth, all else being equal, signal a much higher agricultural productivity. To the contrary, agricultural productivity is still low. According to Nilsson (2016) and MINAGRI (2018),

Rwanda is experiencing decreasing agricultural productivity in tandem with the increasing youth dominated population. Furthermore, although Rwanda has experienced fast and sustainable economic growth since 2000, rural areas of the country are still characterized by high poverty rate and food insecurity. The officially registered poverty reduction rate is reported to be low. For example, between 2010 and 2017, the percentage of poor people dropped from 44.8 % to only 36.7 %, with almost 93 % of the poor people residing in rural areas (NISR, 2018b).

Admittedly, there is a dearth of literature on the link between land resources, youth livelihood strategies, food security and income poverty (Atuoye *et al.*, 2019; Ellis and Mdoe, 2003; Salam, 2020). Specific studies on youths and livelihood are also reported in the literature (Ghebru and Zavale, 2018; Holden, 2018; Kosec *et al.*, 2017; Yeboah *et al.*, 2019). These phenomena leave behind key questions regarding rural youths' livelihood strategies in Rwanda worth of research attention. For example, what is the impetus behind youths' choices of livelihood strategies? How do the youths' choices of livelihood strategies influence food security and income poverty? The thesis at hand is an attempt to answer these questions. While the contribution of these previous studies is highly acknowledged, the current study is intended to shed more light on the effect of youths' choice of livelihood strategies on food security and income poverty. In this attempt, the relationship between choice of livelihood strategies, food security and income poverty are uniquely studied from youths and Rwanda perspectives. Furthermore, the study provides empirical evidence on the existing opportunities of livelihood activities for rural youth in Rwanda and their corresponding returns to labour. It informs policy makers on the existing economic subsectors from which youths are deriving their livelihood in order for the policy makers to design wellbeing enhancing intervention packages. The Sustainable Development Goals (SDG) framework guiding Rwanda's Vision 2050 and Economic

Development and Poverty Reduction Strategy (EDPRS) motivates the choice of food security and income poverty as the outcome variables).

### **1.3 Objectives**

#### **1.3.1 Overall objective**

The overall objective of this study is to assess rural youths' choice of livelihood strategies and their effect on food security and income poverty in Rwanda.

#### **1.3.2 Specific objectives**

The following are specific objectives of this study:

- i. To analyze the factors influencing the choice of livelihood strategies among rural youth
- ii. To determine the effect of youths' choice of livelihood strategies on household food security and income poverty in Rwanda.

### **1.4 Hypotheses**

The guiding hypotheses of this study are as indicated hereunder. The first hypothesis (**H<sub>1</sub>**) addresses the first specific objective of this study on the determinants of youths' livelihood strategies. Testing this hypothesis provides insights into the factors behind youths' choice of livelihood strategies in Rwanda and guide the packaging of policy interventions.

The second hypothesis (**H<sub>2</sub>**) is central to this study as it addresses key outcome variables of food security and income poverty expected to be attained as per the SDG framework.

**H<sub>1</sub>:** The socio-economic, community and institutional factors have no significant effect on youth's choice of livelihood strategies.

**H<sub>2</sub>:** Choice of livelihood strategies do not significantly influence household food security and income poverty.

### **1.5 Scope and Limitation of the Study**

This study primarily focused on the assessment of youths' choice of livelihood strategies in Rwanda and how the choices effect the food security and income poverty of the households. It involved only the youths aged 16 to 30 years. The choice of this age category is in accordance with the definition of youth in the 2006 Rwanda National Youth policy which was revised in 2015 (Republic of Rwanda 2015). The United Nations without prejudice to any other definitions made by Member States defines 'youth' as those persons between the ages of 15 and 24 years. While rural youth migration is one of the important youth livelihood strategies outside agriculture in rural areas of Rwanda and SSA as a whole (Allen *et al.*, 2016; Kosec *et al.*, 2017), rural-urban migration as a rural youth livelihood strategy was not considered in this study. This was due to the fact that the available data lack the required information such as activities pursued by the migrants, labour spent on those activities, and their earnings that would allow estimation of their daily returns to labour and hence make migration comparable to other rural livelihood strategies in terms of their returns to labour and impact on the livelihood outcomes. The available data on migration is limited to whether an individual rural youth was absent in the household or not. In addition, the choice of livelihood strategies was individual based, while livelihood outcomes were household based. Based on the data used for the study, individual youth contribution to household level outcome through livelihood strategy pursued could not be estimated after controlling for other factors. In this study, each outcome was assigned to all youths belonging to a particular household regardless of their individual livelihood strategy's contribution to that household outcome. The results



indicate the contribution of youths per household without considering the diversity of the livelihood strategies pursued by youths in households with more than one youth.

## **1.6 Organization of the Thesis**

This thesis is organized in five chapters as follows; Chapter one draws premises of the thesis by providing contextual background and conceptual clarification. It also presents objectives and hypotheses of the study. Next to chapter one is chapter two that presents review of previous related research. It discusses theoretical and empirical research on rural livelihood strategies and factors influencing the choice of livelihood strategies. This is followed by the discussion on youths' choice of livelihood strategies in the face of land scarcity. Additionally, chapter two presents measurements of choice of livelihood strategies used in previous studies. Chapter three is on methodology and it presents conceptual framework, source of data and analytical tools. The findings of descriptive and econometric analysis are presented and discussed in chapter four. The chapter begins with the presentation of findings of the descriptive analyses which include the results on identification and characterization of choice of livelihood strategies pursued by rural youths. The chapter winds up with the presentation and discussion of the findings on return to choice of livelihood strategies and the effect of these choices on food security and income poverty. The last chapter of this thesis is chapter five that draws conclusions and provides recommendations based on the findings of the study.

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

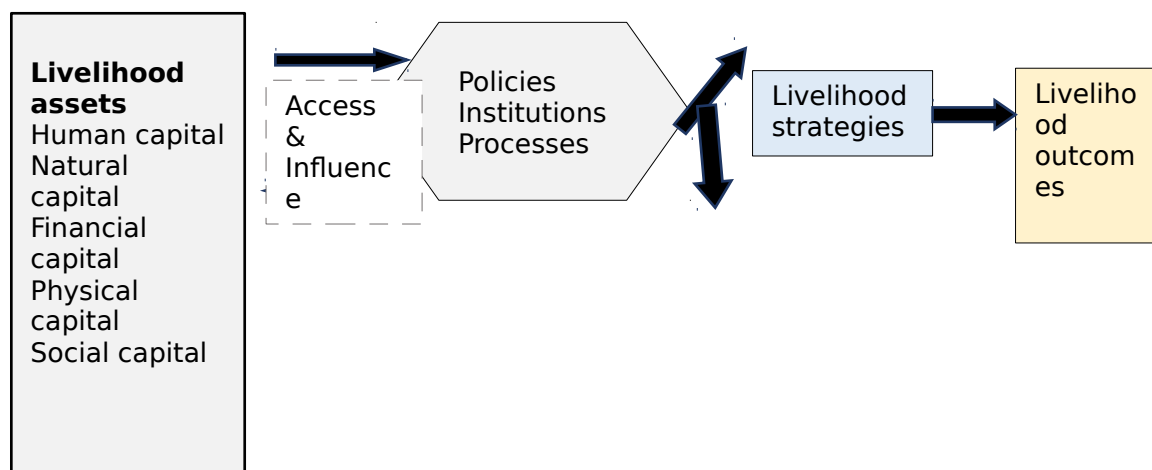
#### 2.1 Rural Livelihood Strategies

Livelihood was first described by Chambers and Cornwall (1991) as capabilities, assets and activities required for a means of living. With time, this definition was adopted and modified by different researchers. For example, Ellis (1998) argues that livelihood encompasses both the income in cash and in kind, the social institutions, gender relations, and property rights required to support and sustain a given standard of living. He differentiates livelihood from income by defining income as cash earnings of the household plus payments in kind that can be valued at market prices. In 1998, Carney (1998) introduced the concept of sustainable livelihood and argued that livelihood is sustainable when it copes with and recovers from stresses and shocks.

The concept of sustainable livelihoods and sustainable livelihood framework was developed as a tool to help integrate the livelihoods perspective into research and development projects (Scoones, 1998) and it has been widely adopted by researchers and multilateral agencies. Generally, the heart of sustainable livelihood framework makes a link between people and the overall enabling environment that influences the outcomes of livelihood strategies as shown in Figure 1 (Mensah, 2011).

Livelihood strategies are a range and combination of activities and choices that people make to achieve outcomes. According to Scoones (1998) the type of livelihood strategy pursued determine the ability of individual or household to achieve positive or negative

outcomes. Livelihood outcomes include income, wellbeing, reduced vulnerability, and food security.



**Figure 1: Sustainable Livelihood Framework**

**Source:DFID (1999)**

Livelihood strategies are usually classified according to different criteria. For example, Scoones (1998) categorized rural livelihood strategies into three groups namely agricultural intensification, diversification, and migration based on the nature of activities undertaken. Coulibaly *et al.* (2008) classified livelihood strategies into five groups namely market-oriented agriculture; subsistence oriented; labour oriented (wage in agriculture, rural non-farm economy, non-farm self-employment); diversification; migration and remittance. Ansoms and McKay (2010) grouped rural livelihood strategies into agricultural activities, off-farm and remittances. Holden (2018) on the other hand categorized livelihood strategies pursued by youth youth's livelihood strategies into farm and non-farm. Several categories of livelihood strategies have been identified by scholars and the most dominant livelihood strategies pursued by rural people are described below:

**Agricultural livelihood strategies:** These include all activities related to crop production, livestock, fishery, and forestry. They are comprised of both consumption in kind of own farm output and cash income from output sold (Barrett *et al.*, 2001).

If individuals/households diversify their sources of income within agricultural sector or earn income from different crop production and livestock rearing, they are pursuing agriculture as a livelihood strategy (Holden, 2018).

**Non-farm livelihood strategies:** These are a set of activities other than agriculture in the form of wage labour or skilled labour. They also include property income such as rent, urban-to rural remittances arising from national boundaries and from cross border and overseas migration, pension and other government transfer (Ellis and Freeman, 2004).

**Self-employment or business:** State of working for oneself as the owner of a business rather than for an employer. Self employment includes activities such as processing of agricultural commodities, handcraft, home-made piecework manufacturing, services, trade (Ovwigbo, 2014).

**Diversification:** Diversification is a risk management strategy that involves a variety of investments within a portfolio. In rural areas, diversification has driven the farmers to depend on a portfolio of income sources rather than relying on agriculture as their sole survival strategy (Suchiradipta *et al.*, 2018). Multiple motives prompt rural individuals and households to diversify their livelihood strategies. For example, Barrett *et al.* (2001); Kassie *et al.* (2017); Ghebru and Zavale (2018) argue that diversification is distress driven by self-insurance against risk, an ex-post coping strategy, mechanism to stabilize income flows and consumption and inability to specialize due to incomplete markets. As Reardon *et al.* (1998) observe, rural population diversify into non-farm activities to earn more returns to pay for farm inputs and other related costs .

Informed by livelihood literature and based on nature of available data, this study adopts agriculture, non-farm, and self-employment and the combination of these choices as livelihood strategies pursued by rural youth in Rwanda. Although a significant proportion of rural youth in the study population pursue simultaneous livelihood strategies, this is not termed diversification. This is because the motive for rural youth to pursue multiple livelihood strategies is not to cope with risk, rather to ensure food and income security, given the economic environment in which they operate.

## **2.2 Determinants of Choice of Livelihood Strategies**

Choices of livelihood strategies are motivated by several factors. As indicated in section 1.1, livelihood scholars (Bezu and Holden, 2014; Gecho, 2017; Maniriho and Nilsson, 2018; Rahman and Akter, 2014) have attempted to classify the factors as individual, institutional, household and locational factors. Some of the individual factors include sex/gender, age and education. For example, sex is considered very important in choice of livelihood strategies, because men and women have different access to resources, assets, and opportunities variably guiding their decision making. According to Ellis (1998), rural women have low access to productive resources, especially land as compared to men. Women typically confront a narrow range of labour markets and low wage rates than men. The cultural influences in most developing countries such as land inheritance are considered as men's domain (Ellis (1998)).

Age is another key factor that determines choice of livelihood strategies. It is a measure of experience that reflects changes and therefore has a significant influence on decision-making. According to Rahman and Akter (2014), younger farmers are more oriented towards modern agricultural technologies and non-farm livelihood activities. This is

based on assumption that farming experience increases with age, and consequently, old people are likely to continue farming rather than involved in non-farm activities. Education refers to the human capital of individual or household usually measured as number years of formal schooling. The technical skills acquired through education allow rural families to easily take up more livelihood strategies seemingly difficult to be taken by less educated people (Maniriho and Nilsson, 2018). According to Barrett *et al.* (2001) skills and education attainment serve as substantial entry barriers to high paying non-farm employment and self-employment, especially in rural Africa.

In terms of institutional factors, access to credit appears high on the list. Rural financial services can provide important incentives to invest in improved land and use of improved agricultural technologies as well as increasing the chance of starting new business and skill acquisition (Itana, 2019). Reardon *et al.* (2001) assert that credit failure drives farm households to undertake local non-farm activities, and they return to rural areas to reinvest the cash in farming, cattle, education and housing or setup local enterprises.

