



## **Determinants of Competitiveness of Tree Tomato Value Chain in Rwanda**

By

Gasengayire Solange

Reg N<sup>o</sup>: 219015151

Cell phone: +250788682971

E-mail: [gasengsolange2020@gmail.com](mailto:gasengsolange2020@gmail.com)

Supervised By:

Prof. RAMA B. RAO

Emeritus Professor of Management

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**DECLARATION**

I, the undersigned, hereby declare that this research entitled “Determinants of Competitiveness of Tree Tomato Value Chain in Rwanda” is my own original work and that it has not been submitted to any other University, research institution or any other organization for any purpose.

Sign.....

Date.....

Author: GASENGAYIRE Solange

Student No: 219015151

## CERTIFICATE

I hereby confirm that the work presented in this thesis was carried out by our MBA student Mrs. Solange Gasengayire under my guidance as University supervisor.



Sig:

Date: 6<sup>th</sup> April 2021

Prof. RAMA B. RAO

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**May all might God bless you all**

## **DEDICATION**

This thesis is dedicated to:

My husband, my children and my brother Dr Alphonse Karagirwa,  
My sisters and brothers who are Resting in Peace with almighty God  
who encouraged me to go on every adventure,  
especially this one.

## **LIST OF ABBREVIATIONS**

AIHR	Academy to Innovate Human Resources
CTA	Technical Centre for Agricultural
EFA	Economic and Financial Analyses
ESSEC	École Supérieure des Sciences Économiques et Commerciales
FRW	Rwandan Francs
Ha	Hectares
Kg	Kilogram
MBA	Master of Business Administration
MINAGRI	Ministry of Agriculture and Animal Resources
NAEB	National Agriculture Export Board
NCCR	Confederation of Coops of Rwanda
NIRDA	National Industrial Research and Development Agency
NSTC	National Science and Technology Council
PSF	Private Sector Federation
RCA	Rwanda Cooperative Agency
RDB	Rwanda Development Board (RDB)NAEB
RPSF	Rwanda Private Sector Federation
RSB	Rwanda Standards Board
SCP	Single Cell Protein
SMART	Specific, Measurable, Achievable, Realistic, and Timely
SMEs	Small and Medium Enterprises
SPSS	Statistical Package for the Social Sciences
SqM	Square Meters
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
US	United States

## LIST OF TABLES

<b>Table No</b>	<b>Title of the table</b>	<b>Page No</b>
Table 3.1:	Objective-wise data required for the study, their sources and collection tools/methods .....	23
Table 3.2:	District-wise details of study population of Tree Tomato growing farmers .....	25
Table 3.3:	District-wise details of study population of Tree Tomato growing farmers .....	26
Table 4.1:	Area under cultivation of fruits by district/province in Rwanda in 2018 .....	30
Table 4.2:	Trend of tree tomatoes production in tonnes during 2016 and 2020 .....	31
Table 4.3:	Actors involved in production, processing, and storage of fruits in Rwanda .....	33
Table 4.4:	Income generated from fruits (Horticatures) in “1000 Rwfs” by province .....	36
Table 4.5 :	Irrigation practices by provinces in cultivating tree tomato.....	37
Table 4.6 :	Distribution of respondents by provinces in Rwanda .....	40
Table 4.7:	Distribution of respondents by gender .....	41
Table 4.8 :	Distribution of respondents by highest level of education attained .....	41
Table 4. 9 :	Respondents by age groups .....	42
Table 4.10:	Tree tomatoes by preferred color on the market from the perspective of respondents.....	43
Table 4.11:	Respondents by tree tomatoes market destinations.....	48
Table 4.12:	Availability of types of Information by sources for tree tomatoes cultivation and management .....	51
Table 4.13 :	Respondents by sales volume collected from tree tomatoes in 2020.....	52
Table 4.14:	Respondents’ opinions about factors that determine the competitiveness of tree tomatoes ..	53
Table 4.15 :	Challenges vis a vis accessing pesticides in future by tree tomatoes farmers .....	56
Table 4.16 :	Model Summary output.....	58

## LIST OF FIGURES

<b>Figure No</b>	<b>Title of the figure</b>	<b>Page No</b>
Figure 2.1:	Conceptual framework.....	20
Figure 4.1:	Trend of tree tomatoes production in tonnes during 2016 and 2020.....	32
Figure 4.2:	Actors involved in production, processing, and storage of all fruits in Rwanda.....	33
Figure 4.3:	Quantity (in tons) of fruits production by their types .....	34
Figure 4.4:	Fruit processing capacity (In tones – Vertical line) across provinces in Rwanda .....	35
Figure 4.5:	Availability of greenhouse facility and other buildings across provinces in Rwanda.....	38
Figure 4.6:	Land ownership description by tree tomatoes farmers .....	42
Figure 4.7:	Support received by the respondents as requested.....	44
Figure 4.8 :	Respondents by the category of funding Partners .....	45
Figure 4.9:	Respondents by the use of fertilizers in tree tomatoes production .....	46
Figure 4.10 :	Respondents by the usage of kinds of tree tomatoes seeds.....	47
Figure 4.11 :	Ability to use pesticide / fungicide .....	47
Figure 4.12 :	Respondents by the class of buyers of tree tomatoes.....	49
Figure 4.13:	Respondents’ perception of buyers’ preferences, for tree tomatoes standards.....	49
Figure 4.14:	Source of information for tree tomatoes stakeholders .....	51
Figure 4.15:	Constraints to access inputs and other services .....	55

## TABLE OF CONTENT

<b>ACKNOWLEDGEMENTS</b> .....	<b>iii</b>
<b>DEDICATION</b> .....	<b>iv</b>
<b>LIST OF ABBREVIATIONS</b> .....	<b>v</b>
<b>LIST OF TABLES</b> .....	<b>vi</b>
<b>LIST OF FIGURES</b> .....	<b>vii</b>
<b>ABSTRACT</b> .....	<b>x</b>
<b>CHAPTER ONE: INTRODUCTION</b> .....	<b>1</b>
1.1 Background .....	1
1.2 Statement of Problem .....	3
1.3 Research objectives .....	4
1.3.1 General objective.....	4
1.3.2 Specific objectives.....	4
1.5. Importance and Justification of the study.....	5
1.7 Scope of the study .....	5
1.8 Brief description of thesis structure.....	6
<b>CHAPTER TWO: REVIEW OF LITERATURE</b> .....	<b>7</b>
2.2 Conceptual review .....	10
2.3 Empirical review .....	15
2.4 Research Gaps .....	19
2.5 Conceptual framework .....	20
2.4.1. Introduction .....	20
<b>CHAPTER THREE: RESEARCH METHODOLOGY</b> .....	<b>22</b>
3.2 Source of data.....	23
3.2.1 Primary data sources .....	24
3.2.2 Secondary data sources .....	24
3.3 Population of the study.....	25
3.3 Sample size.....	26
3.4 Research instruments.....	27
3.4.1 Questionnaire.....	27
3.4.2 Documentation .....	27

3.5 Data analysis.....	28
3.6 Ethical consideration .....	28
3.7 Validity and reliability.....	28
<b>CHAPTER 4: DATA ANALYSIS AND INERPRETATION .....</b>	<b>30</b>
<b>CHAPTER 5. SUMMARY, CONCLUSION AND RECOMMENDATIONS .....</b>	<b>61</b>
5.0. Introduction .....	61
5.1. FINDINGS .....	61
5.2 Discussions.....	63
5.2.1 The determinants of tree tomatoes value chain competitiveness .....	63
5.2.2 Trends in the value chain competitiveness of tree tomatoes in Rwanda.....	63
5.2.3 The challenges facing by actors in tree tomatoes value chains in Rwanda.....	64
5.3.1 The determinants of tree tomatoes value chain competitiveness .....	65
5.3.2 Trends in the value chain competitiveness of tree tomatoes in Rwanda.....	65
5.3.3 The challenges facing by actors in tree tomatoes value chains in Rwanda.....	65
<b>5.4 Recommendations .....</b>	<b>66</b>
5.4.1 Recommendation for improvement.....	66
5.4.2 Recommendation for further studies .....	67
<b>References .....</b>	<b>69</b>

## **ABSTRACT**

This research was conducted to establish the determinants of tree tomatoes value chain competitiveness, to analyze the trends in the value chain competitiveness of tree tomatoes in Rwanda and to find out the challenges facing by actors in tree tomatoes value chains in Rwanda. The study adopted a mix of both qualitative and quantitative approaches to the population of 56 firms and outsourced a questionnaire to 56 firms that produce, process and engage in fruits value addition. The study adopted a mix of both qualitative and quantitative approaches and outsourced a questionnaire to all 56 firms that produce, process and engage in fruits value addition, reports and publication about tree tomatoes were collected to increase the understanding under study. NAEB has provided the secondary data while primary data were collected by sending a questionnaire to the selected tree tomato actors. The study is the relevancy of Porter's Value chain, Diamonds, structural and French theories.

The research found five determinants including use of best quality of inputs (seeds & fertilizers), pesticides/fungicides, processed tree tomatoes (kgs), employment over time and having access to tree tomatoes financing. There is a gradual decrease in production of tree tomatoes. The regression analysis found a variation in the dependent variable due to change in independent variables, the Adjusted R Square is 0.94. ANOVA test shows a p-value of 0.000 less than alpha (5%) significance level. The regression equation,  $Y = 22.75 + 1.75X_1 + 0.006X_2 + 0.049 X_3 + 0.046X_4 + 0.0014X_5$  under which  $X_1$  stands for inputs (seeds & fertilizers),  $X_2$  for pesticides/fungicides,  $X_3$  for processed tree tomatoes (kgs),  $X_4$  employment over time and  $X_5$  for Finance in (100,000 RWF).

The study recommends NAEB and RAB to make policies that facilitate the effective production, processing, marketing, to adopt technology in tree tomatoes growing, to provide trainings and facilitate communication / information sharing. The government has to build proper infrastructures for effective transport of tree tomatoes from harvesting sites to the market.

**Key Words: Competitiveness, Value Chains, Tree Tomato, Agriculture**

## **CHAPTER ONE: INTRODUCTION**

### **1.1 Background**

Tree tomato is relatively a new fruit on the international market. The fruit has high demand in countries of the United Kingdom, Germany, Netherlands, and Spain, especially for the organic tree tomato fruits. Upon reaching these countries, the fruit is processed to make juice, sweets, jams, gelatins among others. The demand for such products increases the demand for tree tomato, (NEAB 2018). Those countries have built their Inbound logistics, Operations, Outbound logistics, services, and Marketing and Sales, Whereas Secondary Value Chain activities are; Procurement, Infrastructure, Human Resources, and Technological development for not tree tomatoes agriculture but also for different economic sectors (TARVER 2019).

E-Hinga (2015) in his research pointed out that, Tree tomato farmers in most of African countries access their planting material in form of seedlings which is normally bought in the local market. Some proportion of farmers opt to get their planting material from other farmers especially those that have healthy fruits in form of seeds. The planting materials can also be accessed from government organizations. The families in EAC countries engaged in tree tomatoes agribusiness, and horticulture by use of their factors, analysis, and criticisms of their significance to the industry in linking supply chain for enhancement of the industry which is specific to the tree tomato business. Tree tomatoes famers in EAC have a variety of reasons for growing the tree tomatoes. Though the tree tomatoes are mainly grown for home consumption, other family growers cultivate the tree tomatoes to generate income for their households.

In Rwanda, agriculture comes at the largest to employ many people and contribute a lot to export earnings in African countries (Adekunle et al 2013). The NISR (2018) report shows that Rwanda 's economy employs 85% of its population in agricultural sector, this increased 8% to the production and contributed 2.4% to the GDP growth rate. The cause of this increase is that Rwanda had planned to do agriculture which is oriented to the market and to have food security as well as land degradation as a consequence of high population pressures (Adekunle et al 2013).

All those initiatives have not yet applied all crops grown in the country. Rwanda continues to export mainly coffee and tea, which affects the overall agricultural supply chain since different crops may increase the rate of exports (Ndiaye & Sofranko 2014). Apart from coffee and tea, Rwanda practices horticultural under which citizen cultivate tree tomatoes.

Tree tomatoes available in Rwanda are an egg-shaped edible fruit which are also called Tamarillo locally known as “Ibinyomoro”. These fruits are rich in minerals and vitamins. They contain vitamins like A, B, C, E and K as well as minerals such as potassium, phosphorous, calcium and magnesium which are needed in the human body and they provide protein (Ndereyimana & Busobozi 2016).

Tree tomatoes are not particular to Rwanda, according to Dinhm (2013). Tree tomatoes were found early in East Africa (where Rwanda is located), Asia and the East Indies before 1903 and introduced in New Zealand in the year 1891 while reached the United States Department of Agriculture in 1913. Kester & Grasselly (2011) pointed out that there is a strong demand for fruits but suffers from and lack of proper value chain deliver the fruits to consumers in fresh form particularly in the UK, Germany, the Netherlands and Spain. The ones with high demand are tree tomatoes in yellow, orange, red and purple colors. The yellow and orange tree tomato fruits which are available in Rwanda are sweet and can be exported (Ndereyimana & Busobozi 2016).

According to Kester & Grasselly (2011) those stakeholders include: input suppliers, producers, middlemen, consumers and the government. Rwanda face challenges such as new market requirements (quantity demands with reliable consistency, food safety, and compliance to Global GAP certification) and value chain related issues (Kester Gradziel & Grasselly 2011).

To build the value chain in agricultural sector requires different components (H Jacques 2011) , first there must be a removal of; the main constraints which impact the effective market access, inadequate infrastructure, lack of capital and consider the upgrading options that are described in the area of value addition as the quest for markets. The structure of the value chain network and the governance form of the chain can also be considered to construct the value chain. (H Jacques 2011).

According to (Dininni & Jeanne 2020) , “Human resources, financial resources, physical infrastructures, administrative infrastructures, information infrastructures, scientific and technical infrastructures and natural resources infrastructures are the specialized inputs available to enterprises”. On the other hand, the classical theory emphasized the technological aspects of the organization and how individuals can have made an organization more effective and emphasized the structural aspects of an organization so that individuals can have made the competitive value chain more effective collectively. This research therefore will refer to the above theories and assess the determinants of competitiveness of the tree tomato value chain in Rwanda. The reason why the study choose tree tomatoes is describe problems of statement of this study.

## **1.2 Statement of Problem**

Rwanda, a developing as an emerging country has a high demand for the tree tomato. The demand for tree tomato in Rwanda is traced to mainly urban markets especially in hotels, supermarkets, local retail outlets and export to international markets. To respond to this demand, Cooperatives and producer groups can opt for growing them as business oriented because it has been revealed that they can produce the fruit with an average yield of 15-20 kg per tree annually or 15-17 tons per hectare. NAEB (2018) has reported that tree tomatoes actors continue to lack low-cost advantages.

It would be better to have research evidence that link theories (value chain theories: theories Michael Porter Theory, Classical theory and Von Thunen’s Theory talked about how to build value chain competitiveness of Rwandan agricultural sector especially tree tomatoes. Referring to those theories, the stakeholders acting in the tree tomato business would provide collective production to increase and sustain the target market, they would be a crucial mechanism for understanding how tree tomatoes inputs and services of tree tomatoes can be integrated and then used to grow, transform, or manufacture a product out of it; how the product then physically travels from the supplier to the customer; and how value increases along the way.

A known perspective that provides an essential means of understanding how business-to-business relationships between tree tomatoes link the chain, efficiency enhancement mechanisms, and to enable tree tomatoes businesses to increase productivity. In addition to these issues, there are number of challenges that have stopped farmers from time to time and hampering tree tomatoes production (The New Times 2017). These include long dry periods. To encounter this, farmers have been keen to harvest rainwater though majority lack the necessary tools and capacity. Another challenge is post-harvest losses which according to the country's data, on average, farmers lose 21 percent of their crop during the harvest. A further 15 per cent of tree tomatoes are lost at the collection point. At the wholesale stage, 10 percent of tree tomatoes are culled out. Another loss is that 13.6 per cent of the fruit is discarded at the retail level (Oxfarm 2017). So, from the given information it is clear and visible that there is a need to build an efficient and competitive value chain for tree tomatoes in Rwanda based on research evidence.

### **1.3 Research objectives**

This research has general and specific objectives

#### **1.3.1 General objective**

The research generally focusses on identifying the determinants of competitiveness of the tree tomato value chain in Rwanda.

#### **1.3.2 Specific objectives**

This research specifically aimed to realize the following objectives:

1. To establish the determinants of tree tomatoes value chain competitiveness
2. To analyze the trends in the value chain competitiveness of tree tomatoes in Rwanda
3. To find out the challenges facing by actors in tree tomatoes value chains in Rwanda

#### **1.4. Research questions**

In the pursuit of the above stated research objectives, the following research questions are identified to answer with the results of the study;

1. What are the determinants of tree tomatoes value chain competitiveness?
2. How is the trend of value chain competitiveness of tree tomatoes in Rwanda?
3. What are the challenges facing by the actors of tree tomatoes in Rwanda?

#### **1.5. Importance and Justification of the study**

A cluster of beneficiaries, including the researchers, the NAEB, the University of Rwanda, the Rwandan society and other researchers, will benefit greatly from this study. The study will enable the researcher to equip her with the knowledge of the value chain of tree tomatoes and to contribute to the new literature in this field.

The research project will assist NAEB in making successful planning and the production (thesis) will be submitted to the library of the educated school where academics and other researchers will find it to enrich their literature once they are interested in the conduct of research in the field of tree tomatoes. This research will help to define and provide the way to resolve the explicit issues facing the tree tomato value chain. In particular, the research will raise awareness among the people of Rwanda about the picture of tree tomatoes value chain, the way producers can produce tree tomatoes and how the challenges under productions stage can be addressed. the research will inform what determine the competitiveness of tree tomatoes.

#### **1.7 Scope of the study**

This research had a geographical scope, contents scope, and time scope. Geographically, the research used the information from people working, owns and stakeholders of enterprise and firm that produces, process and practices tree tomatoes businesses across the 30 districts of the country, those are. This is because of the compatibility of our research objective, the companies that engage in production, processing and value addition of fruits operate under those listed districts (NIRDA 2019) have enough information that helped to reach the research objectives. The contents scope was to identify the determinants of competitiveness of the tree tomato value chain in Rwanda. The time scope was 10 months to carry out the research which will cover data of 15 agricultural season that will be 2014 A to 2018 C.

## **1.8 Brief description of thesis structure**

General introduction talks about the Context and significance of the analysis, problem statement, research goals used to guide the research course, research questions, Rationale of the analysis, limitations and delimitations of the research and brief description of thesis structure.

Literature Review which attempts to assess the determinants of the competitiveness of tree tomato value chain in Rwanda. The chapter gives a brief description theoretical review, conceptual review, empirical review and conceptual framework vis some vis the tree tomato value chain.

Research methods explains the methodology used to compile this report. It talks about research design, study population, sampling procedure, data collection, operational definition of variables, methods of data Analysis and ethical considerations.

Data analysis and presentation of research findings is the research part that present the findings on the determinants of competitiveness of the tree tomato value chain in Rwanda. These findings were secondary data and primary data.

The review, conclusion and recommendations include and present a summary of the study's key results, general conclusion and study recommendations on the determinants of competitiveness of the tree tomato value chain in Rwanda.

## **CHAPTER TWO: REVIEW OF LITERATURE**

Chapter two is devoted to explore existing theories and concepts related to the topic under the study, reviews the research already done to identify the gaps so as to configure a conceptual framework to guide the study. Theories are discussed respective to the proposed objectives in order to answer the set research questions. It highlights the concepts behind the main theme of the research and methods for evaluating the case study. The literature review focuses on the theory and the application of the methods used by different researchers to tackle problems similar to the ones dealt with in this research. This chapter is presented in three sections. Section 2.1 deals with theoretical review and section 2.2 is concerned with conceptual review while section 2.3 is devoted for empirical review. The chapter ends with the conceptual framework of the study.

### **2.1. Theoretical review**

This section “theoretical review and section” presents a group of related ideas that provide guidance to this research. It discusses the French systematic method, the structure-conduct-performance paradigm, the strategic approach, development cycle and Von Thunen’s theory.

#### **The French Systematic Method**

As described by (Kaplinsky & Morris 2000), French scholars built their model (ESSEC 2013) based on the value-added process of the US Agricultural Research and adapted it to the vertical integration of the French agriculture. This approach emphasizes the inputs and outputs between firms. It also favors the interaction of dependence and dominance along a value chain (ESSEC 2013). Thus, this approach was used to describe the flow of materials and different services needed for manufacturing a final product. On the negative side, this approach does not take into consideration of the dynamic characteristics of growth and shrinking of the products, of knowledge and number of actors.

This method is too descriptive, neglecting the strategic approach to value chain analysis, However, this method is advantageous though it is descriptive because of its usefulness for chain mapping as a first step of value chain analysis to obtain an overview of the chain, the product flows, the chain actors and type of interaction between the actors (ESSEC 2013).

## **The Structure - Conduct-Performance Paradigm**

The Structure-Conduct-Performance paradigm (SCP model) is an approach based on industrial economics in the field of industrial organization. According to (Scherer & Ross 2010), industrial organization is concerned with “how productive activities are brought into harmony with the demand for goods and services through some organizing mechanism such as free market, and how variations and imperfections in the organizing mechanism affect the success achieved in satisfying an economy’s wants.” (ESSEC 2013).

Practically, the basic structure of the SCP-model provides a good framework for describing the chain structure. Its structural approach has been used to establish a kind of checklist for chain mapping from which the researcher can select the factors according to the focus of the analysis. On the other side conceptually, this model provides a notion of potential factors impacting the performance of the chain (ESSEC 2013).

The focus of the approach is on the fundamental principle that good performance is what society wants from producers of goods and services. In line with the Structure-Conduct-Performance Paradigm, the authors state that it is difficult to measure the degree to which the goals have been reached. They recommend analysis of relevant indicators like price-cost margins, rates on change in output per hour of work, price levels, the difference between actual and lowest possible unit costs and the variability of employment over time.

The basic concept for this model was first established by Edward S. Mason of Harvard in the 1930s and further developed by many scholars. So, based on this model, the performance of industries depends on the conduct of buyers and sellers. This means that despite the government intervention, there performance of a market can be determined by forces of demand and supply. This approach calls upon government intervention for regulatory purposes (Harvard School, opposes the one from the Chicago School), and latter encourages the laissez-faire (ESSEC 2013).

## **The Strategic Approach**

Porter (1980) supports the Strategic Approach with the model “The Driving Industry Competition” which describes five forces commanding competition: Rivalry between existing companies, the bargaining power of suppliers, the bargaining power of purchasers, the threat of new entrants, and the threat of substitute goods or services (Porter 2011). Also based on the context in which a value chain is embedded, the regulation role of public authorities could be a sixth force (ESSEC 2013).

In the scope of study of the supply chain, there exists significant relationship between buyers and sellers. Rivalry might be an obstacle in this scope; however, potential new entrants in an existing chain are not considered as a threat. Moreover, substitute are the products that can serve the same role. So, when the customer is not satisfied with the products in one chain, they can shift to another. In this case the customers need satisfaction in terms of quality, quantity and price (ESSEC 2013). This method contributes essentially to the guidelines.

Porter ‘s (1985) competitive strategy focuses on interactions between players and strategic positioning, but the competitive advantage deals with the organization context of the firm. A firm’s value chain analysis is the key tool for its underlying concepts of activity and competence. The strategy itself add the way strategy is put at work are important. Based on Porter’s seminal work (Porter, 1985), scholars have come up with conceptual and practical refinements. These concepts are useful at different levels: a firm, chain, and nations. The method also contributes to guidelines. Practically on possible critical issues for firm or chain development, and the conceptually that focuses on the firm rather than development (ESSEC 2013).