Other key factors influencing choices of livelihood strategies are classified as household factors and they include household size and land holding size. The household size reflects the amount of labour in the household, which may lead to an expanded range of livelihood activities, particularly in the contexts in which land is limited. As Fabusoro *et al.* (2010) and Bezu and Holden (2014) observe, rural households with larger adult labour supply are expected to be pushed towards non-farm activities since they are likely to have higher labour to land ratio. This is because sufficient family members remain at home or on farm to meet the labour needs for subsistence. Land size on the other hand is widely recognized as an important factor of production, a form of security and collateral to access credits. It is a means of generating livelihoods, accumulating

wealth and transferring the same between generations (Yeboah *et al.*, 2019). However, land holding size declines over time due to escalating population growth. In this case, youths are the most affected segment of population because the land obtained through inheritance is too small to sustain a livelihood for the rapidly growing number of youth. As a result, limited access to land pushes youth to look for alternative livelihood strategies other than agriculture (Khatiwada *et al.*, 2017). For the purpose of this study, land size is assessed across households since time is fixed.

In different contexts, various studies examined factors that influence the choice of livelihood strategies. For instance, Gecho *et al.* (2014); and Rahman and Akter (2014) did studies in Ethiopia and Bangladesh respectively that revealed the influence of some of socio-economic factors on choice of livelihood strategies. Their results showed that age, livestock ownership and farm size are positively significantly associated with choice of agricultural based livelihood strategies. Same variables negatively significantly affected the probability of choosing non- farm livelihood strategies in all countries. While female headed households were more likely to choose agriculture in Bangladesh and Ethiopia, male headed households were more likely to engage in off- farm livelihood in Ethiopia and all livelihood strategies in Bangladesh. Other studies such as Nielsen *et al.* (2013); Bezu and Holden (2014) and Kosec *et al.* (2017) revealed that access to land is strongly positively associated with the choice of agriculture in Nepal, Mozambique, Bolivia and Ethiopia. The same studies reported a negative influence of land on the choice of non-farm and migration.

In particular, a pool of literature identified access to farmland as an important factor that determines whether a rural youth can depend on agriculture or look for alternative means of livelihood (Ghebru *et al.*, 2018). As reported by Van der Geest (2010); Dash (2018); Holden (2018), limited access to land and poor performance of agriculture sector have led

to rural youths' disinterest in farming as a source of livelihood. Even those who have access to land and choose to pursue farming experience low productivity, and most of them are small-scale farmers (Widiyanti *et al.*, 2018; Yami *et al.*, 2019). On the other hand, Allen *et al.* (2016); Sebastian (2017) and NISR (2018a) revealed that the highest share of rural youth in developing countries pursue farming as their primary source of livelihoods. Yeboah *et al.* (2019) argue that the choice of livelihood strategies among youth changes with age. Youth aged between 15 to 19 years old are likely to pursue farming than non-farm activities. As age increases from 20 to 30 years, the proportion of youth pursuing farming decline significantly in favor of non-farm opportunities. As Yeboah *et al.* (2019) observe, without huge increases in the value of output per unit of land, the continued subdivision of small land will constrain the profitability of agricultural self-employment and therefore discourage youth from choosing agriculture as their primary source of livelihood. This study explores a range of socio-economic, institutional and community factors that influence an individual rural youth to choose a particular livelihood strategy among a set of alternative strategies, in the face of land scarcity.

### **2.3 Analysis of Choice of Livelihood Strategies**

The analysis of rural choice of livelihood strategies is complex because households or individuals engage in a variety of economic activities. The earlier studies such as that of Toufique and Turton (2002) and Gecho (2017), were skewed towards qualitative accounts that are mostly descriptive in nature. The quantitative analyses have also tended to focus either on descriptive analysis (Ellis and Freeman, 2004) and/or cluster analysis (Ansoms and McKay, 2010; Nielsen *et al.*, 2013). Moreover, the conclusion based on descriptive analysis only may not be precise and it is hard to generalize (Rahman and Akter, 2014).



Other studies (Ellis, 1998; Ghebru and Zavale, 2018; Kosec et al., 2017; Magagula and Tsvakirai, 2019; Maniriho and Nilsson, 2018; Sebastian, 2017) modelled choice of livelihood strategies as being that code individual or household's choice of livelihood strategy as either farm or non-farm. Most of economic models such as binary logit/probit that have been used in measuring the choice of livelihood strategies and failed to capture the interdependence and relationship between choices and the potential correlation between unobserved error terms. These models are only able to estimate the choice of a single measure, with only two outcomes (Greene, 2012). However, non-farm options are heterogeneous and thus unrealistic to combine them into a single group. This study categorized non-farm into wage employment and self-employment. Nonetheless, there is a possibility that youth may pursue simultaneously more than one livelihood strategy. Therefore, youths' choices of livelihood activities should not be limited; rather they should be explored as a continuum.

Another stream of literature focused on the determination of factors that influence the choice of livelihood strategies, with multiple outcomes choices. For instance, Adzawala and Kane (2018) used multivariate probit to assess the factors that affect the choice of livelihood diversification strategies. Other studies such as, Bezu and Holden (2014); Rahman and Akter (2014); Kena (2017); Holden (2018) have employed Multinomial Logit model (MNL) to assess the determinants of the choice of livelihood strategies, where an individual can choose only a single outcome among a set of alternative options. Although both models are commonly used in examining the choice of livelihood diversity, their guiding assumptions differ. For example, multivariate probit allows potential correlation between unobserved error terms and the correlation between the choice of each livelihood strategy. Aurier and Mejía (2014) argue that a significant

proportion of choices are multiple, in the sense that an individual may choose two, or more units of choice from within a given category. In this case, the choices may not be mutually exclusive and the possibility for a simultaneous choice of more than one livelihood strategy as well as the interdependence between these different livelihood strategies (Sileshi *et al.*, 2019).

The multinomial logit model (MNL) on the other hand, is valid under two hypotheses. First, given the probability that an option will be chosen is expressed in terms of the relationship between its utility and the combined utility of other options belonging to the overall choice set, the MNL model postulates that

the relationship between the probabilities of two options  $i$  and  $j$  ( $\frac{P_i}{P_j}$ ) is independent of this overall choice set (Cheng and Long, 2016). Subsequently, the competitive structure is considered to be perfectly homogenous within the category. Second, MNL assumes that utility maximization results in a single choice or alternatively in the absence of a choice. In such situation, the multinomial logit should pass the IIA test (Wooldridge, 2005).

In that regard, the current study is built on the understanding of Greene (2012) assertion that, individual youth chooses only one among a set of alternative strategies that provides the highest utility. The study adopts MNL model, as the nature of data indicate that an individual rural youth can choose a single strategy. The model provides rich information on factors influencing various occupational choices with reference to a base category (Greene, 2012). Each choice is presented as a dummy variable,  $y_{ij}=1$  if the choice for livelihood  $j$  ( $j=0,1,2,\dots,J$ ) for individual/household  $i$ , is observed. In this formulation, choice behaviour is represented by a reduced-form MNL model indicated in Equation 1.

$$1 + \sum_{j=1}^n \exp(z_{ij}\beta) \dots \dots \dots (1)$$

$$P(y_i = j | z_i) = \frac{\exp(z_{ij}\beta)}{\sum_{j=1}^n \exp(z_{ij}\beta)}$$

$j = 1, 2, \dots, J; i = 1, 2, \dots, n$

Where  $P(y_i=j|z_i)$  is the probability that individual or household  $i$  chooses livelihood strategy  $j$  that can take on any of the  $J$  possible values corresponding to different livelihood strategies,  $z_i$  is a vector of exogenous variables affecting the choices.

The model controls for individual characteristics, household head characteristics, household characteristics, community and institutional factors that correlates with rural youths' choice of alternative livelihood strategies.

#### 2.4 Effect of Choices of Livelihood Strategies on Poverty and Food Security

Although agriculture remains a major source of employment, food, and income in developing countries, the share of non-agriculture income to household total income in these countries lie between 35 to 50 percent (Reardon *et al.*, 2007). Various studies have examined the role of different livelihood strategies on food security and poverty reduction in rural areas and their findings are mixed. For instance, Adjimoti and Kwadzo (2018) and Mango *et al.* (2018) assessed the effect of crop diversification on household food security, using a multiple linear regression model and estimated by ordinary least squares respectively. Both studies found a positive effect on household food security status. Similarly, scholars such as Atuoye *et al.* (2019); Etea *et al.* (2019) and Ntwalle (2019) analyzed the the impact of income diversification on household food security. The first study used multivariate ordered logistic regression and highlights that households with diversified income are more likely to be severely food insecure. The study concludes that

although income diversification is a necessary strategy for survival, this alone does not seem to alleviate food insecurity. The same study reports that lucrative non-farm activities are the way of improving food security in rural areas. On the other hand, the last two studies employed binary logistic regression and their findings show that income diversification has a positive influence on food security. The study by Gecho *et al.* (2014) reveals that pursuing multiple livelihood strategies improves food security. Tarasuk (2017) on the other hand, argues that improved household income is the right strategy for improving food security.

Other income related studies by Dabalen *et al.* (2004 ); Nielsen *et al.* (2013); and Ashley *et al.* (2018) have quantified income from alternative rural livelihood strategies and assessed their share on the total household income. These studies reveal that income from different livelihood strategies contributes significantly to the total household income which varies positively with food security. Carter and May (1999) found that poor and non-poor households derive their livelihoods from distinct activities. For example, using non-parametric regression methods, their studies showed that wage income earners are relatively non-poor than those that depend on agriculture as their important source of income. While Salam (2020) and Dzanku (2020) examined the effect of livelihood strategies on poverty reduction and concluded that multiple livelihood strategies could be poverty reducing. Ellis and Mdoe (2003) assert that rural poverty is strongly associated with lack of land and livestock.

While the contribution of this stream of literature is highly acknowledged, the current study extends the body of knowledge by looking at the extent to which individual rural youths' choice of a particular livelihood strategy may influence household poverty status and food security. The above studies have employed several methods to examine the

effect of livelihood strategies on livelihood outcomes. The highly acknowledged method is binary logit (Atuoye *et al.*, 2019; Etea *et al.*, 2019; Gecho *et al.*, 2014). This method measures singly the relationship between a livelihood strategy and the outcome.

The study by Asmah (2011) analysed the effect of rural livelihood diversification of agricultural household welfare using endogenous switching regression. The approach takes care of self-selection and endogeneity problem which may make it difficult to determine causation. Despite the fact that the study disaggregates livelihood strategies, it did not assess the impact of each strategy on household welfare. Rather, the study combined different livelihood strategies into a dichotomy of whether a farmer diversifies or not.

This may not give enough information on how each of the identified livelihood strategies impact household welfare. The current study extends single choice analysis to multiple choices impact analysis and adopted Multinomial Endogenous Treatment Effect (METE) model proposed by Deb and Trivedi (2006 b). METE has been extensively applied in adoption studies, aiming at identifying various factors affecting the decision to adopt alternative agricultural practices and their impact on yield, income and child nutritional status (Kim *et al.*, 2019; Manda *et al.*, 2016; Varma, 2017 ). The framework has the advantage of evaluating both individual and combined livelihood strategies while capturing interactions between the choice of alternative strategies (Kassie *et al.*, 2015b)

## **2.5 The Choice of Instrumental Variable**

An instrumental variable refers to the third variable used in regression analysis when there are endogenous variables in the model (Green, 2012). It is used to account for unexpected behavior between variables. However, the choice of an instrumental variable is empirically

challenging (Sileshi *et al.*, 2019; Kim *et al.*, 2019). For this study, if choices are endogenous, the estimates of outcome variables will be biased and inconsistent. To this end, Deb and Trivedi (2006a) recommend the use of exclusion restrictions or instruments for more robust identification, where regressors included in treatment equations do not enter the outcome equation. For multinomial treatment effects to be identified, it is not strictly necessary that the vector of covariates includes additional variables not included in the outcome equation, because parameters for semi-structural model can be identified through the non-linear functional form of the selection model (Manda *et al.*, 2016). Although the selection of valid instruments that satisfy both exclusion and inclusion may be empirically challenging, the study used access to information on livelihood strategies opportunities through mobile phones as an instrumental variable. Access to information on opportunities of livelihood strategies through mobile phones is a binary variable that takes a value of one if youth has access to information on livelihood strategy opportunities through mobile phones and 0 if no access to information. Although in most cases the primary sources of information on livelihood strategy opportunities maybe usually internet, newspaper, television and radio announcements, mobile phones are the most used and vital source of information in rural areas, as they facilitate the decision-making concerning involvement in different livelihood strategies. This variable is likely to be correlated with the choice of livelihood strategies and unlikely to have a direct effect on food security and income poverty, except through the choices. The choice of instrument variable in this study is guided by the seminal work of Gupta *et al.* (2020) and Mwalupaso *et al.* (2020), which indicate that access to information through mobile phone is vital for decision making process. In addition, mobile phones assist in the diffusion of knowledge and information that helps the rural youth to gain ideas, skills, and information that increase their capacity to choose livelihood strategies. Access to information has

widely been used as a valid instrumental variable for decision making (Etea *et al.*, 2019; Kim *et al.*, 2019; Manda *et al.*, 2016; Sileshi *et al.*, 2019).