## **Von Thunen’s Theory**

The theory emphasized that the distance from farm to market was highlighted, as well as transport costs, yield, market prices and production costs as determinants of rent. (Chand & Smriti 2020) . It implies that if the environmental variables are held constant, then all other products in the competition for location will be overridden by the farm product that achieves the highest profit. Commenting to this theory, it is visible that the market processes could determine how land in different locations would be used. Refereeing to this theory, it can be stated how plan can revolve around farming practices by focusing on a plan which would make farming most profitable (Chand & Smriti 2020).

### **Summary of understanding of the theories analyzed above how these theories are used in determining the competitiveness of tree tomatoes.**

In summary, the Structure-Conduct-Performance Paradigm was a base for the researcher to know how productive activities are brought into harmony with the demand for goods and services through some organizing mechanism such as free market, and how variations and imperfections in the organizing mechanism affect the success achieved in satisfying an economy's wants, more clearly in line with this Structure-Conduct-Performance Paradigm, the research analyzed the primary data from to show the horticulture production status . The researcher reflected to the Strategic Approach to analyses who each selected variable (Sub – independent and dependent variable) determine the competitiveness of tree tomatoes as an individual strategy that can be sustained or improved. Based Von Thunen's Theory the research assessed the situation of distance from farm to market as well as transport costs, yield, market prices, and production costs as rent determinants and presented them under this research.

### **2.2 Conceptual review**

The conceptual review is devoted to define the operational definition such as Value Chain (Agriculture Value Chain) and the process that it takes, Agricultural Value Chains analysis. Agricultural Value Chains analysis is considered since one of the research objectives is about to analyze the tree tomatoes value chain. This part of the thesis also defines the Competitiveness and talks about how to build Competitiveness of Value Chains as well as Competitiveness of agricultural value chains in general. the part also describes how to analyze the determinants of competitiveness of the Tree Tomato Value Chain And shows the Challenges facing by actors in general.

#### **Value Chain**

The value chain is the system or operation by which a business adds value to an item, including the selling of production and the provision of after-sales services. According to (Bopinc 2020) , in each activity they are also different sub-activities that take place. Aligning to this concept, the below activities are needed to build value chains in the production of tree tomatoes (Jargons 2015).

### Activity 1: Diagnose

In relation to logistics, information processes and in relation to the supply chain, this operation describes the current state of the value chain and supply chain, including presence, storage, lead time, loading factor, current post-harvest, role of out growers. Another one is in relation to economic value chain features, including: the division of margins between actors, market segments and the difference in prices between characteristics (Wamucii & Selina 2020). The last is in relation to stakeholders that include identification of the key stakeholder and role of the stakeholders.

### Activity 2: Mission and workshop

Interviewing key stakeholders to gather data on the dynamics, bottlenecks and possibilities of the tree tomato value chain is an important part of the mission and workshop. (Consulting Promar March, 2012).

### Activity 3: Design and final reporting

This operation is connected to the final design of future interventions which will lead to an improved tomato value chain. The design addresses the key bottleneck recommendations in order to minimize post-harvest losses (Tarver & Evan 2019).

### Activity 4: Support and implementation

During the project, key stakeholders will enforce some of the recommendations. RBC assists tree tomato actors and other key stakeholders in the tomato value chain in Rwanda in implementing the recommendations and enhancing the efficiency of the value chain. (e-Hinga 2015).

### Activity 5: Monitoring

The current post-harvest losses are recognized during activity 1, based on desk research, and confirmed during our field research. The losses would be tracked based on the potential implementation of post-harvest measures (which were not foreseen in the SMART work plan and budget). The above post-harvest loss data would then serve as the basis for this monitoring (Bopinc 2020).

## **Agricultural Value Chains analysis**

According to H jacques (2011) agricultural value chains is composed of three elements. The first consists of defining significant constraints for the upgrading of the value chain: limits on market access, poor infrastructures, lack of capital and institutional voids. In the second component three elements of a value chain are defined: value addition, horizontal and vertical chain-network structure and value chain governance mechanisms. Finally, upgrading options are defined in the area of value addition, including the search for markets, the value chain- network structure and the governance form of the chain. H Jacques (2011). further said that part of this component is the identification of the most suitable partnerships for upgrading the value chain. The three components of the framework are derived from major theoretical streams on inter-company relationships and from the literature on developing country value chains. The outsourced questionnaire has collected the information related to this, under which the respondents shared their views about market access, infrastructures, capital access and the networks that they have. those have been analysed and discussed under chapter four.

### **Competitiveness**

In economic terms, because of the specifics, the agricultural sector has a particular significance. The role of the agricultural sector has also been created and altered in this new climate (Jennifer 2015). Measurement of competition is done taking advantage of its strengths and limitations in order to establish a corrective action process, if applicable, and recommendations for the future. The competitiveness evaluation is done by the use of three key instruments viz., increasing efficiency, productivity and international competitiveness. These tools that can be used alone or in combination. In Rwanda, horticulture has been competitive up to the percentage of 54.83% (UNDP 2020).The results show that Rwandan tree tomatoes can have a slightly greater competitive edge in the manufacturing of them in case one cares about building value chain.

### **Competitiveness of Value Chains**

Different farmers have shared essential knowledge to the effective introduction of good farming practices. Possibilities have been given in different workshops. Production of tree tomato has been on the increase in different areas. Farmers have never been able to connect and exchange data with one another (CTA 2014) . There is a plan to help store soil moisture, and, like other soil conservation methods, it can also be a method to kill weeds. Having taken these measures have made it easy for the tree tomatoes to extend their horizons (CTA 2014) .

### **Competitiveness of agricultural value chains**

Agricultural Value chains are a crucial mechanism for understanding how a product is brought together and then used to grow, turn or produce inputs and services; how the product then physically travels from the manufacturer to the customer; and how value rises along the way (Jennifer 2015). The perspective of the agricultural value chain offers an essential means of understanding the business-to-business relationships that link the chain, performance enhancement processes, and ways to allow businesses to improve productivity and add value. It also offers a point of reference for changes in service support and the market climate. It can lead to pro-poor measures and to a stronger relationship between small businesses and the consumer. Increasingly, as emphasized by (Tardi 2020) , the Competitiveness of agricultural value chains strategy is used to direct and drive sustainable and high-impact measures aimed at improving efficiency, competitiveness, entrepreneurship and small and medium-sized business growth (SMEs).

### **Analyzing the determinants of competitiveness of the Tree Tomato Value Chain.**

According to ESSEC (2013), the analysis of value chains has led to the development of different methods. The researcher identified critical issues for value chains in different emerging and transitional economies, with the objective of achieving a targeted development stage. The researcher also identified the factors influencing chain development and value creation to classify issues as critical or not critical (ESSEC 2013).

In addition, there are several factors that can affect tree tomato competitiveness. One among the factors is the farmer's willingness to adopt innovative timing approaches. For a farmer in the field of tree tomato, there is need to make sure about the awareness of the new methods or bring something that does not exist in the market. Another determinant is the quality of the tree tomato. In the supply chain of the tree tomato, there is need to make sure that fruits are of good quality so that farmer can face competitors. Another determinant is the price. Some farmers do not follow the market price and having their products with high prices makes them to lose their customers (DEval 2016).

## **Challenges facing by actors in general**

The fruit production is facing challenges as the sector that is expanding. There are often pests and diseases, but also sporadic precipitation in Rwanda and crop productivity remains low. Technology and expertise are needed to deal with agricultural risks.

More about the challenges (Vlados 2019) pointed out that there is Lack of expertise and lack of access to emerging technology and advances in processes restrict the adaptability and productivity of players in the value chain. When there is enough information and technologies, this will definitely lead to successful participation in value chains. The author further stated that if the actors at the micro-level can only make effective use of adapted financial resources and if the market information is exchanged reciprocally; would contribute to boost up the business relations (Wamucii 2020).

According to (Dininni & Jeanne 2020), credit to agriculture remains at a low 7% (2016). Financial constraints affect the sector particularly at the time of acquiring required inputs and at the post-harvest stage. Access to finance is a big challenge, especially for young agronomists willing to start a business in horticulture (DEval 2016) . Also, cash flow is a challenge for regional exporters as farmers have to be paid on the day of harvest while payment from importers takes place within 15-30 days, if not product standards are relatively relaxed since most manufacturers sell mainly to consumers in local markets (DEval 2016). As long as growers are able to fulfill product size and color standards and to sell in reasonable quantities, their customers will normally be pleased. The ability to respond to new market requirements (quantity demands with reliable consistency, food safety, and compliance to Global GAP certification) is a major issue right now (Kamau, 2014)

Scielo (2020) pointed out that the availability of packaging material is limited in Rwanda. Rwanda, as a landlocked country, suffers from high transport costs which influence the marketing of its foodstuffs. Rwanda's latest competitive export strategy would concentrate on niche high-quality goods that compete in higher prices and lower volatility markets. There is little awareness amongst stakeholders within the value chain about the importance of cold stores (Scielo 2020).

## **Summary of understanding of concepts and indication about the research**

Briefly, this section attempted to clarify the concepts of Value Chain, Competitiveness, Competitiveness of Value Chains, Competitiveness of agricultural value chains and discussed about how to analyze the determinants of competitiveness of the Tree Tomato Value Chain and Challenges facing by actors in general. All those are the bases to formulate the research questionnaire and to explain it to the respondent for effective information and data provision to reach at the thesis' objectives.

## **2.3 Empirical review**

### **Introduction**

This section is devoted to review the findings of different researchers on the supply chain related theme with an aim to identify the research gaps to be filled. It analyzed the research results on value chain and competitiveness of tree tomatoes production.

Horticultural crops are very important to an outsized percentage of rural households for revenue generation. Improving the scope and enthusiastic participation of tree tomato farmers in markets is a key challenge affecting tree tomato production (Efa Gobena & Tura 2018) . Efa & Tura (2018) in their study, found that the determinants of tree tomato farmers' market outlet decisions couldn't be identified separately since famers grow tree tomato for both home consumption and for market demand. This study established the determinants of tomato producers' market outlet choices in Ethiopia's West Shewa region using the multivariate probit model. For the selection of villages and households, a purposeful sampling method based on different attributes was used, with 300 farm households being surveyed for the analysis (Wamucii & Selina 2020). The results of the multivariate probit model revealed that transaction costs such as distance to nearest markets, access to credit, family size, household head age, education level, farming experience, and tomato volume created significantly affect tomato farmers' choices on the tomato market channels.

The age of the household head, education status and distance to the nearest market were negatively affected by retailer market outlet choices, whereas access to credit was positively affected at various levels of significance. Wholesaler market outlet options, however, were negatively impacted by access to credit, the size of the family and the quantity of tomatoes generated at different probability levels.

Another study conducted by (Life & Green 2017) found that tree tomatoes competitiveness may results from farmers who have inputs of water and nutrients optimize and stabilize development and which are provided on condition when necessary since tree tomato inputs want a steady supply of water because they owe a shallow root system. Life and Green (2017) further added that plants should be safeguarded from strong wind because their shallow root system does not provide adequate support and, when carrying fruits, the sideways branches are brittle and can split easily.

Tree tomato competitiveness may also be motivated by growing demands on the part of traders and rising imports of tomato products which merge to render tomato fruit ads intimidating challenge to smallholder farmers in northern Ghana (Victor & Karbo 2009).

In 2007, the former Pwalugu Tree Tomato Factory closed in 1990, was re-opened with a new name of Northern Star Tomato Company (NSTC) under new leadership as a part of the Region Industrialization Program in Ghana. As by time of research, the new tomato factory was undergoing test runs and hadn't been connected to the national electricity grid yet and the major policy driving industries was the competitiveness of the restored tomato industry in the northern part of the country (Victor & Karbo 2009). This study explored the shortcomings of the tomato tree industry and assessed the strategies for enhancing the competitiveness of the Northern Ghana industry (Victor & Karbo 2009). Using the four attributes of the Porter's Diamond and the typologies of value chain growth respectively, the competitiveness of the restored tomato industry in the northern part of Ghana was examined. Limitations and openings were the outcomes in the development system (Victor & Karbo 2009) . For fear of the roots breaching the canals, the populations are not allowed to grow perennial tree crops on the irrigated lands. The sizes of individual holdings vary from 0.2-0.6 hectares. A few farmers own larger plots, but for a season they do not plant everything and rather lease part out.

Many major problems under tree tomatoes value chain were reported by (Morales Osorio & Juan Gonzalo 2016) and those are poor-quality plant products, the unselective use of agrochemical products including insecticides, fungicides and fertilizers, inappropriate postharvest handling, not strong and intermittent professional expert support, small number of diversifications, developing economies, price changes, insufficient crop planning, and a high spread of pests and diseases.

### **Relationship between value chains and market development.**

According to (DEval 2016), the focus of business expansion is on market entry, market awareness (systems), as well as transport and transit. This has everything to do with the value chain, actually. The value chain has both the supply and demand chain. On the supply side of the value chain, there is a strong connection between the market and the products being supplied as there is value added in terms of production, marketing, and provision of after-sales services. This makes it easier to retain customers as there is customer satisfaction. On the demand side, the value chain increases demand as there is quality products and services, there will be an increase in demand due to the fact that there is satisfaction. Additionally, in particular, this refers to the stage at which producers and processes are put in the demand-led marketing of agricultural products. Consumers are also aware of the commodity unresponsiveness and food security, as the main goal is food invulnerability (DEval 2016).

### **Value Chain and Organizational Development.**

Generally, the value chain has something to do with information spreading, goods and services between the actors and value chain. The term organizational development goes in hand with economic development. It is considered that the establishment of healthy business ties is a high degree of organization among actors in the value chain. So, there is need to increase and improve on activities to support the institutional development of cooperatives. What we are talking about here is organization development, and this is the increase of Capabilities and bargaining power in the private sector (AIHR 2020). So, when there is initiative, it serves to consolidate cooperation among the actors themselves. as a way to increase value chain creation. This is because the aim of these activities not only lead to improving the management of quality and marketing, but also growing efficiency and output. This will later help reduce poverty since there will be increased income and development. Additionally, the key mechanism is based on knowledge and information about access to programs that promote entry into the value chain and sustained involvement (DEval 2016).

## **Summary of understanding on empirical review section**

The review of supply chain related theme found that improving the scope and enthusiastic participation of tree tomato farmers in markets is a key challenge affecting tree tomato production (Efa Gobena & Tura 2018). Also, a study conducted by (Life & Green 2017) found that tree tomatoes competitiveness may results from farmers who have inputs of water and nutrients optimize and stabilize development. Tree tomato competitiveness may also be motivated by growing demands on the part of traders and rising imports of tomato products which merge to render tomato fruit ads intimidating challenge to smallholder farmers in northern Ghana (Victor & Karbo 2009).

Many major problems under tree tomatoes value chain were reported by Morales- Osorio (2016) and those are poor-quality plant products, the unselective use of agrochemical products including insecticides, fungicides and fertilizers, inappropriate postharvest handling, not strong and intermittent professional expert support, small number of diversifications, developing economies, price changes, insufficient crop planning, and a high spread of pests and diseases.

The two-point found under empirical review is the relationship between value chains and market development, the findings vis a vis value chain has both the supply and demand chain. On the supply side of the value chain, there is a strong connection between the market and the products being supplied as there is value added in terms of production, marketing, and provision of after-sales services

The second point is value Chain and Organizational Development. Generally, the value chain has something to do with information spreading, goods and services between the actors and value chain. What we are talking about here is organization development, and this is the increase of Capabilities and bargaining power in the private sector (AIHR 2020).

## 2.4 Research Gaps

The reviews of different papers and researches show that the production of tree tomatoes in Rwanda is mainly by households but there is no quantification of farmers who engage in household farming, issues that they face and what can determine tree tomato competitiveness. Different tree tomato varieties are grown in Rwanda but also there is no review about how red, yellow (Amber), and gold are commonly known around the country and how competitive they are. In line with this understanding, the current research is aimed to collect the information from the respondents on their opinions vis a vis what determine the future tree tomatoes market in terms of preferences and to ascertain the impact of tree tomatoes color on their marketability.

Also, even if the SCP-model provides a good structure, the model allows the researcher to analyze the chain from an external point of view without taking into consideration the opinions of chain actors. It emphasizes structural aspects and the impact of structure on conduct and performance. It is limited to one value chain stage. It doesn't emphasize on the nature and the structure relationships between buyers and sellers in terms of satisfaction. This research looks at how specific behavior of chain actors and present their role in facilitating tree tomatoes competitiveness.

The review found also that conceptually: many institutions affect the development performance. Transaction impacts the chain participants in different ways like costs, risk, efficient investments, and so on (ESSEC 2013) but the markets should not only be based on physical facilities provision. There should be rules and regulations to reduce transaction costs. The rules would also help in protection of different rights for both buyers and sellers. Protection of different rights for both buyers and sellers also is contributing to the guidelines. Practically, there should be inclusion of transaction costs in the guidelines by investing qualitatively the chain actors' judgement about their time and effort related to the search of customers, information exchange, bargaining, and contract settlements.

On the side of value chain analysis, Michael Porter talked of activities that are taken together to build the company’s profit. The current research analyzes how activities can be combined together for effective production of tree tomatoes and assess what can motivate tree tomatoes business practitioners to respond more to the problems said early.

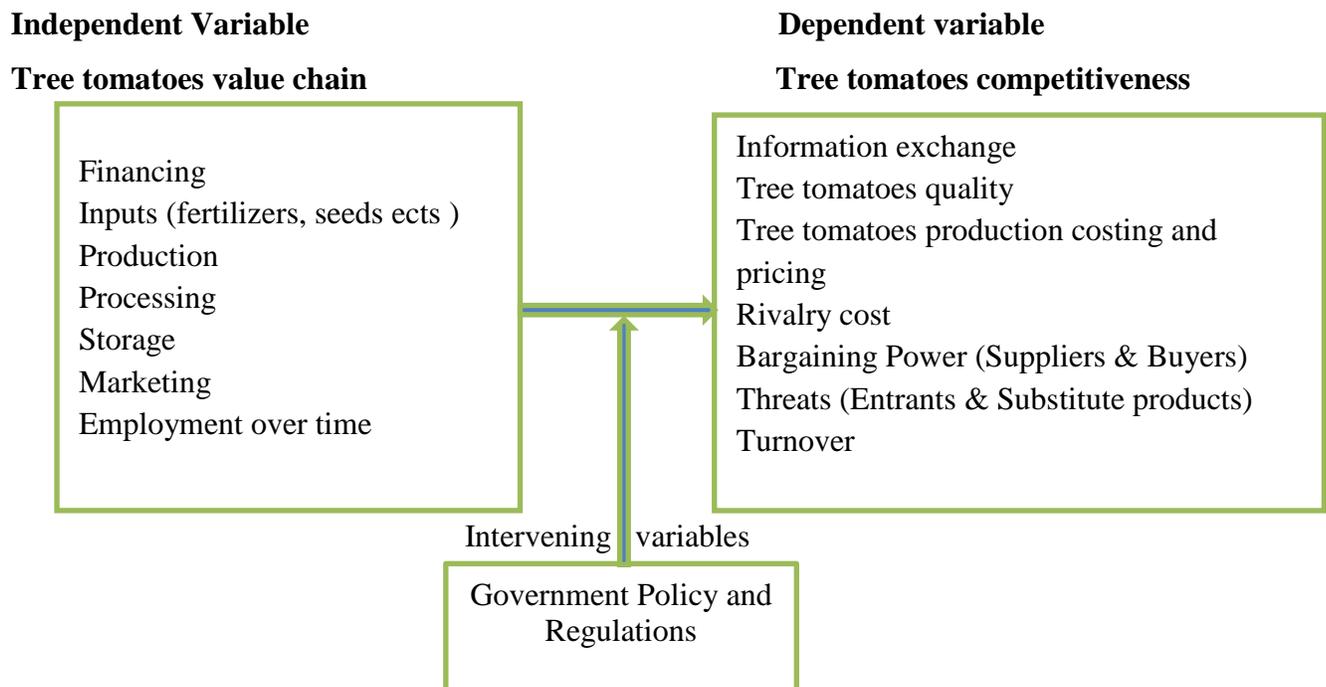
The empirical review reveals some models such as probit and logit models as well as other methodologies were used to analyze tree tomatoes’ supply chains but there is no clear approach to key actors in tree tomatoes viz., farmers, inputs suppliers, buyers, processors etc. This research, therefore, analyses the role of key actors involved in the value chain of tree tomatoes.

## 2.5 Conceptual framework

### 2.4.1. Introduction

Conceptual framework configured on the basis of the detailed review of literature and research is presented in the following figure 2.1. It shows the dependent and independent variable, under each type of variable, the researcher presented the sub variables and those were the bases for data collection.

**Figure 2.1: Conceptual framework**



Source: Configured by the researcher (2021)

On the first hand, the independent variable, has the sub variables such as Financing, Inputs, Production, Processing, Storage, Marketing and Employment over time. These factors were considered to reflect research and literature review findings as the ones that can determine the competitiveness of tree tomatoes. Some of these factors also independently as the primary activities of tree tomatoes value chain influence tree tomatoes to be competitive on the market.

On the other hand, tree tomatoes competitiveness is the dependent variable. Under this sub- variable Information exchange, Tree tomatoes quality, Tree tomatoes production costing and pricing, Rivalry cost, Bargaining Power (Suppliers & Buyers), Threats (Entrants & Substitute products) and Turnover are included. The research is conducted to establish the relationship between the independent and dependent variables. These variables also form the basis for the researcher to find out the challenges facing by actors in tree tomatoes value chains in Rwanda. From each sub variable, the researcher aimed to identify the challenges and if found, recommendations will be provided for their removal and better tree tomatoes competitiveness.

## **CHAPTER THREE: RESEARCH METHODOLOGY**

This chapter is devoted to providing details of the methodology adopted to conduct this study. It presents the research design that have been used to reach at the research objectives, sources of the primary and secondary, population of the study, sample size technique, research instruments, how data have been analysed, ethical consideration validity and reliability of findings and limitations of the study.

### **3.1 Research Design**

This study adopted a mix of both qualitative and quantitative approaches which have been used together by the researcher to assess the determinants of competitiveness of the tree tomato value chain in Rwanda. Quantitative data was collected and analyzed to show the image of tree tomatoes value chain competitiveness and to quantify the determinants of tree tomatoes value chain. On the other hand, qualitative data have been collected and analyzed to establish the determinants of tree tomatoes value chain competitiveness and to find out the challenges facing by tree tomatoes actors in Rwanda. This is a descriptive analytical study aimed to unveil the determinants of the competitiveness of Tree Tomato value chains in Rwanda.

### 3.2 Source of data

This part of the study shows a brief description of the collected data to meet the research objectives. It discusses about primary data and secondary data sources of those data and collection tool/method.

**Table 3.1: Objective-wise data required for the study, their sources and collection tools/methods**

Research Objective	PRIMARY DATA			SECONDARY DATA		
	Required	Source	Collection Tool / Method	Required	Source	Collection Tool / Method
1. To establish the determinants of tree tomatoes value chain competitiveness	Respondents' answers about tree tomatoes Financing, Inputs (fertilizers, seeds ect), Production, Processing, Storage, Marketing and Employment over time	Tree Tomato growing farmers	Questionnaire organized as structural interview	Respondents' answers about tree tomatoes Financing, Inputs (fertilizers, seeds ect), Production, Processing, Storage, Marketing and Employment over time	Report, journals and different sources of information	Literature review
2. To analyze the trends in the value chain competitiveness of tree tomatoes in Rwanda	-	-	-	Quantitative data Respondents' answers about tree tomatoes Financing, Inputs (fertilizers, seeds ect), Production, Processing, Storage, Marketing and Employment over time	<b>NAEB (2018)</b>	Database
3. To find out the challenges facing by actors in tree tomatoes value chains in Rwanda.	Respondents' opinions vis-à-vis the challenges they faced in growing tree tomatoes	Tree Tomato growing farmers	Questionnaire organized as structural interview	Publications, report and all kind of literatures that talk the challenges facing by actors in tree tomatoes value chains.	Report, journals and different sources of information	Literature review

Source: Configured by the researcher (2021)

Table 3.1 shows Objective-wise data required for the study, their sources and collection tools/methods. The tree objectives were reached after analysis primary and secondary data. primary data collected includes Respondents' answers about tree tomatoes Financing, Inputs (fertilizers, seeds ect), Production, Processing, Storage, Marketing and Employment over time. Secondary collected includes Quantitative data Respondents' answers about tree tomatoes Financing, Inputs (fertilizers, seeds ect), Production, Processing, Storage, Marketing and Employment over time. As the researcher outsourced the questionnaire, they were a need of Respondents' opinions vis-à-vis the challenges they faced in growing tree tomatoes. In additional, to know more about the challenges facing by actors in tree tomatoes value chains, they were a need of publications, report and all kind of literatures that talk the challenges facing by actors in tree tomatoes value chains.