## CHAPTER THREE

### 3.0 METHODOLOGY

#### 3.1 Conceptual Framework

The choice of livelihood strategies has been modelled either as an individual utility maximization (Todaro, 1969) or as a household utility maximization problem, following Becker's family labour allocation model (Becker, 1965). The subsequent literature such as that of Duflo (2003); Rangel (2006) and Martínez (2013) challenges the individual utility maximization model in favour of the household utility maximization model for intra-household bargaining. In this model, household outcomes are affected by the distribution of power within the household. Thus household decision making assumes that two individuals who form a household pool their incomes to maximize a neoclassical household utility function subject to household total income constraint and the time constraint. But if the utility function of the members of household differs, then an assumption that forcing them into this aggregate framework may not be acceptable in all cases.

In this study, an individual youth's decision to choose a livelihood strategy is guided by the random utility theory. Under random utility framework, one of underlying motivations for an individual youth's choice of alternative livelihood strategies is to maximize utility from expected earnings from a particular strategy (Lancsar and Savage, 2004). Thus, an individual youth chooses between a number of alternatives and each alternative livelihood strategy is chosen with a certain probability. The random utility framework proposes that utility can be separated into systematic and stochastic components (Lancsar and Savage, 2004) such that:



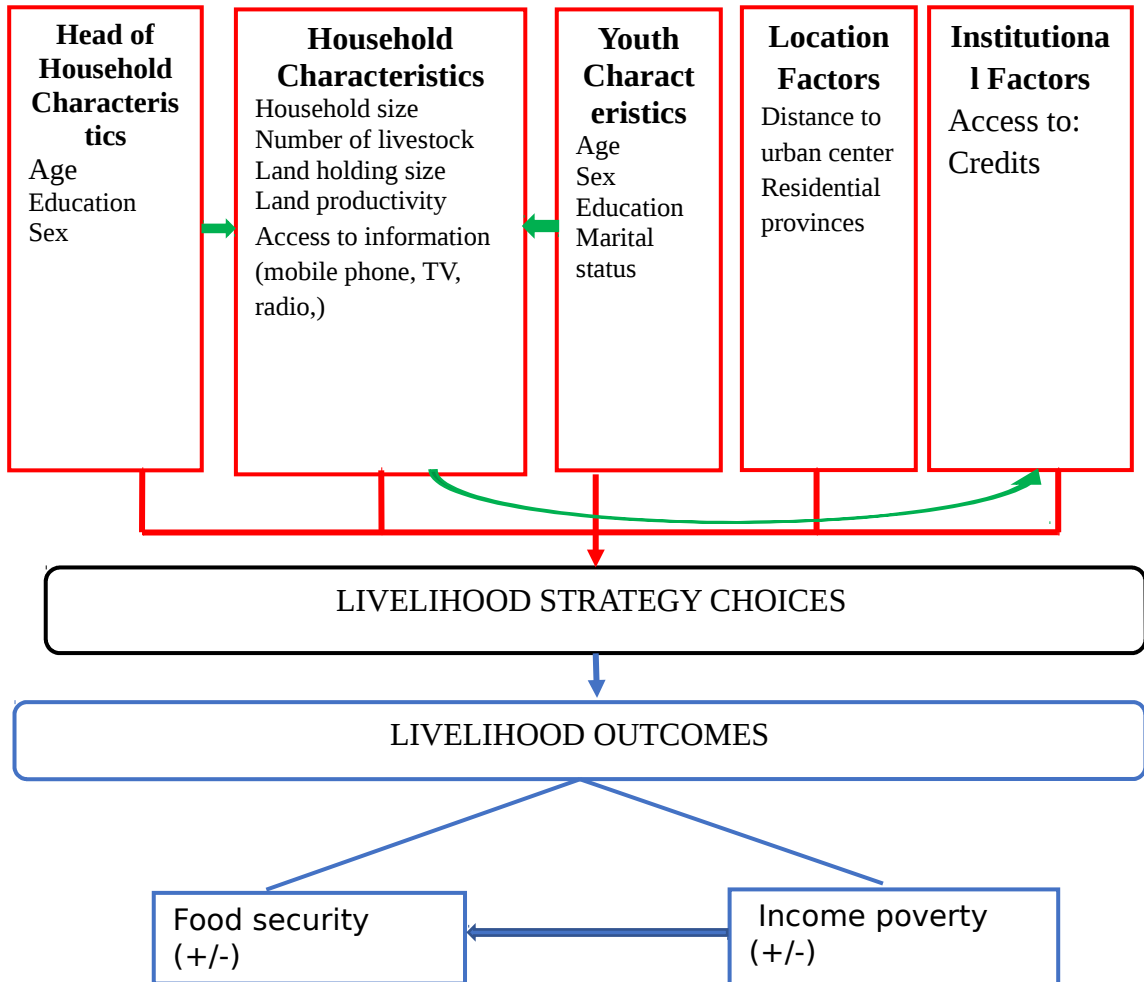
$$U_{ij} = V_{ij} + \varepsilon_{ij} \dots \dots \dots (2)$$

Where  $U_{ij}$  is the utility derived from choice  $j$  by individual  $i$ ,  $V_{ij}$  is the systematic component,  $\varepsilon_{ij}$  is the stochastic error term. We assume that an individual rural youth would choose alternative  $j$  if the utility derived from that alternative is greater than the utility derived from any other alternative in the choice set  $J$ . Thus, the probability that youth  $i$  will choose livelihood strategy, says, is represented as:

$$P(Y_i = s / Z_i) = \Pr ( U_{is} > U_{ij} ) = P ( V_{is} + \varepsilon_{is} > V_{ij} + \varepsilon_{ij} ) \quad s \neq j \dots \dots \dots (3)$$

Where  $Y_i$  denotes choices,  $Z_i$  is a vector of exogenous covariate including individual rural youth ( $i$ ) characteristics.

Figure 2 pictorially depicts the framework used in this study. The figure shows that the choice of a particular livelihood strategy is influenced by a number of factors including individual and household characteristics, socio-economic, demographic and locational related factors that need more consideration in the development discourse of Rwanda. In the end, the choices lead to the improvement of livelihood outcomes such as food security and income poverty.



Key: = Objective 1

= Objective 2

Figure 2: Conceptual framework of the study

Source: Author's own conceptualization

## **3.2 Data and Selection of Sample of Rural Youth**

### **3.2.1 Data**

This study uses data from the Fifth Integrated Household Living Conditions Survey (EICV5). This is the most recent national household survey- conducted in 2016/2017 by the National Institute of Statistics of Rwanda (NISR) with support from the UK Aid, European Union, the World Bank and UN partners in Rwanda.

The EICV is a multitopic survey modelled on the World Bank's standards measurement surveys. The objective of EICV5 cross-sectional survey is to provide nationally representative information that is used by the government and analysts to monitor and evaluate efforts to reduce poverty. The EICV5 cross-sectional survey was conducted weekly over a period of 12 months between October 2016 and October 2017 and each household was visited multiple times. Computer-Assisted Personal Interviewing (CAPI) techniques were used as a method of data collection in order to improve the speed of delivery and quality of the data. The survey is representative of the national, urban, rural, provincial, district levels and provides information on household, individual, and community characteristics. At household level, the information was collected for household members aged 6 years and above, focusing on agricultural and non-agricultural profiles, personal characteristics, migration, credits, and employment. The data that EICV collects at household level include information on housing, household consumption, and expenditure, land ownership, transfer of income, infrastructure facilities, and household assets portfolio.

The employment section of the questionnaire gathered information on employment status, desire to work or seek work-occupation type of paid employment, nature of activity and participation in non-remunerated activities. All this information was captured for the past 7 days from the date of interview. The community level information was administered to the lowest village administrative unit (*umudugudu*) to capture availability and access to infrastructure in the locality.

The EICV5 survey consists of 14 580 households comprising 2526 urban and 12 054 rural households from 30 districts. The NISR national master sampling frame was used for selecting the sample villages in each district. The master sampling framework was based on the 2012 Rwanda Population and Housing Census (RPHC) frame. A two stage sampling design with stratification was used and the districts were used as strata. Within each district the sample villages were selected systematically with probability proportional to size (PPS), and the measure of size was based on the number of households in the village obtained from the 2012 census frame. In the first stage, the sampling of the enumeration areas (EAs) was undertaken using the 2012 RPHC as a sampling frame. The EAs were selected with probability proportional to size. In the second stage, 12 households were selected from each EA.

The 2012 RPHC has classified rural and urban domain into four groups namely urban, rural, peri-urban and semi-urban. From the fourth to the recent rounds of the Integrated Household Living Condition Surveys, the NISR defined rural domain as the combination of rural and peri-urban areas, and urban domain as the combination of urban and semi-urban areas (NISR, 2015, 2018c ). Therefore, the sampling frame for the clusters for EICV4 and EICV5 were based on the 2012 RPHC and the new urban and rural classification was used. The NISR decided to use the classification established by 2012

RPHC for all tabulations by urban-rural location of the unit of analysis to ensure that the current distribution of the population and population characteristics are correctly represented (NISR, 2018b).

### **3.2.2 Study sample selection**

Since the study focuses on rural youth, the original list of 12 054 surveyed rural households in the EICV5 was used as the sampling frame and the final sample used in the study was restricted to youth. The sampling procedure started with the excise of matching the household information to each individual member of the household and to the characteristics of the community where the individual resided. The matching excise was followed by selection youths aged 16 to 30 years who were undertaking at least one livelihood strategy regardless of whether the youth was a household head or living with his or her parents. These were drawn from the list of 1867 rural households in the EICV5 survey data set comprising of 12 054 rural households and 2526 urban households as mentioned above. A total sample size of 2811 rural youth was drawn and involved in the analysis. The number of youth involved in study per province and district is presented in Table 1 below:

**Table 1: Number of rural youth distribution per region and district**

<b>Region/District</b>	<b>Frequency</b>	<b>Percent</b>
<b>Kigali Rural:</b>		
Nyarugenge	6	0.21
Gasabo	35	1.25
Kicukiro	10	0.36
Reginal Total	51	1.82
<b>Southern Rural</b>		
Nyanza	73	2.60
Gisagara	101	3.59
Nyaruguru	153	5.44
Huye	108	3.84
Nyamagabe	181	6.44
Ruhango	66	2.35
Muhanga	105	3.74
Kamonyi	63	2.24
Regional Total	850	30.24
<b>Northern Rural</b>		
Karongi	130	4.62
Rutsiro	95	3.38
Rubavu	34	1.21
Nyabihu	70	2.49
Ngororero	109	3.88
Rusizi	86	3.06
Nyamasheke	135	4.81
Regional Total	659	23.45
<b>Western Rural</b>		
Rulindo	173	6.15
Gakenke	161	5.73
Musanze	60	2.13
Burera	104	3.70
Gicumbi	130	4.62
Regional Total:	628	22.33
<b>Eastern Rural</b>		
Rwamagana	103	3.66
Nyagatare	62	2.21
Gatsibo	92	3.27
Kayonza	88	3.13
Kirehe	79	2.81
Ngoma	105	3.74
Bugesera	94	3.34
Regional Total	623	22.16
Sample Total	2811	100

### 3.2.3 Variables included in the analysis

**Employment:** This is the economic activity status of rural youth in the sample during the past 12 months. Sampled youth were classified as farmers if during the past 12 months were involved in farming activities, thus cultivating their own farm, or engaged in paid agricultural activities. Those classified as non-farm wage employment had worked for salary in the non-farm sector, while youth who are in category of self-employment are the ones who ran business for cash or profit.

**Demographics:** This combines a set of variables describing individual youth and head of household characteristics, including age, marital status, sex and education. It also includes household characteristics such as household size. These variables provide a clear picture of sampled youth as well as the motive behind their decision-making.

**Socio-economic characteristics:** These include households' land holding size, annual crop production data including farm outputs and their values, which were used to estimate productivity and income from farming. The study also extracted consumption-expenditure data from the survey, which was used to measure food security and poverty status. Also, there were institutional and community characteristics where the youth resides, which define the opportunities surrounding youth and which motivate them towards decision making process.

**Land Productivity:** Land productivity is one of determinants of the choice of livelihood strategies. Land productivity was estimated by partial factor productivity method. According to Clay *et al.* (1995), land productivity refers to the ratio of average output and unit of land. When there are two or more crops, they are aggregated using output prices

as weights as shown in Equation 4. For this study market prices for 2016/17 season were used.

The land productivity (LP) is given as;

$$LP_i = \frac{\sum_{j=1}^J (Q_{ij} * P_{ij})}{\sum_{j=1}^J A_{ij}} \dots \dots \dots (4)$$

Where,  $LQ$  is the quantity of  $j^{\text{th}}$  crop from  $i^{\text{th}}$  household,  $P$  is the price of  $j^{\text{th}}$  crop obtained by  $i^{\text{th}}$  household, and  $A$  is the area under  $j^{\text{th}}$  crop owned by  $i^{\text{th}}$  household.  $J$  is the total number of crops under consideration where  $j$  is subscripts ( $j=1,2,\dots,J$ ).

The values are expressed in <sup>2</sup>Rwandan francs (RWF).