### **3.2.1 Primary data sources**

The primary source is drawn from the people or workplace being researched on and therefore most direct and true information were collected. Primary data of this research have been found using administered questionnaires. Specifically, to the primary data, the questionnaire was asking about the determinants of tree tomatoes value chain competitiveness and the challenges facing by tree tomatoes actors in Rwanda, the respondents from 56 companies which deals in supply of input, output processing, finance and logistics activities listed the challenges and provided an overview about the determinants of value chain. The researcher talked to them via phone to make a reminder that the research was in process to collect primary data about financing, inputs, production, processing, storage and employment over time. the questionnaire was also asking about the destination to the local market and regional market as well as information exchange, tree tomatoes quality, rivalry cost, bargaining (suppliers & buyers) and threats (entrants & substitute products).

### **3.2.2 Secondary data sources**

Secondary data is usually extracted from the original data and often the examination of the study someone else has carried out on a subject or an evaluation of commentary or summary of primary material Arthur & Nazroo (2003). The secondary data of this research have been extracted from different reference books, and other previous research documents in the same field. This was a dataset form NISR Seasonal Agricultural Surveys 2014-2015-2016-2017-2018. The descriptive analysis of this dataset helped to find out the description of fruits supply chains in Rwanda. They were a dataset form NAEB Seasonal Agricultural Surveys 2014-2015-2016-2017-2018.

### 3.3 Population of the study

A total population of 56 firms which have 550 farmers who involved in producing, processing and engaged in fruits value addition in general. Table 3.2 shows the district-wise details of population.

**Table 3.2: District-wise details of study population of Tree Tomato growing farmers**

S.No	Name of the District	No. of Farmers Producing Tree Tomatoes	Percentage to Total	S.No	Name of the District	No. of Farmers Producing Tree Tomatoes	Percentage to Total
1	Gasabo	20	3.64	16	Rubavu	1	0.00
2	Kicukiro	14	2.55	17	Rusizi	14	4.30
3	Nyarugenge	5	0.91	18	Rutsiro	8	0.50
4	Gisagara	16	5.10	19	Burera	10	1.20
5	Huye	2	0.60	20	Gakenke	7	1.30
6	Kamonyi	26	2.60	21	Gicumbi	1	0.90
7	Muhanga	19	2.00	22	Musanze	15	3.50
8	Nyamagabe	11	0.30	23	Rulindo	14	0.70
9	Nyanza	27	5.10	24	Bugesera	21	4.20
10	Nyaruguru	3	0.20	25	Gatsibo	52	11.70
11	Ruhango	8	0.70	26	Kayonza	27	6.60
12	Karongi	13	1.90	27	Kirehe	74	7.60
13	Ngororero	3	0.55	28	Ngoma	19	2.30
14	Nyabihu	6	2.30	29	Nyagatare	50	9.50
15	Nyamasheke	19	3.10	30	Rwamagana	45	5.60
Grand total		550					100%

**Source: NAEB (2018)**

Table 3.2: shows district-wise details of study population of Tree Tomato growing farmers, at least two districts have 1 horticulture growers (Gicumbi, Rubavu) only one district (Kirehe) has 74 people involved in horticulture practices. the average of people involved in horticulture is 20. This inequality of people involved in horticulture as dataset was given by NIDO is explained by people's choice to involve in horticulture practices with respect to the land consolidation of 2009. Horticulture is the cultivation of fruits including tree tomatoes, vegetable, and landscape plants.

### 3.3 Sample size

Robinson (2014) in his words commented on sample size as phase of research which is crucial because of its major impact on time and money that must give into the data collection. In fact, the whole population should be used to get the information for the research, but due to inadequate resources, it is impossible to pass through the whole population for investigation. This research involved in purposive sampling process, a total of 56 firms that engaged in fruits production, processing and value addition provided the information to research at our research objective. Table 3.3 provides the details of the sample of the population chosen for the study.

**Table 3.3: District-wise details of study population of Tree Tomato growing farmers**

S.No	Name of the District	No. of Farmers Producing Tree Tomatoes	Percentage to Total	S.No	Name of the District	No. of Farmers Producing Tree Tomatoes	Percentage to Total	
1	Bugesera	2	3.57%	16	Ngororero	1	1.79	
2	Burera	1	1.79%	17	Nyabihu	1	1.79	
3	Gakenke	2	3.57%	18	Nyagatare	1	1.79	
4	Gasabo	4	7.14%	19	Nyamagabe	1	1.79	
5	Gicumbi	1	1.79%	20	Nyamasheke	2	3.57	
6	Gisagara	1	1.79%	21	Nyanza	2	3.57	
7	Huye	2	3.57%	22	Nyarugenge	2	3.57	
8	Kamonyi	2	3.57%	23	Nyaruguru	1	1.79	
9	Karongi	2	3.57%	24	Rubavu	4	7.14	
10	Kayonza	1	1.79%	25	Ruhango	2	3.57	
11	Kicukiro	2	3.57%	26	Rulindo	3	5.36	
12	Kirehe	2	3.57%	27	Rusizi	3	5.36	
13	Muhanga	3	5.36%	28	Rutsiro	2	3.57	
14	Musanze	2	3.57%	29	Rwamagana	2	3.57	
15	Ngoma	2	3.57%					
Grand Total		<b>56</b>						<b>100</b>

**Source: NAEB (2018)**

Table 3.3 shows district-wise details of study population of Tree Tomato growing farmers. They were 9 districts with 1 respondent each, 15 districts with 2 respondents each, 3 districts with 3 respondents and 2 districts with 4 respondents. What can explain this inequality by district is the choice to involve tree tomatoes growers, processing and marketing.

The reason to choose this sample is the availability of full information from those firms. United Nations The reason to choose this sample is the availability of full information from those firms as the database was taken from the study of United Nations Industrial Development Organization (UNIDO) and National Industrial Research and Development Agency (NIRDA). UNIDO and NORDA together conducted the technology audit for fruits and vegetable value chain and updated the database for Rwanda. The database has the contacts from each and every firm of the whole country as well as the specific actions vis a vis fruits processing and value addition. The researcher contacted RAB, the institution that have agricultural research in its functions to recommend her to those companies. The researcher called each and every number provided to answer the research questions. That total of 56 firms in the country work hand in hand with NAEB, RSB, PSF, RCA, RAB and RDB, the institutions websites to have assurance of what provided under the dataset. Reasons to choose those 56 respondents are that among them some involve in tree tomatoes growers, processing and marketing. UNIDO provided their full information so that to communicate them was effective.

### **3.4 Research instruments**

Different instruments were used to gather information from respondents and other sources that are felt relevant to this research. Information was collected using questionnaire and documentary analysis to gather valid and reliable information or data from the representative of our population which is concerned in this study.

#### **3.4.1 Questionnaire**

Questionnaires was organized as a structural interview and have been interpreted in Kinyarwanda since all respondents were not able to understand English. The researcher interpreted herself normally. The questionnaire methods is chosen for the purpose of collecting data being it is easy to control and time saving. That questionnaire helped to collect the primary data from Tree Tomato growing farmers.

#### **3.4.2 Documentation**

Document study was used in literature review. The researcher documented about tree tomatoes production from reports, journals and different sources of information vis a vis tree tomatoes value chain were used as references. Some of the report, journals and different sources of information were from Academy of Innovate Human Resources (AIHR), Technical Centre for Agricultural (CTA), École

Supérieure des Sciences Économiques et Commerciales (ESSEC), Ministry of Agriculture and Animal Resources (MINAGRI), National Agriculture Export Board (NAEB), Confederation of Coops of Rwanda (NCCR), National Industrial Research and Development Agency (NIRDA), United Nations Industrial Development Organization (UNIDO).

### **3.5 Data analysis**

Data obtained from the field and from available literature were compiled, sorted, edited, classified, coded and entered into the computer for analysis, the researcher used SPSS version 20 to produce descriptive analysis and other output table for interpretation. The descriptive analysis (Mean, mode and frequencies) of the secondary dataset helped to find out the description of fruits supply chains in Rwanda. Through this, the researcher was able to explain the relationship between independent and dependent research variables and data have been presented based on the research questions, studies and purpose of the study. This helped to avoid miss- representation of findings.

### **3.6 Ethical consideration**

While gathering information, the personal identity of individual from whom information were drawn by keeping confidential and not disclosed anyhow. The final report contains any person's information revealing him or her. Nobody is to be pressurized or scrutinized in giving information to the subject matter of the research or even be biased in his or her opinion. We are sure, once all these ethical standards are respected, for them to be safe, socially and psychologically are regarding our research.

### **3.7 Validity and reliability**

To ensure that the instrument measured what it supposed to measure, the instrument have been checked to insure validity. For further improvement, the questionnaire was pretested with a pilot study in order to test its utility which guarantees correctness and relevance of the instrument. To ensure that the data is reliable and valid, standard tests have been done whereby the instruments subjects to the representative of a sample. If each time the question is asked and the respondent answers question which is similar or consistent then the instrument was reliable. A research instrument is said to be valid if it actually measures what is supposed to be measured.

Reliability of the data collection instrument was tested using Cronbach's Alpha coefficient. The reliability is expressed as a coefficient between 0 and 1.00. The higher the coefficient, the more reliable is the test. Reliability test as provided by SPSS version 20 found that Cronbach Alpha is 0.871 which is above of 0.5 suggested values (Amadeo K. & Kimberly M 2000) , thus basing on the reliability test of scales used, the study is reliable.

### **3.8 Limitations of the Study**

The challenges faced include some of the respondents who had not immediately picked the call and respond our mails during data collection. They were often misunderstood, insufficient answers to questions and unforeseen events, such as people who were on leave. These limitations were mitigated through constant approaches by calling, texting and physical meeting of the respondents where it was possible. Also, the researcher was challenged as most respondents were prohibited from answering any of the questionnaires by the organizational privacy policy. It was perceived to be against the confidentiality policy of the company to report sensitive matters to the organization. The introduction letter received from the university to the management of the organization helped to escape suspicion and required the institutions to reveal most of the data requested by the report.

## CHAPTER 4: DATA ANALYSIS AND INERPRETATION

### 4.1. Introduction

This chapter deals with the interpretation and analysis of the data collected in pursuit of the objectives of the study. It presents the research findings in tables, figures, frequencies, and percentages. This chapter is presented in sections. Section one describes and analyses the tree tomato cultivation and supply chain scenario in Rwanda. Section two presents the determinants of the competitiveness of tree tomato supply chains, Section three highlights the challenges to farmers of tree tomatoes in making their supply chains competitive and the section four deals with the relationship between independent and dependent variables of the study and clarifies the research questions with evidence-based answers.

### 4.2. SECTION ONE: Tree Tomato Cultivation and Supply Chain Scenario in Rwanda

Section one describes and analyses the tree tomato cultivation and supply chain scenario in Rwanda. Data from Horticulture Processors Database, NAEB (2018) were analyzed to show the picture area under cultivation of fruits, trend of tree tomatoes production, actors involved in production, processing, and storage of fruits, quantity (in tons) of fruits production, fruits processing capacity, income generated from fruits, irrigation practices by provinces and availability of greenhouse facility and other buildings.