**Return to labour:** This is the amount of money earned by an individual rural youth per activity. The return to labour allows to compare income from different livelihood strategies such as agriculture and non-farm activities pursued by rural youth. To estimate the return to labour, the study considers the difference between gross value and all costs incurred including labour, materials, other inputs such as seeds and fertilizer. It is important to note that costs and revenue vary across livelihood strategy. Given the nature of activity, youths get their income at different periods of time, that could be daily, weekly, monthly, seasonally, and sometimes annually. For the purpose of this study, the return to labour was expressed per day for all choices to maintain consistency. To do so, the total amount of money earned in a specific period of time is divided by the number of days equivalent to that period. That is the earnings divided by 7, 30, 90, 182 and 365 for periods one week, one month, three months, six months and one year respectively.

The estimation of return to labour per activity is presented below:



**Agricultural activities:** This includes the difference between the total value of production (both sold and unsold) and the cost of inputs, such as labour, seeds, fertilizer, cost of irrigation, costs of renting land, and all other costs associated with livestock rearing in a period of three or six months, variably depending on crop produced. The total revenue was then divided by 90 days for months and 182 days for six months. The two equations (5) and (6) specified below indicate the estimation of return to labour per day from agricultural livelihood activities. First, the total value of production is estimated as shown by the following equation (5):

$$TFR = SA + ILP + IL + LS + LR \dots \dots \dots (5)$$

Where,

*TFR* = the total value of agricultural production; *SA* = value of crop production; *ILP* = income from livestock products (milk, meat, eggs and skin); *IL* = income from live animal or carcass sold; *LS* = income from land sales; *LR* = income from land rental.

Second, the return from agricultural activities was calculated using Equation (6) below:

$$RA = TFR - TC \dots \dots \dots (6)$$

Where,

*RA* = return from agriculture; *TC* = the total agricultural expenses.

In the same way, the income estimator is also used to determine return from non-farm wage livelihood strategies. To do so, costs such as taxes, pension, insurances, and other costs are deducted from gross income.

Subsequently, the return from self-employment livelihood strategy was estimated by counting the difference between business turnover and total business expenses including labour and non-labour costs, as indicated by the following equation:

$$IS = \hat{i} - TE \dots \dots \dots (7)$$

Where,

$IS$  = income from self-employment;  $TO$  = business turnover per year;  $TE$  = the total business expenses including labour and non-labour and  $n$  is the number of activities.

### **3.3 Analytical Tools**

Statistical and econometric methods were used to analyze the data from the sample. First, descriptive statistics were used to characterize socio-economic characteristics of rural youth and to identify the types of livelihood strategies pursued by rural youth. Multivariate factor analysis was employed to investigate the patterns in a set of quantitative variables that influence the choice of livelihood among rural youth. To analyse the determinants of choice of livelihood strategies and the effect of livelihood choices on food security and poverty, Multinomial Endogenous Treatment Effect model was employed.

#### **3.3.1 Descriptive analyses**

The descriptive analysis was used to summarize important characteristics of respondents (rural youths). Measures of central tendencies and dispersion such as mean and standard deviation respectively were used to summarize quantitative data while percentages and frequencies were used to summarize socio-economic characteristics of rural youths. Frequencies and percentages were used to identify livelihood strategies pursued by rural youth. Returns from choices were analyzed using means, standard deviation and median. Inferential statistics such as chi-square test was used to assess the association between

youths' choices and household food security as well as the association between choices and household poverty status.

**3.3.2 Factor analysis**

In this study, factor analysis was used to investigate patterns in a set of quantitative variables that influence the choice of livelihoods. In doing so, factor analysis reduces the large number of quantitative variables affecting choice of livelihood strategies among rural youth into logical groups and each variable being given a weight by factor loading. Factor analysis is derived from an assumption that an individual rural youth chooses a livelihood strategy based on *n* variables. Then, the factor analysis models can be represented as a multivariate linear regression on a number *k* of unobserved or hidden variables  $F_{ji}, i=1... k$  called factors (Equation 8).

$$Z_{ji} = \alpha_j + \sum_{k=1}^K \beta_{jk} F_{k,i} + \epsilon_{ji} \dots \dots \dots (8)$$

$j=1,2,\dots,n$

Explicitly, Equation (9) can be written as a set of *n* equations (where *n* represents the number of independent variables;  $j=1... n$

$$Z_{1i} = \alpha_1 + \beta_{11} F_{1i} + \dots + \beta_{1k} F_{k,i} + \epsilon_{1i} \dots \dots \dots (9)$$

$$Z_{2i} = \alpha_2 + \beta_{21} F_{1i} + \dots + \beta_{2k} F_{k,i} + \epsilon_{2i} \dots \dots \dots (10)$$

$$Z_{ni} = \alpha_n + \beta_{n1} F_{1i} + \dots + \beta_{nk} F_{ki} + \epsilon_{ni} \dots \dots \dots (11)$$

Where:  $Z_{ji}$  are quantitative variables for  $i^{\text{th}}$  youth associated with livelihood choice; the  $a_j$  are the constant terms, the coefficients  $\beta_{ji}$  are called factor loadings associated with quantitative variables, the  $F_{ji}$  are the hidden factors, and the  $\mu_{ji}$  are the error terms.

Factor analysis and Principal Component Analysis (PCA) are the common methods used for data reduction. Despite their similarities, PCA is a linear combination of variables while factor analysis is a measurement model of latent variables, and this makes it suitable for the analysis. To assess the fitness of data for factor analysis, the results from Kaiser –Meyer-Olkin (KMO) and Bartlett’s test were performed. Following the rule of thumb, KMO measure of sampling adequacy explains the proportion of variance in variables that might be caused by underlying factors. If the value is greater than 0.50, this indicates that factor analysis maybe useful for the data. Bartlett’s test of sphericity tests the hypothesis that the correlation matrix is an identity matrix; values less than 0.05 of the significance level shows that the suitability of factor analysis. After factoring the correlation matrix by PCA method, factors with eigen values greater than one, are retained. Rotating matrix aims to examine the loading pattern to factors that have the most influence on each variable. Theoretically, loadings close to -1 and 1 indicate that the factor strongly influences the variable, loading close to 0 shows weak influence. In this study, absolute values which load the highest of greater than 0.5 in this case identified the category.

### **3.3.3 Multinomial endogenous treatment effects model**

Multinomial Endogenous Treatment Effects Model (METE) was used to analyse the factors influencing choice of livelihood strategies and their effect on household food security and income poverty. The model was used because it allows the analysis of both

the determinants of choice of livelihood strategies and the impact of choices on income poverty and food security with provision for self selection correction and addressing the endogeneity problem arising from the unobservable factors. Because of the possibility of self-selection into choice of livelihood strategies, selection bias and endogeneity may arise (Kim *et al.*, 2019). The adopted model is based on multinomial logit and allows the distribution of endogenous treatment i.e choice of livelihood strategies and outcome (food security and income poverty) to be specified using a latent factor structure, thereby allowing a distinction to be made between selection of unobservable and observables (Deb and Trivedi, 2006b). The framework has the advantage of evaluating both individual and combined livelihood strategies while capturing interactions between the choice of alternative strategies (Kassie *et al.*, 2015b). According to Bourguignon *et al.* (2007), the selection bias on the multinomial logit model seems to be a reasonable alternative to multinomial normal models when the focus is on estimating an outcome over selected population rather than on estimating the selection process itself, even when the IIA is violated. In case the combinations of livelihood strategies are exhaustive and there is no other choice that an individual can make, these combinations of livelihood strategies are mutually exclusive (Kassie *et al.*, 2015b).

Furthermore, the analysis explicitly considers the possibility of self-selection into choice of livelihood strategies, as such represents an additional contribution to the existing livelihood literature in which the issue of choice selectivity has been neglected. Thus, METE assesses the differential impacts of alternative livelihood strategies rather than combining them into a binary choice (Manda *et al.*, 2016).

In a multiple-choice framework, the choice analysis of the three livelihood strategies (agriculture, non-farm wage, self-employment) led to eight ( $2^3$ ) potential combinations of

choices which an individual rural youth can choose. Since non-economically active youths ( $A_0N_0S_0$ ) are not included in the analysis, only seven possible choices are considered as shown in Table 2.

**Table 2: Choice packages of livelihood strategies**

N/S	Choice packages	Agriculture (A)		Non-farm wage employment (N)		Self-employment (S)		Frequency (percent)
		A <sub>1</sub>	A <sub>0</sub>	N <sub>1</sub>	N <sub>0</sub>	S <sub>1</sub>	S <sub>0</sub>	
1.	A <sub>1</sub> N <sub>0</sub> S <sub>0</sub>	√						1317 (47)
2.	A <sub>0</sub> N <sub>1</sub> S <sub>0</sub>			√				239 (8.5)
3.	A <sub>0</sub> N <sub>0</sub> S <sub>1</sub>					√		67 (2)
4.	A <sub>1</sub> N <sub>1</sub> S <sub>0</sub>	√		√				611 (22)
5.	A <sub>1</sub> N <sub>0</sub> S <sub>1</sub>	√				√		426 (15)
6.	A <sub>0</sub> N <sub>1</sub> S <sub>1</sub>			√		√		16 (0.5)
7.	A <sub>1</sub> N <sub>1</sub> S <sub>1</sub>	√		√		√		135 (5)
<b>Total</b>								<b>2811</b>

Note: Each of element is a binary variable for agriculture (A), non-farm wage employment (N) or Self-employment (S)

Subscript 1= choose, and 0 =otherwise

### 3.3.4 Model specification

METE model was staged in two step procedures to assess the effect of youths 'choice of livelihood strategies on household income poverty and food security status. In the first stage, the choice of livelihood strategies is modelled using a mixed multinomial logit model. An individual rural youth  $i$  chooses one from a set of seven alternative strategies  $j(j=0,1,2,3,4,5,6)$ , which included a control group which was agriculture in this case.

As Deb and Trivedi (2006 b) argue, if  $EV_{ij}^i$  denotes the indirect utility obtained by an individual rural youth  $i$  from choosing the  $j^{th}$  livelihood strategy,  $j=0,1,2,3,4,5,6$  then:

$$EV_{ij}^{\hat{i}} = z_i' \alpha_j + \delta_j l_{ij} + \eta_{ij} \dots \dots \dots (12)$$

Where,  $z$  is a vector of exogenous covariates including rural youth ( $i$ ) characteristics, with associated parameters  $\alpha_j$ , and  $\eta_{ij}$  are independently and identically distributed error terms.  $l_{ij}$  is a latent factor incorporating unobservable characteristics common to  $i$ th rural youth choice of  $j^{th}$  alternative livelihood strategy and the resulting outcomes, which in this case are household poverty and food security status. The  $l_{ij}$  are assumed to be independent of  $\eta_{ij}$ .

If  $j=0$  denotes the control group referred here as agriculture only and  $EV_{ij}^{\hat{i}} = 0$ , then

we observe a vector of binary variables,  $(d_{i3}, d_{i4}, d_{i5}, d_{i6})$  and  $d_i = \hat{i}$

$(l_{i3}, l_{i4}, l_{i5}, l_{i6})$  whose probability of treatment can be expressed as follow:  
 $l_i = \hat{i}$

$$Pr(d_i = 1 \vee z_i, l_i) = g(z_i' \alpha_j + \delta_1 l_{ij}), j \dots \dots \dots (13)$$

Where,  $g$  is a multinomial probability distribution. Following Deb and Trivedi (2006a; 2006b), we assume that  $g$  has a mixed multinomial logit structure, defined as:

$$Pr(d_i \vee z_i, l_i) = \frac{\exp(z_i' \alpha_j + \delta_1 l_{ij} + \Pi \theta_i)}{1 + \sum_{k=1}^j \exp(z_i' \alpha_k + \delta_k l_{ik} + \Pi \theta_i)} \dots \dots \dots (14)$$

$Z_i$  is a vector of exogenous covariates including individual youth's characteristics. The  $\theta_i$  is a parameter associated with  $\theta_i$  which is an instrumental variable denoting access to information on opportunities of livelihood through mobile phones.

In the second stage, the effect of choice of livelihood strategies on household income poverty and food security status was determined using binary logit model, with a selectivity correction term from the first stage. The expected outcome equation expressing the effect of choice of livelihood on household poverty and food security is defined as:

$$Pr(y_i=1 \vee d_i, z_i, l_i) = x_i' \beta + \sum_{j=1}^J (\gamma_j d_{ij}) + \sum_{j=1}^J (\lambda_j l_{ij}) \dots \dots \dots (15)$$

$$Pr(y_i=0 \vee d_i, z_i, l_i) \quad \text{Otherwise}$$

Where,  $y_i$  represents household poverty or food security status for  $i^{\text{th}}$  household.

$Pr(y_i=1 \vee d_i)$  is the probability of a household  $i$  being poor or food secure; ;  $x_i$  is a vector of exogenous covariates with associated parameters  $\beta$ , and  $\gamma_j$  (for  $j=1,2,3,4,5,6$ ) denoting the treatment effects for other livelihood strategies relative to the control group, agriculture.  $l_i$  are unobservable characteristics that also affect the selection of livelihood strategy.  $\lambda_j$  are factor loading whose sign will indicate whether a treatment and outcome are positively or negatively correlated through unobservable variables meaning that there is positive or negative selection (Kim *et al.*, 2019). The model was estimated using maximum likelihood simulated approach. Hausman and McFadden test was employed in this study to test the validity of IIA.