**Table 4.1 : Area under cultivation of fruits by district/province in Rwanda in 2018**

S.No	Province & District	Land in Number of Ha	Percentage total %	S.No	Province & District	Land in Number of Ha	Percentage to total %
1	East Province	2530	0.697	19	Gicumbi	41	0.011
2	Kirehe	1176	0.022	20	Rulindo	35	0.01
3	Ngoma	1045	0.026	21	Musanze	13	0.003
4	Gatsibo	93	0.004	22	Burera	12	0.003
5	Bugesera	81	0.324	23	South Pro.	296	0.082
6	Nyagatare	64	0.288	24	Kamonyi	112	0.031
7	Rwamagana	56	0.018	25	Muhanga	84	0.023
8	Kayonza	15	0.015	26	Nyamagabe	31	0.009
9	West Pro.	520	0.143	27	Ruhango	31	0.008
10	Karongi	181	0.05	28	Gisagara	17	0.005
11	Nyamasheke	103	0.017	29	Nyaruguru	9	0.003
12	Rutsiro	83	0.008	30	Huye	7	0.002
13	Ngororero	60	0.028	31	Nyanza	7	0.002
14	Rusizi	39	0.007	32	Kigali Pro.	22	0.006
15	Nyabihu	29	0.011	33	Kicukiro	18	0.005

16	Rubavu	26	0.023	34	Gasabo	4	0.001
17	<b>North Pro.</b>	<b>259</b>	<b>0.071</b>	35	Nyarugenge	1	0
18	Gakenke	159	0.044				

Source: Horticulture Processors Database, NAEB (2018)

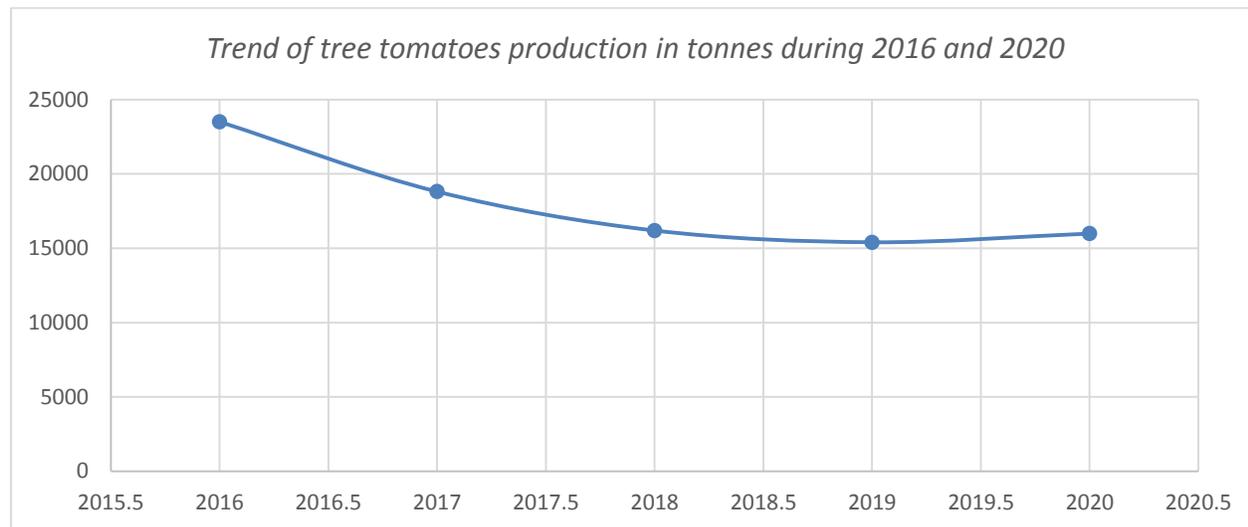
Rwanda is known for cultivation of different kinds of fruits such as Pineapple, Passion fruit, Tree tomatoes (Tamarillos), Mango, Banana (fruit), Strawberry, Other fruit, Avocado, Lemon, Orange, Apple, Papaya and Cape Gooseberry. Table 4.4 shows the area under cultivation of all fruits in Rwanda. The available data does not specify how much land was under cultivation of tree tomatoes. Eastern province comes at the first place to have a big land size for fruits production with a total land size of 2530 ha, followed by western province with 520ha, northern province with 259 ha, south province with 296 ha and lastly Kigali province with 22 Ha. Kirehe comes at the first place in having highest size of land under fruit cultivation with 1176 Ha followed by Karongi with 181, Gakenke, Kamonyi, Kicukiro with 159,112, 18 respectively. The areas reflect to the policy of land consolidation made by the government in 2009. The areas inequalities are due by the policy of land consolidation made by the government in 2009. The researcher asked herself whether this land is sufficient to satisfy both local and international market demand. NAE (2014) reported untapped potential for fruits production because only 8667 tonnes were exported while orders are three times more to this figure.

**Table 4.2: Trend of tree tomatoes production in tonnes during 2016 and 2020**

Years	Production in tonnes	% change over previous year
2016	23507	- 0.58
2017	18811	- 0.32
2018	16191	- 0.03
2019	15985	- 0.07
2020	15404	- 0.58

Source: Horticulture Processors Database, NAEB (2018)

**Figure 4.1: Trend of tree tomatoes production in tonnes during 2016 and 2020**



Horticulture Processors Database, NAEB (2018)

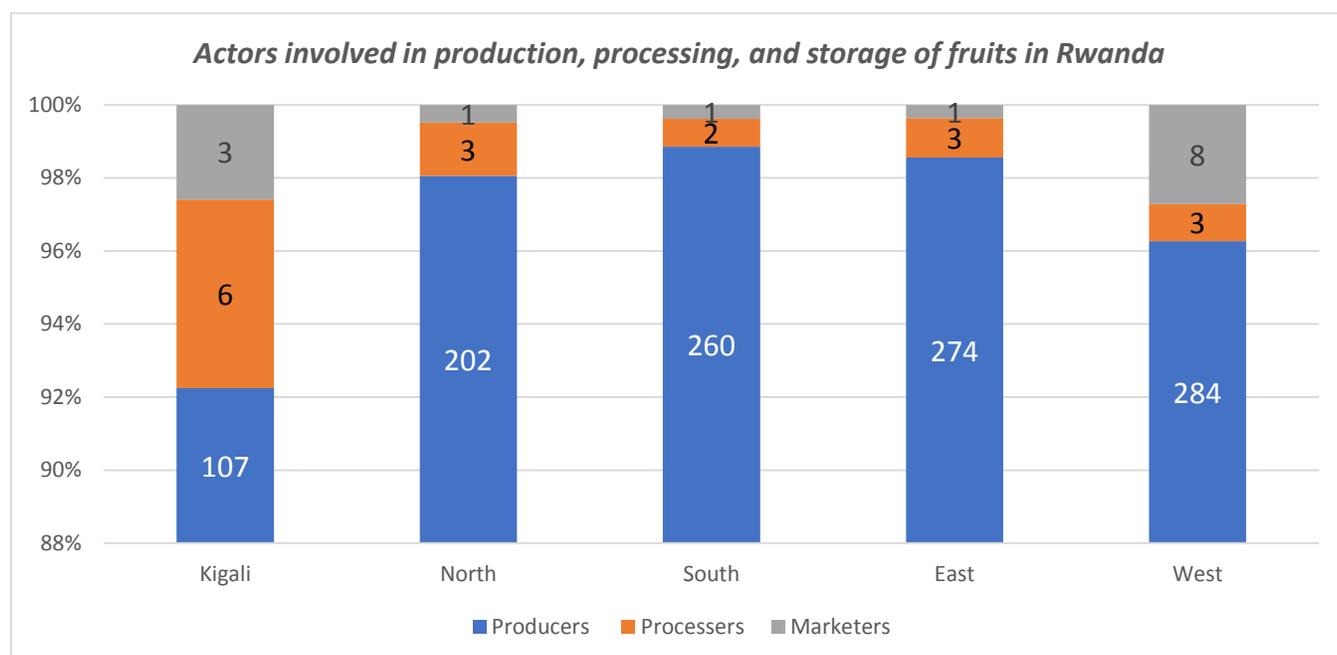
The Table 4.2 and figure 4.1 show that the total production of Tree Tomatoes is 89,898 tonnes during the during 2016 and 2020. That is 23507 for the 2016, 18811 tonnes, 16191 tonnes, 15404 tonnes ,15985 tonnes for the years 2017, 2018, 2019 ,2020 respectively. This is gradually decrease of 0.58, 0.32, 0.03, 0.07 and 0.58 for the year 2016, 2017, 2018, 2019 and 2020. This confirms the claim that Rwandan market lack enough tree tomatoes since as on can see 89,898 tonnes cannot satisfy 12 million people and be exported. This research found the challenges behind this lower production and analysed accordingly. Reasons behind this decline as reported by NAEB (2019) including lack of government subsidies (seeds and fertilisers), capital intensive which is demanding a huge financial outlay and patience and issues of climate changes. This affects the supply chain competitiveness because of lack to respond to the demand for fruits outpaces the supply. The country continues to rely on importing mangos, apples and oranges NAEB (2019).

**Table 4. 3 : Actors involved in production, processing, and storage of fruits in Rwanda**

Actors	Kigali	North	South	East	West
Producers	107	202	260	274	284
Processers	6	3	2	3	3
Marketers	3	1	1	1	8

Source: Horticulture Processors Database, NAEB (2018)

**Figure 4.2: Actors involved in production, processing, and storage of all fruits in Rwanda**

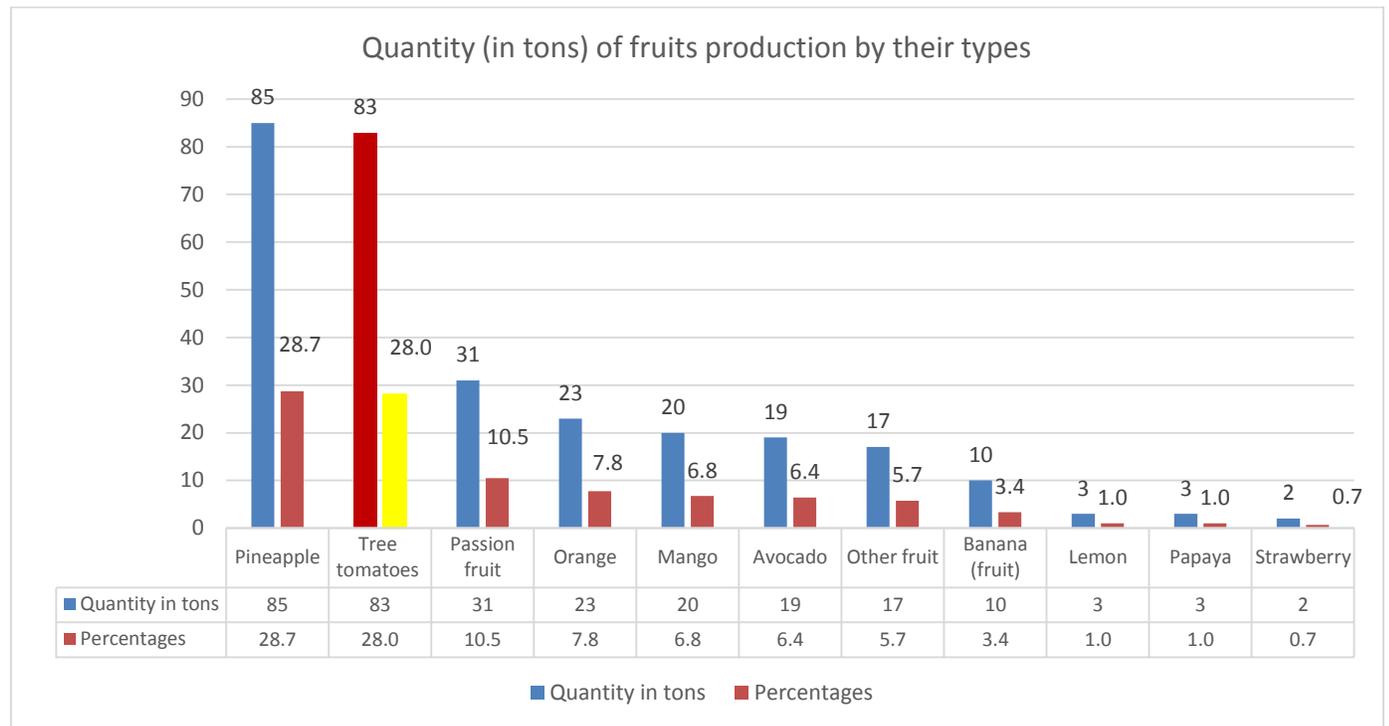


Source: Horticulture Processors Database, NAEB (2018)

Figure 4.2 titled Actors involved in production, processing, and storage of fruits in Rwanda shows individual total producers , processors and marketers of all fruits in Rwanda . Kigali has a big number of markerts (6) compared to others, Western province comes have a big number of producers 284 compared to 274 in east, 260 in south,202 in north and 107 in Kigali . The research found 6 processers in Kigali , 3 in North , East and West and 2 In South . It evidences that there are a big proportion of producers compared to the processers and marketers , meaning producing many tones may result in being a big task to processers and marketers. Producers cultivate and sell tree tomatoes to the middlemen who in turn transport and sell to traders ( Processers or direct consumers ). Processers add value by transforming tree tomatoes into jus. Marketers works as intermediaries between producers and

buyers, they help in sharing information between the two and facilitate in negotiation (Amos Gyan, 2014).

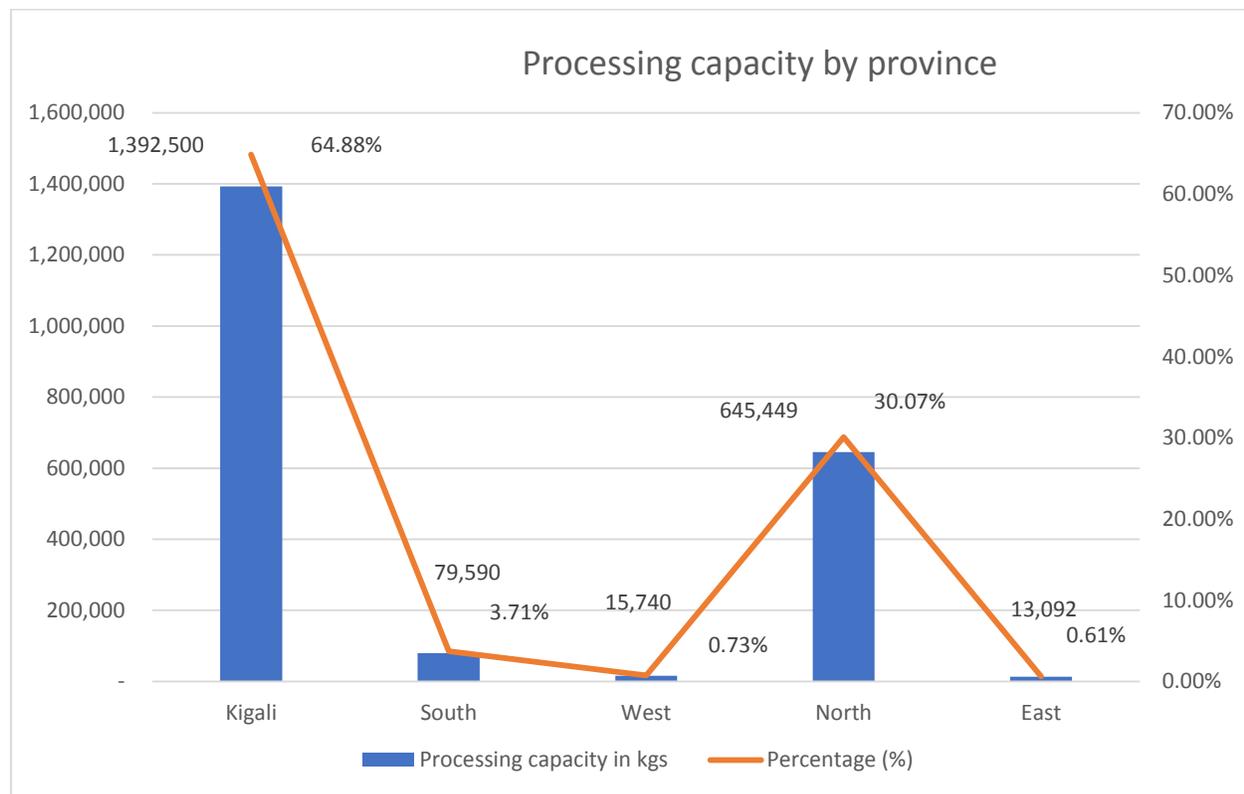
**Figure 4.3: Quantity (in tons) of fruits production by their types**



Sources: Horticulture Processors Database, NAEB (2018)

Figure 4.3 shows that 11 types of fruits are produced in Rwanda, 28.7% the farmers produced pineapple, 28 % tree tomatoes, 10.5 % passion fruits, 7.8% orange, 6.8% orange, 6.8% mango, 3.4% banana, 1% Lemon and Papaya, 0.7 % strawberry. The research found that other fruits are produced at 5.7%. The figure 4.3 shows tree tomatoes at the second place with red colors for quantity and yellow for percentage.

**Figure 4.4: Fruit processing capacity (In tones – Vertical line) across provinces in Rwanda**



Source: Horticulture Processors Database, NAEB (2018)

Figure 4.4 shows a big number of kilograms are processed in Kigali (1392500 kgs) which is equivalent to 64.88% of the total production of fruits across the country. North province comes at the second place with 645449 kgs (30.07 %) followed by south province with 79590 kgs (3.71%), western province 15740 (0.73%) and lastly eastern province 13092 (0.61%). It could be meaningful to have a big number of processors and big quantity of fruits processed. the reason behind this contradiction is a big portion of the fruits are sold in Kigali which has good capable machines and sufficient skilled employees. There are no specific processors for tree tomatoes NAEB (2018), This undermines the value chain competitiveness because having specific processors for tree tomatoes enhance specialization which leads to gain competitive advantage and quality required by the buyers.

**Table 4.4: Income generated from fruits (Horticatures) in “1000 Rwfs” by province**

Type of fruits	Total Country wide	Kigali	South	West	North	East
Passion fruit	372,300 (100)	1,098 (0.29)	10,298 (0.03)	83,503 (0.22)	277,098 (0.74)	303 (0.00)
Pineapple	330,919 (100)	2,470 (0.01)	36,201 (0.11)	54,548 (0.16)	79,042 (0.24)	158,658 (0.48)
Tree tomatoes (Tamarillos)	318,615 (100)	2,200 (0.01)	6,902 (0.02)	158,153 (0.50)	145,829 (0.46)	5,531 (0.02)
Strawberry	20,875 (100)	0 (0.000)	1,200 (0.057)	17,275 (0.828)	2,400 (0.115)	0 (0.000)
Mango	10,962 (100)	545 (0.05)	0 (0.00)	9,180 (0.84)	0 (0.00)	1,237 (0.11)
Banana (fruit)	8,915 (100)	1,164 (0.13)	500 (0.06)	600 (0.07)	42 (0.00)	6,609 (0.74)
Other fruit	6,933 (100)	120 (0.02)	1,750 (0.25)	135 (0.02)	840 (0.12)	4,088 (0.59)
Avocado	3,615 (100)	838 (0.232)	140 (0.039)	570 (0.158)	280 (0.077)	1,787 (0.494)
Orange	3,377 (100)	600 (0.18)	0 (0.00)	110 (0.03)	0 (0.00)	2,667 (0.79)
Apple	2,090 (100)	2,000 (0.96)	0 (0.00)	0 (0.00)	90 (0.04)	0 (0.00)
Lemon	1,820 (100)	600 (0.33)	0 (0.00)	1,060 (0.58)	0 (0.00)	160 (0.09)
Cape Gooseberry	500 (100)	0 (0)	0 (0)	0 (0)	500 (1)	0 (0)
Papaya	329 (100)	320 (0.97)	0 (0.00)	0 (0.00)	9 (0.03)	0 (0.00)

Source: Horticulture Processors Database, NAEB (2018)

Table 4.4 shows the income in “1000 Rwfs” generated from fruits production by province, Passion fruit comes at the first place generated 372,301,000 francs, North province is the first with 277,098 000 (74%) and the last one is south with 10,298 (3%). Pineapple generated 330,918,000 francs, Eastern province comes at the first place to produce Pineapple with 158,658 (48%) and Kigali is the last one with 2,470 (1%). Tree tomatoes which is the focus of this thesis comes at the third place generated 318,615,000 francs. Papaya is the last category of fruits which generated 329 ,000 francs, Western

produced more tree tomatoes 158,153 (50%) compare to the rest of provinces while Kigali is the last one with 2,200 (1%). It is understandable that Kigali is noticeably low generated income from tree tomatoes production generated the lowest of 2,200,000 francs among the five provinces because of factors such as lower land size for agriculture practices also Kigali is an administrative and industry city, the reasons behind Eastern province to generate less income from tree tomatoes is explained by its agroecology and topography. Tree tomatoes requires particular agronomic practices (E.g., irrigation) which was not suitable in Eastern province during 2013 and 2018 RAB (2018).

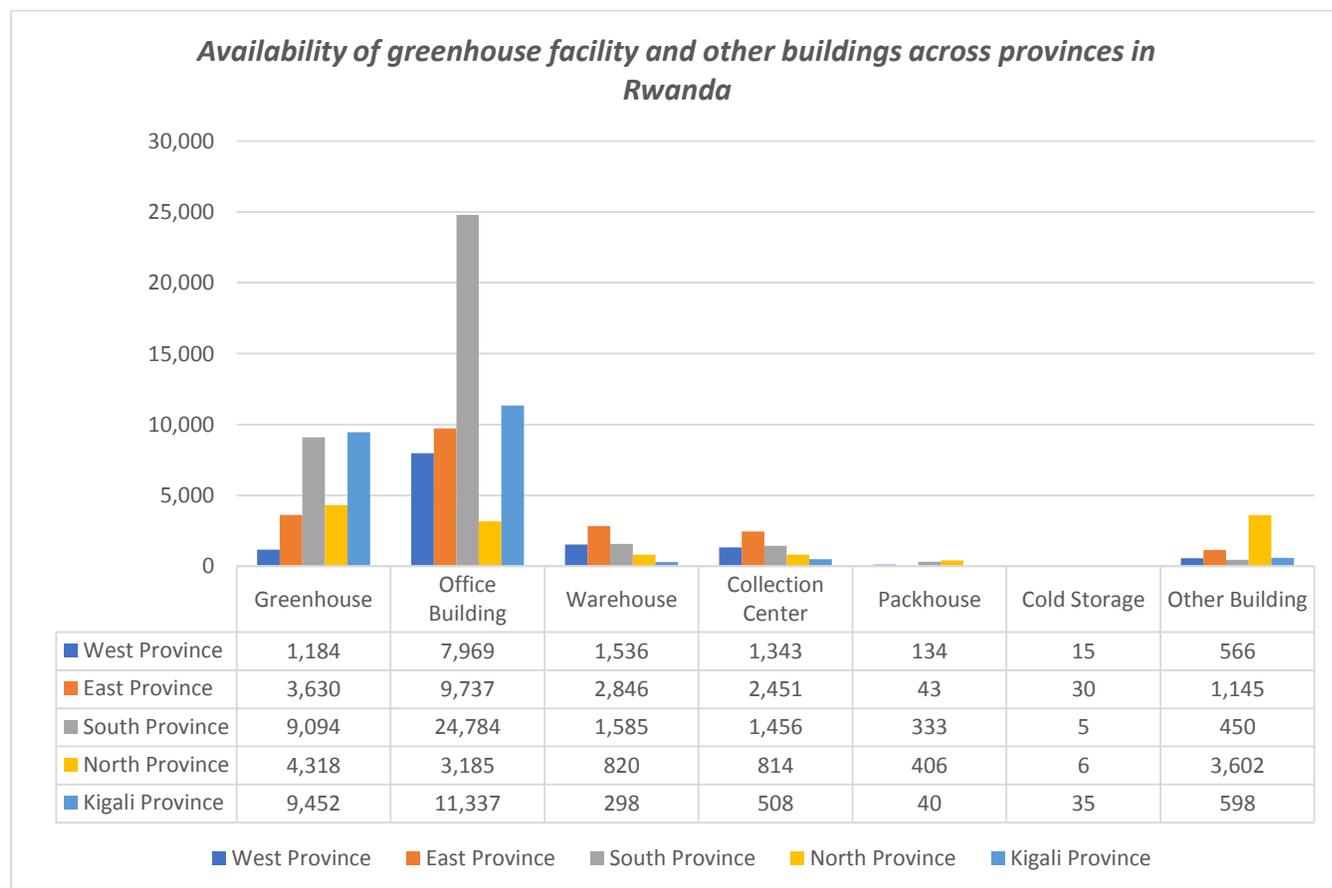
**Table 4. 5: Irrigation practices by provinces in cultivating tree tomato**