The validity of an instrument was tested using a simple falsification test. If the instrument is valid, it will affect the choice of livelihood strategies but will not affect the outcome variables (food security and poverty). The results show that access to information through mobile phones can be considered as a valid instrument because it is statistically significant in all equations of the choice of livelihood strategies (Table 10) but not statistically significant in household food security and income poverty (Appendices 10 and 11).

### 3.3.5 Outcome variables

**Food security:** Household food security status was specified as a dichotomous variable, taking value of 1 if a household is food secure and 0 otherwise. To capture household food security status, this study chose a cut-off point of a minimum average daily calorie intake below which rural households are considered to be food insecure. According to Fatima and Yoshida (2018) and the NISR (2015), this cut-off is set at 2500 kcal per day per Adult Equivalent (AE) and is used as the food security threshold. In monetary terms, the 2500 kcal/day/AE is equivalent to RWF 105 064 per AE per year using end of January 2014 prices. This is the cost of buying enough food to provide an adequate number of calories. In this regard, a household that spends at least RWF 105 064 on food per year is food secure, otherwise, it is food insecure.

**Poverty status:** Poverty status was specified as a binary variable representing the status of the poverty in the household, taking the value of 1 if the household is poor and 0 otherwise. The poverty reported in this study refers to income poverty, defined as insufficient consumption to satisfy food and non-food basic needs (NISR, 2015). Thus, households are classified into poor and non-poor depending on their real annual

consumption per adult equivalent (in January 2014 prices) relative to a national poverty line of RWF 159 375. Therefore, a household was considered to be poor if the level of consumption was below poverty line and non-poor otherwise.

The simplest measure of poverty is the headcount poverty rate, which is the percentage of people living in household whose consumption per adult equivalent is below the poverty line (NISR, 2018b). The total consumption was obtained by adding up a large number of items, including:

- ✓ Spending on food items: for commonly consumed items, households were visited multiple times and asked to estimate the amount spent since the last visit, and their consumption over previous month for items purchased less frequently;
- ✓ Auto-consumption of food: value of food produced and consumed at home;
- ✓ Non-food items purchased over the past year, month or home produced item;
- ✓ The value of durable assets such as phones and bicycles. The standard depreciation and capital costs to the reported value of assets were applied;
- ✓ Spending on education;
- ✓ Spending on housing;
- ✓ Spending on health;
- ✓ In-kind wages that represent consumption (such as meal provided by employer);
- ✓ In kind remittances received.

Then, household consumption was divided by the number of adult equivalents in the household.

### **3.3.6 Description of explanatory variables used in the model**

#### **3.3.6.1 Description of variables of the first stage of METE model**

The row vector variables representing socio-economic, demographic, and institutional aspects that can influence the choice of livelihood strategy ( $Z_{ij}$ ) was drawn from the literature. These variables are age of youth (number of years), sex (dummy taking 1 if male; 0 otherwise), and education measure as number of years of formal education for individual youth or head of household. The relation with the head of household was captured as a dummy variable taking the value of 1 if youth is the head; and 0 otherwise. Household size was captured as total number of people existing in the household. Land holding size is total land owned by the household where youth belongs and was expressed in ha, while livestock ownership referred to total number of animals owned by a household and was expressed in tropical livestock unit (TLU). The access to credit specified as a dummy variable taking the value of 1 if youth had access to credit and 0 otherwise. Other variables include the distance to the nearest urban center, a continuous variable expressed in km.

The literature suggests that the magnitude and influence of the above independent variables differ from one livelihood strategy choice to another. For example, Holden (2018) argue that education motivates rural citizens to engage in non-farm activities, while households headed by young people in rural areas are more likely to engage in agricultural activities. Nielsen *et al.* (2013) suggest that large land holding size inspire the choice of farming. According to Maniriho and Nilsson (2018) and Nilsson (2016), asset endowments and access to credit motivate people to choose non-farm livelihood strategies. Additionally, Teshager *et al.* (2019) argue that livestock ownership, considered as measure of wealth, positively influences the choice of agricultural based livelihood

strategies. This is because livestock provide fertilizer to increase productivity and they provide draught power for ploughing. Similarly, large household sizes influence rural people to investigate options other than agriculture.

### **3.3.6.2 Description of variables of the second stage of METE model**

Variables hypothesized to affect household food security and income poverty are described in Table 3 below.

**Table 3: Variable description**

Factors	Variable	Description and measurement	Expected sign	
			<i>Poverty status</i> (yes =1 if poor)	<i>Food security</i> (yes=1 if food secure)
Individual youth and	Age	Continuous variable measured in years	-	+
	Sex	Dummy variable taking the value of 1 if male, and 0 otherwise	+/-	+/-
	Education	Continuous variable Number of formal years of education	-	+
Household head characteristics	Age	Continuous variable measured in years	-	+
	Sex	Dummy variable taking the value of 1 if male, and 0 otherwise	+/-	+/-
	Education	Continuous variable Number of formal years of education	-	+
Household factors	Land size	Continuous variable Total number of ha	-	+
	Household size	Continuous variable, defining total number of people in the household	+	-
	Livestock ownership	Continuous variable, defining the total number of livestock per household in TLU	-	+
Institutional and community level factors	Access to credit	Dummy variable taking 1 if youth can access credit and 0 otherwise	-	+
	Distance to the nearest centre	Continuous variables express in km	+/-	+/-
	Rural south	Dummy variable taking 1 if youth lives in south it and 0 otherwise	+/-	+/-
	Rural west	Dummy variable taking 1 if youth lives in west and 0 otherwise	+/-	+/-
	Rural north	Dummy variable taking 1 if youth lives in north and 0 otherwise	+/-	+/-
Controlling factors (Livelihood strategies)	Rural east	Dummy variable taking 1 if youth lives in east and 0 otherwise	+/-	+/-
	Agriculture	Dummy variable taking 1 if youth pursue farming, and 0 otherwise	-	+
	Non-farm wage employment	Dummy variable taking 1 if youth pursue non-farm wage, and 0 otherwise	-	+
	Self-employment	Dummy variable taking 1 if youth is self-employed, and 0 otherwise	-	+

## CHAPTER FOUR

### 4.0 RESULTS AND DISCUSSION

#### 4.1 Rural Youths' Choice of Livelihood Strategies in Rwanda

Rural youths obtain livelihood from different sources. These include wages, salaries and commissions, own business, sales of farm produce and services, rent and interests, remittances, pensions and grants. In this study, all these livelihood strategies were matched, and seven major livelihood strategies were identified: agriculture, non-farm wage employment, self-employment, agriculture plus non-farm wage, agriculture plus self-employment, non-farm wage plus self-employment, agriculture plus non-farm wage plus self-employment. Results in Table 4 indicate that most of the sampled rural youth (47 % ) chose agriculture as their primary livelihood strategy.

**Table 4: Livelihood strategies chosen by rural youth**

<b>Livelihood choices</b>	<b>Percent</b>
1. Agriculture only	47.0
2. Non-farm wage employment only	8.5
3. Non-farm self-employment only	2.4
4 Agriculture +non-farm wage employment	21.5
5. Agriculture +self-employment	15.0
6. Non-farm wage employment + self-employment	0.6
7. Agriculture + non-farm wage employment + self-employment	5.0
<b>Total</b>	<b>100</b>

Despite several challenges that the agriculture sector is facing in Rwanda, a large percentage of rural youth from the sample pursue agriculture where they are involved in different activities. These activities include crop production and sales, fisheries, forestry, gardening, and livestock keeping. In the selected sample, all the respondents were involved in at least one of these activities with majority being found in crop production. The most grown crops are beans, maize, potatoes, and sorghum, while the commonly

raised animals are cattle, sheep, goats and pigs (Table 5). Furthermore, rural poor families in Rwanda were supported by Girinka (one cow per family) program whose aim is to increase agricultural production and improve nutrition status. Farming in Rwanda involves mainly multi-cropping practiced on more than half of all lands (MINAGRI, 2018). Those findings are consistent with these by Ansoms and McKay (2010) that Rwandan peasants generally like to combine different crops, ranging between 7 to 8 on average.

**Table 5: Main crops and livestock produced in Rwanda**

	<b>Percent</b>
<b>Types of crops produced</b>	
Maize	18.2
Sorghum	10.2
Potatoes	16.9
Beans	29.7
Vegetables and Fruits	16.0
Coffee	3.9
Others	5.1
<b>Total</b>	<b>100</b>
<b>Type of livestock kept</b>	
Cattle	20.2
Sheep	10.4
Goats	10.1
Pigs	10.2
Rabbits	9.9
Chickens	9.2
Others	30.0
<b>Total</b>	<b>100</b>

Although most farmers produce crop and livestock products for own consumption, some of the produces are sold at regular and periodic markets. Further, farmers may face some constraints such as low return to labour when they grow a single crop (Ansom, 2008). Therefore, farmers are obliged to diversify the crops they cultivate. These findings support the findings by (NISR, 2018a) who argue that a significant proportion of young people in Rwanda is engaged in farming. The choice of farming is possibly linked to the

passion for agriculture or limited rural non-farm livelihood strategy opportunities, barrier to entry and restrictions to other livelihood strategies. Ghebru and Zavale (2018) report that rural youths choose farming because youths are more responsive to tenure security than the rest of the population.

Non-farm wage employment is viewed as white-collar job that rural youth aspire and dream to secure it. However, the percentage of rural youth pursuing this strategy in rural areas of Rwanda is relatively smaller than those engaged in agriculture. This is mainly because rural youths have limited access to these opportunities due to many restrictions such as education and limited technical skills. Rural non-farm livelihood strategies are service oriented activities mostly taking place within rural community, which require specific skills as a condition for entry. The low percentage of youth involvement in non-farm wage employment is also reported in previous studies, including Allen *et al.* (2016) and Maniriho and Nilsson (2018) who reported limited rural non-farm activities in Rwanda. Given what is found in Gecho *et al.* (2014), non-farm livelihood strategies arise as survival strategies following the failure of rural people unable to obtain employment in agriculture, and therefore pursue non-farm livelihood activities to improve their wellbeing and to fill the gap that agriculture sector is unable to do.

Furthermore, only 2 % of the sampled rural youth were engaged in non-farm self-employment as their primary source of livelihood. This is maybe due to lack of access to financial resources such as credits, which hinders them from pursuing own businesses. Self-employment livelihood strategy includes service and related sales work, craft, street and market sellers, as well as hairdressing. Ghebru and Zavale (2018) reports that in a situation where there is undeveloped non-agriculture economy, only land shortage pushes rural youth to look for non-farm livelihood strategies like business and others.



It is evident that when agriculture is unable to sustain lives in rural areas, a combination of more than one activity becomes a norm and necessary to leverage rural development. The findings from the study reveal that a significant proportion of the sampled rural youth pursued two or three different livelihood strategies. For example, about 21.5 % of rural youth choose agriculture plus non-farm wage as their main source of livelihood (Table 4 ). This implies that the aforementioned proportion of youth derive their satisfaction when they combine the two types of livelihood activities. On the other hand, 15 % of the sampled youth were involved in a combination of agriculture plus self-employment, while only 0.5 % combine self-employment with non-farm. Education and lack of technical skills are presumably attributable to the low involvement of youths in self-employment and non-farm activities. Lastly, only 5 % of youth combine agriculture, non-farm, and self-employment. Apparently, youths are undertaking simultaneous livelihood strategies partly due to shortage of land in Rwanda. Youths are taking non-farm activities to smoothen their consumption and improve their wellbeing. In this regard, simultaneous livelihood sources is considered as an efficient means to ensure sustainable income, secure survival and improve livelihood assets. This supports the findings by Gecho (2017) that rural people combine more than one livelihood strategies due to the failure of agriculture perceived as means of providing livelihood to substantial proportion of rural people.

#### **4.2 General Characteristics of the Sampled Rural Youth and Their Choice of Livelihood Strategies**

The overview of characteristics of the sampled youth were summarized in Table 6. Generally, the sample was dominated by young females, with 51.58 percent of females

against 48.42 % males. On average the youth were 23 years of age and completed seven years of education on average, which indicates attainment of at least secondary school since primary school in Rwanda is six years. Young people at the mean age are commonly known to be mobile in search of non-farm income generating opportunities in near or distant rural or urban communities. Education of young people has been of policy concern in the study area since 2003. Education is an important entry criterion for some livelihood activities. This is because education provide skills that are required for some rural non-farm activities, but also contributes to increased productivity (Fabusoro *et al.*, 2010). The findings on education in this study support the findings by NISR (2018a) that most youths in Rwanda know how to read and write. This comes as a result of the policy implemented since 2003 that introduced free education to improve school enrolment. Furthermore, sampled youth belong to household with with a median of 0.61 hectares with a an average dependancy ratio of 66 %.

The results from Table 6 also indicate the characteristics of sampled youth who chose each livelihood strategy. Compared other livelihood strategies, rural youth who pursued agriculture only are females, younger in age and less educated who came from household with high median land holding size, and moderate dependancy ratio. The choice of non-farm wage employment benefits males with high level of education and who do not head households. Older youths with probability of heading households preferred multiple livelihood strategies. This is attributed to more responsibilites and experience associated increase in age.



**Table 6: General characteristics of rural youth and their choice of livelihood strategies**

Variables		Agriculture	Non-farm wage	Agriculture +nonfarm wage	Self-employment	Agriculture + self-employment	Non-farm wage +self-employment	Agriculture +non-farm wage +self-employment	Total	Test statistics
Land size (ha)	Mean	1.71	2.08	1.54	2.01	1.61	1.09	1.49	1.68	0.98
	SD	5.06	6.63	4.75	3.32	3.06	1.28	2.31	4.76	
	Median	0.63	0.62	0.55	0.70	0.66	0.56	0.75	0.61	
Age of youth	Mean	23.30	23.13	24.04	23.27	24.26	22.25	24.79	23.65	3.70***
	SD	3.79	3.67	3.72	3.56	3.84	4.00	3.91	3.80	
	Median	23	23	24	23	24	20.5	25	23	
Sex of youth (percentage)	Males	35.05	14.03	30.49	2.94	10.80	0.96	5.73	48.42	332.765***
	Females	59.31	3.43	12.97	1.93	18.83	0.21	3.59	51.58	
Education of youth	Mean	6.60	8.01	6.84	7.85	6.05	7.93	6.58	7	1.35
	SD	3.84	5.13	4.31	3.78	3.87	5.62	3.58	4	
	Median	6	6	6	7	6	7.5	6	6	
Dependency ratio	Mean	0.64	0.49	0.57	0.51	0.72	0.38	0.79	0.63	1.86**
	SD	0.57	0.48	0.51	0.41	0.60	0.29	0.77	0.56	
	Median	0.5	0.4	0.5	0.46	0.5	0.33	0.58	0.5	
Youth heading households (percentage)	Yes	8.83	4.64	22.72	11.76	16.67	12.50	27.69	13.59	110.413***
	No	91.17	95.26	77.28	89.24	83.33	87.50	73.31	86.41	

### 4.3 Return to Labour and Choice of Livelihood Strategies

The returns to labour per livelihood strategy per day are reported in Table 7. This analysis was undertaken to determine the most rewarding livelihood strategy. Apparently, rural youths pursuing non-farm wage plus self-employment obtained the highest return, as it generated the median income of RWF 526 per day. Non-farm employment is the second rewarding strategy with RWF 424 median earning per day, followed by self-employment with RWF 357 per day. Surprisingly the first three choices with high return are less practiced than others, which implies that they are faced with entry barriers such as educational qualifications and access to financial resources, while the reliance on family savings may be linked to the weakening of social interactions in the Rwandan community. These findings are consistent with findings of other studies such as Dabalén *et al.* (2004) and Alemu (2012) who found that non-farm wage earners are better off in rural areas than other livelihood strategies.

Agriculture, the most practiced livelihood strategy in Rwanda, was the least remunerative with a median daily income of RWF 201 per day. Some characteristics of the agriculture subsector such as low productivity, inferior technologies, limited markets, high transaction costs may be attributable to this (MINAGRI, 2018). These characteristics largely contribute to low return to land and labour. The low return makes rural people including youth to pursue agriculture as the last resort for lack of an alternative livelihood strategies.

This situation can be reversed by increasing returns from agriculture through government interventions that enhance agricultural productivity. Results of sensitivity analysis carried out to determine the effect of increase in agricultural productivity on returns to labour indicate that all being equal, when yield is increased by 15 %, the return to labour in agriculture will increase by over 20 % (Appendix 9). Promoting domestic food production instead of entirely depending on

imports is important as it protects a county from volatile food markets in periods of world food crisis.

Findings from quantile regression test for medians indicate significant differences between median daily returns earned from all choices at less than 5 percent probability levels using agriculture as a control group (Table 8). A positive significant difference was observed between median daily return from the choice of non-farm wage, agriculture plus non-farm wage, self-employment, non-farm plus self employment and agriculture, implying that the afromentioned strategies are better in terms of return to labor than agriculture. This is due to use of traditional technologies, drought, high labour cost, and others leading to low income (AnAsnoms and McKay, 2010). The median daily earnings differential between agriculture and the choice of agriculture plus self-employment, agriculture plus non-farm wage employment plus self-employment were not statistically significant. Therefore no conclusion was made. This confirms that the top four choices ranked in Table 7 are the most rewarding strategies than agriculture only as a livelihood strategy.

**Table 7: Return to labour from each choice of livelihood strategy ( RWF per day)**

<b>Variables</b>	<b>Category</b>	<b>Agriculture</b>	<b>Non-farm wage employment</b>	<b>Self-employment</b>	<b>Agriculture + non-farm wage</b>	<b>Agriculture + self-employment</b>	<b>Non-farm + self-employment</b>	<b>Agriculture + non-farm wage + self-employment</b>	<b>Total sample</b>
<b>Return to labour per day</b>	Mean	748	13 319	1 045	813	4 626	2 638	816	2 422
	SD	3 769	183 612	2 610	2 104	70 368	7 602	1 958	59 924
	Median	201	424	357	333	166	526	220	225
	Rank in descending order of median income/day	6	2	3	4	7	1	5	

(1USD = 834 RWF, December 2017)

**Table 8: Median differences in return to labour per day among choices**

<b>(I) Livelihood strategies</b>	<b>(J) Control group</b>	<b>Coefficients</b>	<b>Std. Err</b>
Non-farm wage	Agriculture	223.0	53.5
Agriculture +non-farm wage	Agriculture	65.7	19.4
Self-employment	Agriculture	54.2	24.8
Agriculture +self-employment	Agriculture	-8.6	8.47
Non-farm wage +self-employment	Agriculture	98.3	31.4
Agriculture +non-farm wage +self-employment	Agriculture	0.2	10.0

#### **4.4 Results of Multivariate Factor Analysis**

The result of multivariate factor analysis indicate that, the Kaiser measure of sampling adequacy is equal to 0.52 which is slightly higher than threshold of 0.5, the optimal lower limit value to be considered for model suitability (Appendix 6). Out of ten initial components, 4 factors appear to explain 51.53 % of variability in the dataset (Appendix 7). The bolded figures in Table 9 show that the first latent factor which explains 16 percent of the original variance is positively associated with education of youth and head of household. It therefore describes rural youths' human capital. The second common factor explains 14 % of the variance is positively correlated with the age of youth, and negatively associated with the household size. It describes youths' socio-demography.

Location and annual income are substantially loaded on the third factor. This factor extracted value is named youths' motivational factors. The fourth common factor is positively correlated with livestock ownership and distance to the nearest services. This factor describes assets and infrastructure necessary for youth to orient their choice of livelihood strategies. Conclusively, the overall results from Table 9 reveal that the quantitative variables that influence the choice of livelihood strategies for youth are explained by factors such as human capital, socio-demography, motivational, household assets and infrastructures.



**Table 9: Rotated Component Matrix results**

	<b>Factor 1</b>	<b>Factor 2</b>	<b>Factor 3</b>	<b>Factor 4</b>
Education of youth (number of years of formal education)	<b>.839</b>	.062	.370	.234
Education of head of household (number of years of formal education)	<b>.801</b>	.037	.457	.101
Savings (in Rwf)	.001	.321	.438	.206
Household size (number of people living in the household)	.430	<b>-.779</b>	.167	.090
Age of youth (years)	.389	<b>.726</b>	.234	.296
Residential provinces	.151	.492	<b>.659</b>	.241
Annual income (RWF)	.133	.284	<b>.606</b>	.032
Livestock ownership (TLU)	.000	.371	.469	<b>.700</b>
Distance to the nearest services (km)	.060	.240	.265	<b>.609</b>
Land size (hectares)	.373	.119	.341	.288

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

#### **4.5 Factors Influencing the Choice of Livelihood Strategies**

As noted earlier, rural youth pursue different livelihood strategies. This sub-section discusses the choice of seven strategies namely agriculture, non-farm wage employment, self-employment, agriculture plus non-farm wage, agriculture plus self-employment, non-farm plus self-employment, and agriculture plus non-farm wage plus self-employment, as shown in Table 10. Agriculture is the reference category against which all other livelihood choices are compared. The coefficients in the first stage of METE are calculated and reported in relation to the reference category and thus not easy to interpret directly like the linear models. However, the signs were informative and average marginal effects were predicted and also provided useful insights. Furthermore, the results from Hausman and McFadden test presented in Annexes 2 and 3 indicate that the choice of livelihood strategy is mutually exclusive, and therefore, MNL is appropriate for the analysis.

The findings from Table 10 revealed a negative and significant relationship between distance to the nearest urban centre and the choice of non-farm wage employment ( $p < 0.01$ ) relative to agriculture. This implies that youths who live far from the services are likely to engage in agriculture than other activities. The long distance from home to the nearest urban centre prevents rural youths from accessing to necessary and timely information regarding urban non-farm opportunities. These findings are in agreement with Gecho (2017) who found that better access to the nearest services and market increases non-farm earnings. Keeping other things constant, for every one-kilometer increase to the nearest urban centre, the probability that rural youths will choose non-farm wage employment drops by 0.5 %.

Being a head of household influences the choice of non-farm wage employment and affect positively negatively the choice of agriculture plus self-employment ( $p < 0.01$ ;  $p < 0.1$ ) relative to agriculture among rural youth. This means that being a head of household increases the probability of youth to choose non-farm wage and decreases the chance of rural youth involvement in agriculture plus self-employment strategy. Rural youths heading households are motivated to look for alternative options because of hardships associated with agriculture such as shortage of agricultural land in Rwanda.

The findings from the analysis reveal that sex of youth has a negative and significant influence on the choice of non-farm wage employment, self-employment, non-farm plus agriculture, agriculture plus self-employment, non-farm wage plus self-employment and agriculture plus non-farm wage plus self-employment, relative to agriculture ( $p < 0.01$ ). This suggests that being a male decreases the likelihood of rural youth choosing other livelihood strategies outside agriculture. The implication of these findings is that males are more advantageous, due to cultural influence and are more favored to get access to

productive resources including land and other opportunities than their counterpart females. Young females are restricted to access land and farm income which is mostly controlled by male. As a result of this, females are pushed to look for other opportunities outside agriculture. These findings support the results of previous studies such as Sebastian (2017) and Holden (2018) which revealed that agriculture activities in rural areas are dominantly pursued by males.

Education has a positive and significant influence on the choice of non-farm wage employment, and a negative influence on the choice of agriculture plus self-employment relative to agriculture ( $p < 0.05$  and  $p < 0.01$ ). High level of education implies more exposure, more skills and knowledge, which enable youths to qualify for non-farm wage employment than is the case for youths with low level of education. On the other hand, rural youth with high level of education are less likely to engage in agriculture plus self-employment.

For one more year increase in level of education, the probability of rural youth choosing non-farm wage increases by 0.1 %, while the probability of youths choosing agriculture plus self-employment drops by 1.2 %, *ceteris paribus*.

Older youth are more likely to choose nonfarm wage employment and the combination of agriculture plus nonfarm wage plus self-employment. Age measures experience and reflects changes which guide youth to choose livelihood strategies outside agriculture in the face of land scarcity. Keeping other factors constant, one-year increase in age of youth will increase the likelihood of youths choosing non-farm wage employment and agriculture plus nonfarm wage plus self-employment by 0.3 % and 0.2 %, respectively. Youth from households headed by educated heads are more likely to engage in non-farm wage employment. The implication is that educated heads would encourage children to

attain high education levels which would increase their expectation of success in other sectors outside agriculture.

Household size has a positive and negative correlation with the choice of non-farm wage employment and combination of agriculture plus non-farm wage ( $p < 0.01$  and  $p < 0.05$ ), respectively. On one hand, this can be attributed to high large household size leads to decline of farm size for those who want to engage in agriculture. In this regards, young males and females from such households will look for non-farm opportunities to meet their needs. The increase in the number of household members is associated with high consumption and other needs such as good education and financial facilities, which maybe hardly achieve by an ordinary rural farmer. On the other hand, the increase in household size decrease the likelihood of youth combining agriculture with non-farm wage because of limited non-farm activities and capital access.

Land size decreases the likelihood of youth choosing agriculture plus non-farm wage relative to agriculture only. This indicates that limited access to land is an important factor that drives rural youth away from farming. These findings are consistent with the findings by Bezu and Holden (2014) who found that limited access to land pushes youth away from agriculture. An increase of one ha of land size decreases the likelihood of youth choosing agriculture combined with non-farm wage by 0.8 %, when other things are kept constant. Land productivity has a negative and significant influence on the choice of agriculture plus non-farm wage plus self-employment over agriculture only ( $p < 0.05$ ). The results imply that the increase in land productivity makes rural youth attracted to agriculture, as they get higher return to land than undertaking multiple livelihood strategies. Keeping other things constant, an increase in one Rwandan francs per ha land

will reduce the likelihood of rural youth combining agriculture plus non-farm wage plus self-employment by 0.7 %.

Rural youth with access to information through mobile phones are more likely to choose other livelihood strategies outside agriculture. This is because information helps to exchange information regarding available livelihood strategy opportunities, which provide guidance in decision-making. In the view of previous studies such as Maniriho and Nilsson (2018), non-farm salary based livelihood strategies are limited in rural areas, forcing youths to engage in agriculture.

**Table 10: Determinants of choice of livelihood strategies for rural youth**

Variables	Non-farm wage		Self-employment		Agriculture+ non-farm wage		Agriculture + self-employment		Non-farm +self-employment		Agriculture+ non-farm wage +self-employment	
	dy/dx	Robust St. Err.	dy/dx	Robust St. Err.	dy/dx	Robust St. Err.	dy/dx	Robust St. Err.	dy/dx	Robust St. Err.	dy/dx	Robust St. Err.
Sex of youth	-0.094***	0.208	-0.05***	0.282	-0.16**	0.130	0.099	0.142	-0.07***	0.707	-0.025***	0.225
Age of youth	0.003**	0.028	0.000	0.051	0.001	0.020	0.001	0.021	-0.001	0.108	0.002*	0.032
Education of youth	0.001**	0.025	0.001	0.027	0.001	0.017	-0.01***	0.021	0.001	0.075	-0.000	0.025
Access to credit	0.008	0.378	0.004	0.600	-0.014	0.258	0.063**	0.254	-0.004	0.779	0.016	0.485
Livestock ownership (TLU)	0.018	0.227	0.005	0.345	-0.039	0.244	0.021	0.212	-0.012	1.444	0.016	0.311
Sex of head of household	0.006	0.236	0.004	0.370	0.019**	0.180	0.022*	0.198	0.006**	0.533	0.037***	0.295
Education of head of household	0.003***	0.022	0.000	0.041	0.004	0.020	0.003	0.022	-0.001	0.101	-0.003	0.036
Land size (ha)	0.001	0.031	0.001	0.023	-0.008**	0.025	0.002	0.016	-0.001	0.117	-0.001	0.033
Land productivity	0.176	0.058	0.034	0.043	0.019	0.094	0.054	0.045	0.105	0.196	-0.144	0.074**
Relation with head of household	0.060***	0.164	0.009	0.305	-0.029	0.126	-0.032*	0.126	-0.004	0.440	-0.011	0.182
Distance to the nearest center km	-0.005***	0.028	-0.000	0.024	0.001	0.012	0.001	0.013	0.000	0.031	-0.001	0.024
Household size	0.009***	0.046	0.002	0.087	-0.016**	0.038	-0.001	0.041	0.001	0.172	0.003	0.063
Access to info through mobile	0.020***	0.199	0.001***	0.306	0.045***	0.133	0.075***	0.146	0.014**	1.123	0.015***	0.242
Access to info through tv/radio	0.025**	0.182	-0.000	0.306	0.003	0.133	0.022*	0.142	-0.001	0.627	0.002**	0.226
Constant	-1.489	1.358	-3.045	2.481	2.709***	0.914	1.452	0.976	7.921*	4.241	0.271	1.541

Pseudo r-squared 0.09 Number of obs 2811

Chi-square 629.107 Prob &gt; chi2 0.000

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

#### 4.6 Choice of Livelihood Strategy Choices and Food Security

The association between youths' choice of livelihood strategy and household food security status observed at less than 1 % significant level is summarised in Table 11. About 52 percent of the youths in the sample belong to food insecure households. On one hand, about 57 % of youths engaged in agriculture come from food insecure households. This may be attributed to low production and its associated factors in the study area. It may also be explained by the fact that rural youth normally follow the footsteps of their parents, thus agriculture was transmitted to youth by parents because rural farmers constitute the majority of the poor who lack access to financial resources for buying nutritious food. On the other hand, majority of rural youth engaged in non-farm wage employment, self-employment and all sorts of combinations are from food secure households. Food secure households generally have better living as they can afford required food in terms of quality and quantity. Non-farm sector is one of food insecurity coping mechanism as it helps rural people to minimize risks and shocks, while smoothening income and consumption. That said, non-farm activities have higher level of per capita income as they ease liquidity constraints and consumption over time.

**Table 11: Youth choices of livelihood strategy and household food security**

Choices	Household Food security Status		Total
	Food insecure	Food secure	
Agriculture	57.44	42.56	100.00
Non-farm wage	40.51	59.49	100.00
Agriculture + non-farm wage	53.07	46.93	100.00
Self-employment	42.65	57.35	100.00
Agriculture + self-employment	43.33	56.67	100.00
Non-farm wage + self-employment	43.75	56.25	100.00
Agriculture + nonfarm wage + self-employment	40.00	60.00	100.00
<b>Total</b>	<b>51.73</b>	<b>48.27</b>	<b>100.00</b>

$\chi^2$  value :(51.5) \*\*\*

\*\*\*, statistically significant at 1 percent probability level

#### 4.7 Rural Youths' Choice of Livelihood strategies and Household Income Poverty

The results presented in Table 12 indicate the association between the choice of livelihood strategies for youths and household poverty status is significant at less than 1 % probability level. Apparently, 72 % of households to which rural youths in the sample belong are classified as non-poor. The results suggest that youths who rely on non-farm, and self-employment belong to households which are relatively better off than youth engaged in agriculture. Non-poor households have the ability to provide better education to their children, and individuals with higher education levels with attainment of secondary education and beyond have greater access to employment in non-farm sector. The youths from non-poor households can afford to bear the risks in self-employment, as they are likely to get capital from families. According to Dabalén *et al.* (2004) family background matters for individual members' choice of livelihood strategies. This means that the family may bring their relations and network to make descendants have easier access to non-farm wage employment or self-employment. Parents may transmit specific skills to their children. Based on findings of this study, this may also explain the reason why majority of rural youths from poor households are in agriculture. This may also reflect a low level of productivity in that sector.

**Table 12: Rural youth's choice of livelihood strategy and household poverty status**

Livelihood strategies	Poverty status		
	Non-poor	Poor	Total
Agriculture	68.74	31.26	100.00
Non-farm wage	82.70	17.30	100.00
Agriculture + nonfarm wage	70.98	29.02	100.00
Self-employment	80.88	19.12	100.00
Agriculture + self-employment	77.14	22.86	100.00
Non-farm wage + self-employment	81.25	18.75	100.00
Agriculture + non farm wage + self-employment	75.38	24.62	100.00
<b>Total</b>	<b>72</b>	<b>28</b>	<b>100</b>

$\chi^2$  value :(40.4) \*\*\*



\*\*\* statistically significant at 1percent probability level

#### **4.8 Effect of Rural Youths' Choice of Livelihood Strategies on Livelihood Outcomes**

The estimates of the effect of youths' choice of livelihood strategies on household poverty and food security status are presented in Table 13. The results show that rural youths pursuing non-farm wage employment, self-employment, agriculture plus self-employment, non-farm wage plus self-employment and agriculture plus non-farm wage plus self-employment have a positive and significant influence on household food security ( $p < 0.01$ ;  $p < 0.05$ ;  $p < 0.1$ ), as opposed to the choice of agriculture only. On the other hand, a negative and significant effect on household poverty is observed when rural youths choose non-farm wage, self-employment, agriculture plus self-employment, than when rural youth pursue agriculture only ( $p < 0.01$ ;  $p < 0.1$ ;  $p < 0.05$ ). Pursuing agriculture in a combination with non-farm wage does not improve food security or poverty status when compared to agriculture only strategy. The same is true for poverty in case of non-farm wage plus self-employment and agriculture plus non-farm wage plus self-employment.

These findings imply that given the shrinking land holding size and risks associated with agriculture such as low food production and low income. This situation makes rural youths more attracted to other livelihood strategies than agriculture to improve household wellbeing herein referred to as poverty and food security status. This is because non-farm activities have higher level of per capita income that enable greater investments, which in turn ease consumption constraints over time and offers a pathway out of poverty. The combination of more than one livelihood strategy contributes to poverty reduction as it removes agricultural investment constraints. These findings give conclusion similar to the findings by Dzanku (2020); Salam (2020) who reveal that combining agriculture with non-farm activities is a promising strategy, as it offers employment opportunities to rural poor with remuneration levels which are sufficiently high to lift them out of poverty.

Non-farm wage employment allows rural youth to increase income and savings and purchase food from the market while reducing the risks of intra-year fluctuation in food availability. The conclusion from previous studies such as Atuoye *et al.* (2019); Etea *et al.* (2019) are supported by the findings of this study. Creating lucrative non-farm activities is the way out of food insecurity in rural areas. Multiple sources of livelihoods can be guaranteed for becoming resilient against shocks in tradition agriculture and seasonal food shortages leading to food insecurity and poverty among rural people. Other studies such as those by Mango *et al.* (2018); Adjimoti and Kwadzo (2018) confirm a positive relationship between food security and engagement in multiple livelihood strategies. The studies conclude that undertaking more than one livelihood strategy is the best strategy for fighting against food insecurity. These findings are inconsistent with the findings by Ntwalle (2019); Atuoye *et al.* (2019) and Tarasuk (2017) who reported a negative relationship between food security and choice of multiple livelihood strategies, suggesting that combining livelihood strategies that are unreliable, unstable or unsustainable does not improve household food security status. Our findings however conclude that in rural areas of Rwanda, youths who pursue more than one livelihood strategy produce food for own consumption from crops and livestock production, earn enough income from non-farm employment and sale of agricultural products. This allows them to improve household food security.

The overall findings show that, even when controlling for observable and unobservable individual characteristics, rural youths engaged in non-farm wage employment, self-employment, agriculture plus self-employment and are likely to contribute to household food security improvement and poverty reduction. The choice of non-farm wage plus self-employment and agriculture plus non-farm wage plus self-employment

affect household food security but do not improve poverty status. The associated lambda has two implications. First, a positive selection bias is evident for non-farm wage, non-farm wage employment plus self-employment with poverty status. This suggests that unobservable characteristics associated with the choice of non-farm wage and a combination of non-farm wage plus self-employment is associated with high level of poverty than is the case with youths who make a random choice. Second, unobservable characteristics that increase the likelihood of rural youth choosing non-farm wage, agriculture plus non-farm wage, non-farm wage plus self-employment are associated with low level of food security and poverty, than any random choice.

The findings show further that other factors have statistically significant influence on household poverty and food security status. For example, education of both individual rural youth and head of household have a positive and significant effect on household food security and negative influence on poverty status. An increase of education level increases the chances of increasing income through acquisition of a better decision-making capacity and application of the acquired knowledge towards achieving food security. Education increases human capital levels of both youth and head of household and provides necessary skills facilitating entry into remunerative labour market. In other words, the higher the education level including apprenticeships, and informal trainings, the lower the likelihood of the household being the impoverished and the greater the chance of the household being food secure. Household size influences negatively the household food security and positively the household poverty level, suggesting that there are more people to feed in the family such that income per capita is reduced. As a result, the demand can surpass the quantity of food the household is able to purchase. This can also be attributed to the high dependency ratio in the family which leads to high level of poverty and food insecurity, as it is associated with with low productivity of labor force.

**Table 13: Estimates of the effect of youths' choice of livelihood strategies on household food security and income poverty**

Variables	Food security		Poverty	
	Coef.	Robust Std. Error	Coef.	Robust Std. Error
Non-farm wage	0.96***	0.26	-0.33***	0.03
Agriculture + non-farm wage	0.10	0.20	0.34	0.26
Self-employment	0.69**	0.30	-0.79*	0.45
Agriculture+ self-employment	0.66***	0.22	-0.62**	0.21
Non-farm wage + self-employment	0.97*	0.51	-0.14	0.07
Agriculture + non-farm wage + self-employment	0.72**	0.24	-0.31	0.32
Sex (dummy, 1 if male)	0.10	0.207	-0.47	0.32
Age (years)	0.04	0.036	-0.01	0.04
Youth's education (number of years of formal education)	0.03	0.033	-0.29**	0.12
Education of the head of household (number of years of formal education)	0.20***	0.092	-0.27**	0.10
Sex of the head of household	-0.30***	0.88	0.36	0.44
Land size (Ha)	0.04***	0.031	-0.50**	0.18
Livestock ownership (TLU)	0.34***	0.328	-1.79***	0.24
Distance to nearest center (km)	-0.01	0.020	-0.001	0.02
Household size	-0.58**	0.269	0.68**	0.27
Access to credit	0.03***	0.001	0.21	0.65
Location (provinces)				
Rural south	-0.03***	0.023	1.60*	0.84
Rural west	-0.80***	0.16	1.59*	0.64
Rural north	-0.74***	0.12	1.01*	0.44
Rural east	-0.31***	0.60	0.18	0.32
_cons	-0.439***	0.900	-4.32**	2.62
<b>Selection term (<math>\lambda</math>)</b>				
Lambda non-farm wage	-0.05*	0.21	0.38***	0.30
Lambda agriculture + non-farm wage	-0.03	0.26	-0.57**	0.27
Lambda self-employment	-0.02	0.17	0.22	0.30
Lambda agriculture + self-employment	-0.17	0.18	0.72	0.18
Lambda Nonfarm wage + self-employment	-0.23**	0.01	0.46**	0.20
Lambda agriculture + nonfarm wage + self-employment	-0.16	0.14	0.03	0.10

Nbr of obs: 2811; Wald Ch2 (47) =350.30;Prob>chi2: 000

Agriculture is the control group (base category)

200 Halton sequence-based quasi random draws per observation

Significance levels: \*: 10 %, \*\*: 5 % , \*\*\*: 1 %.



The findings also indicate that female headed households are more likely to be food insecure than male headed households. Additionally, the results show that livestock has a positive effect on food security and a negative influence on poverty, implying that rural households keeping livestock are more likely to improve household food security status and to get out of poverty by either consuming or selling livestock and/or livestock products such as milk, meat, manure and draff power.

Land size correlates positively with rural household food security and negatively with poverty status as expected. Land is vital resource and mainstay of rural people in Rwanda. It serves as a coping mechanism during serious food shortage and can be used as collateral for accessing credit. The increase in cultivated land leads to production of more food for consumption and sale and therefore more income than cultivating smaller land. Residential provinces have significant positive influence on poverty, and negative influence on food security. This implies that households residing in rural areas are more likely to be poor and food insecure than those residing in urban areas. These findings are similar to findings by Cho and Kim (2017) who found the positive relationship between residence areas and poverty in three ways. First rural people are likely to be poor because of high dependence on agricultural production which is characterized by low labour productivity and low income. Second there is biasness against rural areas by the policy makers which include pricing policy, education, housing and public services. Third, Cho and Kim (2017) argue that rural poverty may result from natural disasters such as drought and floods.

## CHAPTER FIVE

### 5.0 CONCLUSION AND RECOMMENDATIONS

#### 5.1 Conclusion

With its objective of assessing youth's choice of livelihood strategies and their effect on household food security and income poverty in Rwanda, this study has found that rural youth in Rwanda are mainly involved in seven livelihood strategies. These strategies are namely- agriculture, non-farm wage employment, self-employment, agriculture plus non-farm wage, agriculture plus self-employment, non-farm wage plus self-employment, and agriculture plus nonfarm wage plus self-employment. Agriculture accounts for the highest proportion (47 %), followed by the combination of agriculture plus non-farm wage employment. Moreover, non-farm wage plus self-employment, non-farm wage and self-employment are the first three choices with relatively higher return to labour, as they generate a median income of RWF 526, RWF 424, and RWF 357 per day, respectively. Agriculture, the most prominent strategy in the rural Rwanda, is less remunerative, with a median income of RWF 201 per day.

The results from the first stage of METE indicate that the choice of livelihood strategies is driven by several factors. For instance, sex of youth has a consistently negative influence on all choices relative to agriculture. In the same way, access to information on livelihood opportunities through mobile phone has a positive influence of the choice of livelihood strategies outside agriculture. When analysed independently, the choice on non-farm wage is positively and significantly influenced by age and education of both youth and head of household and household size, while negatively correlating with distance to the nearest urban centre. The choice of agriculture plus non-farm wage is

positively and significantly influenced by sex of the head of household and negatively influenced by land size and household size. Access to credit has a positive influence on the choice of agriculture plus self-employment, which is also affected negatively by education of youth. Lastly, the choice of both non-farm wage plus self-employment and agriculture plus non-farm wage plus self-employment has a positive relationship with sex of the head of household. Land productivity has a negative influence on the choice of agriculture plus non-farm wage plus self-employment. These findings suggest rejection of the null hypothesis that socio-economic and demographic, institutional, and community factors have no significant influence on the choice of livelihood strategies. The available data supported that alternative hypothesis that socio-economic, demographic, institutional and community level factors significantly influence the choice of livelihood strategies among rural youth in Rwanda.

The estimates from the second stage of multinomial endogenous treatment effect model suggest that rural youth involved in non-farm wage, self-employment, agriculture plus self-employment, non-farm wage plus self-employment, agriculture plus non-farm wage plus self-employment contribute substantially to household food security improvement and poverty reduction as opposed to agriculture only. Pursuing agriculture in a combination with non-farm wage does not improve food security or poverty status when compared to agriculture only strategy. The same is true for poverty in case of non-farm wage plus self-employment and agriculture plus non-farm wage plus self-employment. Other factors such as education of both youth and head of household and total cultivated land, livestock ownership have a positive effect on food security while, household size, residential provinces and sex of household head have a negative influence on household food security. Household poverty status is negatively affected by education, land size and positively influenced by livestock ownership and location factors. These findings suggest



rejection of the hypothesis that youths' choice of livelihood strategies has no significant effect on household poverty and food security status. Unless otherwise, the available data support the alternative hypothesis that youths' choice of livelihood strategies has significant effect on household poverty and food security status.

## **5.2 Recommendations**

Based on the major findings of this study, the following recommendations are found to be relevant to improve youths' participation in income generating activities and their contribution to food security and income poverty reduction among rural households in Rwanda.

- i. Since the findings of this study indicate that rural youth pursuing non-farm wage livelihood strategy are better-off in terms of return to labour than the rest of the strategies and that this strategy has a significant contribution to household food security and poverty reduction, it is imperative to consider creation and improvement of access to remunerative rural non-farm livelihood strategies. This will stabilize income and food supply and it can be done by facilitating proper institutional platform that help rural youth to contribute to food security and poverty alleviation.
- ii. The empirical results from this study have indicated that, although agriculture is the most practiced livelihood strategy, it is less rewarding. However, agriculture, which is currently employing majority of the youths in Rwanda cannot be ignored because of its importance in ensuring food self-sufficiency. The results of sensitivity analysis indicate substantial increase

from the return to labour in agriculture with increase in agricultural productivity. This calls for government in collaboration with agricultural development partners to support agricultural productivity enhancing interventions including use of technologies such as improved seeds, fertilizers and irrigation. Agricultural productivity enhancement would not only lead to poverty reduction but would also ensure food self-sufficiency. Additionally, the improvement of agricultural productivity would absorb the ever-growing rural youth, who cannot be employed in non-farm activities because this sector grows at slow pace.

- iii. The findings that education level has a greater impact on the choice of non-farm wage livelihood strategy calls for special attention from the Ministry of Youth, in collaboration with the Ministry of Education to work on improvement of youth's knowledge in various dimensions using both informal and formal education in rural areas. Specifically, this can be achieved by enhancing trainings opportunities, capacity building and skills in different aspects, increasing knowledge and technology-intensive programs that accelerate economic transformation and rural job creation.
- iv. There is need for targeting in policy interventions to ensure youths' access to productive resources such as land.
- v. The government should upgrade infrastructure especially roads and other telecommunication services which will help rural youth to connect easily to urban employment opportunities and markets.

- vi. The government and concerned bodies should enhance programs aiming at food security improvement and poverty reduction in rural areas.

### **5.3 Suggestion for Improvement of the Integrated Household Living Conditions**

#### **Survey Dataset**

The body of literature has identified migration as one of livelihood strategies that is significantly affecting livelihood outcomes. However, as indicated in section 1.5, this study did not take into account migration as one of key livelihood strategies, because of paucity of certain information in the Fifth Integrated Household Living Conditions Survey (EICV) dataset. In that regard, the study recommends the National Institute of Statistics of Rwanda to improve the dataset by providing detailed information such as income and other related benefits attributed to youth migration. This will allow for the comparison between migration and other livelihood strategies in terms their impact on livelihood outcomes.

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## APPENDICES

### Appendix 1: Marginal effects of Agriculture

	<b>dy/dx</b>	<b>Std. Err.</b>	<b>z</b>	<b>P&gt;z</b>
Sex of youth	0.174	0.019	8.960	0.000
Age of youth	-0.009	0.003	-3.010	0.003
Relation with the hh	-0.009	0.006	-1.660	0.096
Education of youth	0.006	0.003	1.910	0.056
Land size	0.000	0.000	2.060	0.039
Livestock ownership (TLU)	-0.031	0.035	-0.870	0.383
Household size	0.001	0.006	0.160	0.876
Sex of the head of household	-0.073	0.030	-2.470	0.013
Age of the head of household	0.003	0.001	2.920	0.004
Education of te head of househol	-0.005	0.003	-1.590	0.111
Land productivity	0.000	0.000	2.040	0.042
Distance to the nearest urban center	0.002	0.002	1.150	0.252
Access to info through tv_radio	-0.051	0.022	-2.270	0.023
Access to information through mobile	-0.161	0.021	7.530	0.000

### Appendix 2: Test for IIA assumptions: Suest-based Hausman test

Suest-based Hausman tests of IIA assumption (N=2811)

Ho: Odds (Outcome-J vs Outcome-K) are independent of other alternatives.

<b>Omitted</b>	<b>chi2</b>	<b>df</b>	<b>P&gt;chi2</b>	<b>Evidence</b>
Non-farm wage	43.080	75	0.999	For Ho
Self-employment	56.456	75	0.946	For Ho
Agriculture plus nonfarm wage	35.267	75	1.000	For Ho
Agriculture plus self-employment	59.870	75	0.899	For Ho
Non-farm plus self-employment	14.405	75	1.000	For Ho
Agriculture plus non farm plus self-employment	52.859	75	0.975	For Ho

### Appendix 3: Hausman tests of IIA assumption

Ho: Odds (Outcome-J vs Outcome-K) are independent of other alternatives.

Omitted	chi2	df	P>chi2	Evidence
Non-farm wage	2.240	70	1.000	For Ho
Self-employment	-31.846	70	...	...
Agriculture plus nonfarm wage	-1.504	71	...	...
Agriculture plus self-employment	-3.828	71	...	...
Non-farm plus self-employment	-0.057	71	...	...
Agriculture plus non farm plus self-employment	-5.293	71	...	...

(Note: If  $\text{chi}2 < 0$ , the estimated model does not meet asymptotic assumptions of the test.)

### Appendix 4: Conversion factors of tropical livestock unit (TLU)

Livestock Category	TLU
Cows	1.000
Oxen	1.000
Heifers	0.750
Calves	0.200
Goats	0.060
Sheep	0.060
Donkey (adult)	0.700
Donkey (young)	0.350
Mature chicken	0.013
Horses or mules	1.100
Camels	1.250

Source: Storck *et al.* (1991)

### Appendix 5: Conversion factors for Adult –Equivalents

Age group (years)	Male	Female
<10	0.6	0.6
10-13	0.9	0.8
14-16	1.00	0.75
17-50	1.00	0.75
>50	1.00	0.75

Source: Storck *et al.* (1991)

### Appendix 6: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.522
Bartlett's Test of	Approx. Chi-Square	287.667
	df	45
Sphericity	Sig.	.000

**Appendix 7: Percentage of variance**

Component	Initial Eigenvalues		Cumulative percent
	Total	percent of Variance	
1	1.581	15.811	15.811
2	1.371	13.714	29.525
3	1.131	11.313	40.838
4	1.070	10.698	51.536
5	.984	9.842	61.378
6	.971	9.706	71.084
7	.882	8.817	79.901
8	.825	8.252	88.153
9	.661	6.606	94.758
10	.524	5.242	100.000

**Appendix 8: Multicollinearity test: factors influencing the choice of livelihood**

Variable	VIF	1/VIF	
Age of youth	1.22	0.8213	
Sex of youth	1.95	0.5116	
Education of youth	1.20	0.8303	
Relation to head of household	2.52	0.3973	
Land productivity	1.14	0.4212	
Education of the head of household	1.20	0.8320	
Sex of the head of household	1.14	0.8751	
Age of the head of household	1.83	0.5461	
Household size	1.53	0.6522	
Livestock ownership	1.20	0.8305	
Land size	1.13	0.8844	
Distance to the nearest urban center	1.01	0.9900	
Access to info	Tv / Radio	1.04	0.9580
	Mobile phones	1.08	0.9247
Access to credits		1.02	0.9850
Mean VIF		1.26	

**Appendix 9: Results of Sensitivity Analysis**

			Returns (rwf)	
Yield (kg /ha)	60			<b>14800</b>
Price (rwf)	300	Yield	40	8800
Cost of input (rwf)	3200	(kg/ha)	50	11800
<b>Predictions:</b>				

		60	14800
Revenue (rwf)	18000	70	17800
	3200	80	20800
	<b>14800</b>	90	23800
		100	26800

Key prediction: **14800** to which the outcome will be compared.

### Appendix 10: Falsification test for food security

Food security	Coef.	St. Err.
Sex f youth	0.108	0.094
Age of youth	0.005	0.014
Education of youth	0.008	0.014
Access to credit	-0.008	0.194
Livestock ownership (TLU)	0.011**	0.153
Household size	-0.234***	0.028
Sex of the head of household	0.073**	0.130
Age of the head of household	-0.016***	0.004
Education of the head of household	0.078***	0.016
Land size	0.001***	0.014
Distance to the nearest center	-0.012	0.009
<b>Access to info through mobile phones</b>	<b>0.130</b>	<b>0.152</b>
Constant	2.973***	0.697

Pseudo r-squared: 0.101 Number of observations: 2811

Chi-square 303.388 Prob > chi2 0.000

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

### Appendix 11: Falsification test for poverty

Poverty status	Coef.	St.Err.
Sex f youth	-0.019	0.111
Age of youth	-0.007	0.016
Education of youth	-0.062***	0.019

Access to credit		0.092	0.222
Livestock ownership		-0.566**	0.224
Household size		0.260***	0.032
Sex of the head of household		0.078	0.155
Age of the head of household		0.006	0.005
Education of head of household		-0.093***	0.022
Land size		-0.264***	0.045
Distance to the nearest urban centre		0.009	0.010
<b>Access to info through mobile phones</b>		<b>-0.210</b>	<b>0.168</b>
Constant		-3.749***	0.835
<hr/>			
Pseudo r-squared	0.153	Number of observations	2811
Chi-square	372.612	Prob > chi2	0.000
*** $p < 0.01$ , ** $p < 0.05$ , * $p < 0.1$			