Province	Drip	Hand Delivered	Groundwater	By Gravity	Mechanical (Pumped)	Other methods	Mean
East	34.70%	23.80%	42.90%	40.00%	33.30%	20.00%	32.45%
South	24.50%	23.90%	42.90%	48.20%	25.80%	18.00%	30.55%
Kigali	22.40%	11.80%	0.00%	8.10%	17.20%	19.00%	13.08%
North	14.30%	16.10%	14.20%	1.00%	2.20%	17.00%	10.80%
West	4.10%	24.40%	0.00%	2.70%	21.50%	26.00%	13.12%
Mean	20.00%	20.0%	20.0%	20.0%	20.0%	20.0%	-

Source: Horticulture Processors Database, NAEB (2018)

Irrigation is one of the factors that impact tree tomatoes competitiveness due to climate changes. There are six ways available in Rwanda including: Drip, hand use, ground water, irrigation by gravity, pumped and other methods. According to table 4.8, computing the average, East province comes at the first place, they practice irrigation at 32.45% followed by 30.55 %, 13.12 % ,13.08% and 10.8 for South, West, Kigali and North respectively. This analysis found 20% mean of all irrigation practices. Tree tomatoes are irrigated by adjusting dripper, the reason why after realizing low tree tomatoes income generation in Eastern province, MINAGRI called tree tomatoes growers to adjust drippers, now Eastern from the table 4.3 drip is there at 34.7%. irrigating tree tomatoes by adjusting drippers increase quantity of production and good enough this leads to the first step of effective supply chain.

**Figure 4.5: Availability of greenhouse facility and other buildings across provinces in Rwanda**



Source: Horticulture Processors Database, NAEB (2018)

Figure 4.5 shows the availability of greenhouse facility and other buildings across provinces in Rwanda, and the distribution of storage and other buildings that help in tree tomatoes production and supply chain. The highest number is found in south province, 24,784 office buildings, 9,094 greenhouses followed by Kigali with 11,337 office buildings and 9,452 greenhouses. As one can see from the table, cold storage and packhouse buildings are few for all provinces and Kigali city. Other types available include warehouses and collection centers and other buildings. The reason behind south province to have 24,784 office buildings and 9,094 greenhouses is where RAB as Rwanda Agriculture Board is located, ISAR Rubona Rwanda Agriculture and Animal Resources Development Board Station had initiated different agriculture projects in south province including horticulture value chain development. The dataset does not help to quantify the availability of greenhouse facilities and other buildings specifically to tree tomatoes but what the

research noted is that those houses available help in effective supply chain of different kind of crops NAEB (2018).

## **Summary**

Section one describes and analyses the tree tomato cultivation and supply chain scenario in Rwanda, the research found Eastern province to have a big land size for fruits production with a total land size of 2530 ha, followed by western province with 520ha, northern province with 259 ha, south province with 296 ha and lastly Kigali province with 22 Ha. The available data do not specify how much land was under cultivation of tree tomatoes. There is gradually decrease in total production of Tree Tomatoes of 0.58, 0.32, 0.03, 0.07 and 0.58 for the year 2016, 2017, 2018, 2019 and 2020 respectively. Under this part, the research found Kigali having a big number of markets (6) compared to others, Western province comes have a big number of producers 284 compared to 274 in east, 260 in south, 202 in north and 107 in Kigali . The research found 6 processors in Kigali , 3 in North , East and West and 2 in South.

The research also found 11 types of fruits which are produced in Rwanda, 28.7% the farmers produced pineapple, 28 % tree tomatoes, 10.5 % passion fruits, 7.8% orange, 6.8% orange, 6.8% mango, 3.4% banana, 1% Lemon and Papaya, 0.7% strawberry. The production vis a vis those fruits in Kigali (1392500 kgs) (64.88%) of the total production of fruits across the country. North province comes at the second place with 645449 kgs (30.07 %) followed by south province with 79590 kgs (3.71%), western province 15740 (0.73%) and lastly eastern province 13092 (0.61%). Incomes generated was analyzed from Table 4.2, It is understandable that Kigali is noticeably low generated income from tree tomatoes production generated the lowest of 2,200,000 francs among the five provinces because of factors such as lower land size for agriculture practices also Kigali is an administrative and industry city, the reasons behind Eastern province to generate less income from tree tomatoes is explained by its agroecology and topography. According to table 4.8, computing the average, East province comes at the first place, they practice irrigation at 32.45% followed by 30.55 %, 13.12 % ,13.08% and 10.8 for South, West, Kigali and North respectively.

### 4.3. SECTION TWO: Determinants of the competitiveness of tree tomatoes supply chains

This section responds to the first objective of the study. After collecting the primary data, coding/ codifying them, entering them into the useful software (SPSS), cleaning and editing the data were analyzed as follows:

#### 4.2.2.1 Demographic presentation of the respondents

*Table 4.6: Distribution of respondents by provinces in Rwanda*

Provinces and the city	Number of respondents	Percentage to total
Kigali	7	12.5
Western	10	17.8
Eastern	12	22.3
Northern	14	24.5
Southern	13	23
Total	56	100

**Source: Primary data (2021)**

Table 4.9 presents the distribution of respondents by provinces in Rwanda. A quick glance of the table gives the image that it is a nation-wide study as the respondents spatially come across all provinces for the country. Out of the five provinces of Rwanda, Northern has the highest participants, 14 (24.5%) and Kigali city has the lowest number of participants, 7 (12.5%) of the 56 participants. The reason why Northern province has the highest and Kigali has the lowest province compared to other province is the availability big number of respondents as given by NAEB (This is clearly explained under methodology section), Northern has many tree tomatoes actors and Kigali has few. From this perspective, the quantitative measures gave full information about tree tomatoes production, processing, marketing and other related activities contributing to the supply chain competitiveness.

**Table 4.7: Distribution of respondents by gender**

<b>Gender</b>	<b>Number of respondents</b>	<b>Percentage to total</b>
Male	20	36
Female	36	64
Total	56	100

**Source: Primary data (2021)**

A well-designed tree tomatoes cultivation targeting competitive production could consider the role of gender in terms of role and responsibilities for men and women (CTA 2014) . This research found out that female out-competed males with 64% compared to 36%. The analysis here is that gender balance was not a priority, but the findings confirm what the director of RAB said “horticultural or agricultural sector does not require the physical capacity and what males, or females could contribute toward the tree tomatoes competitiveness”. However, tree tomato cultivation and distribution are female dominated business activity in Rwanda.

**Table 4.8: Distribution of respondents by highest level of education attained**

<b>Highest level of education attained</b>	<b>Number of respondents</b>	<b>Percentage to total</b>
Secondary	8	14.4
Bachelor’s degree	34	60
Masters ‘degree	14	25.6
Total	56	100

**Source: Primary data (2021)**

According to table 4.8, 14.4% of the respondents have secondary level of education, 60% have bachelor’s education level of education and 25.6 % have master’s degree. Having educated respondents is the evident of the effectiveness of sharing complete and valid information about tree tomatoes value chain competitiveness. As same those respondents own tree tomatoes business (Growers (producers), processors and marketers). The 60% bachelor’s holders 25.6 % master’s degree holders are good enough to identify the loopholes under tree tomatoes supply chain competitiveness and search for solutions.

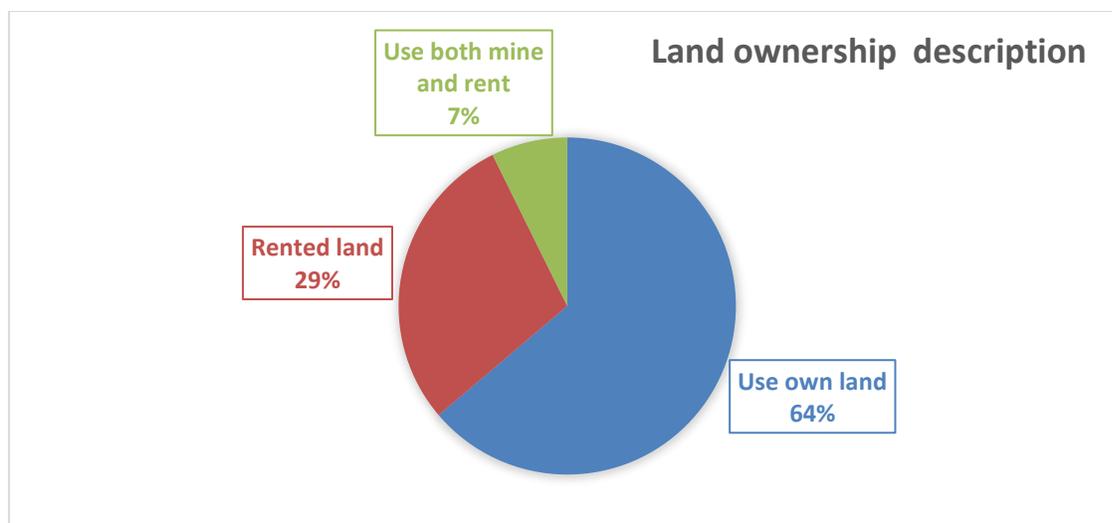
**Table 4.9: Respondents by age groups**

<b>Age groups</b>	<b>Number of respondents</b>	<b>Percentage to total</b>
18-24	2	2.8
25-29	2	4.1
30-34	2	4.2
35-39	22	39.6
40-44	15	26.1
45-49	5	9.5
50-54	5	8.6
55-59	3	5.1
60 and +	0	0

**Source: Primary data (2021)**

This research attracted various age-groups from 18 to 60 and + to participate in the research process. Most of the respondents 's age ranges between 35 - 39 at the rate of 39.6 % followed by those whose age ranges between 40-44 at the rate of 26.1%, the lower age group 18 – 24 is at 2.8% while there are no respondents whose age ranges from 60 and +. This confirms the assurance of the researcher about how accurate is the information collected as most of the respondent are mature enough and know more about tree tomatoes cultivation, supply chain and market management.

**Figure 4.6: Land ownership description by tree tomatoes farmers**



**Source: Primary data (2021)**

The question was about to know if the respondents cultivate tree tomatoes and then the status of ownership. Figure 4.6 shows that land ownership by tree tomatoes famers. 64% of the respondents said that they cultivate tree tomatoes in their own land, 29% rented the land while 7% responded that they produced tree tomatoes on both their own and rented lands. Lack of owning land undermining the returns to tree tomatoes famers because that renting a land contributes to the production costs, this limits them in terms of planting at big size targeting to harvest many kilos of tree tomatoes. The owners of land have an opportunity cost which contribute to effective use tree tomatoes capital. The money they may use to rent land is used to buy enough seeds and fertilizers so that they harvest many kilos of tree tomatoes. RAB (2017) reported that using seeds and fertilizers on individual own land contribute to horticulture competitiveness, RAB’s report does not quantify the level at which owing land and using seeds and fertilizers contribute to competitiveness of tree tomato cultivation.

**Table 4.10: Tree tomatoes by preferred color on the market from the perspective of respondents**

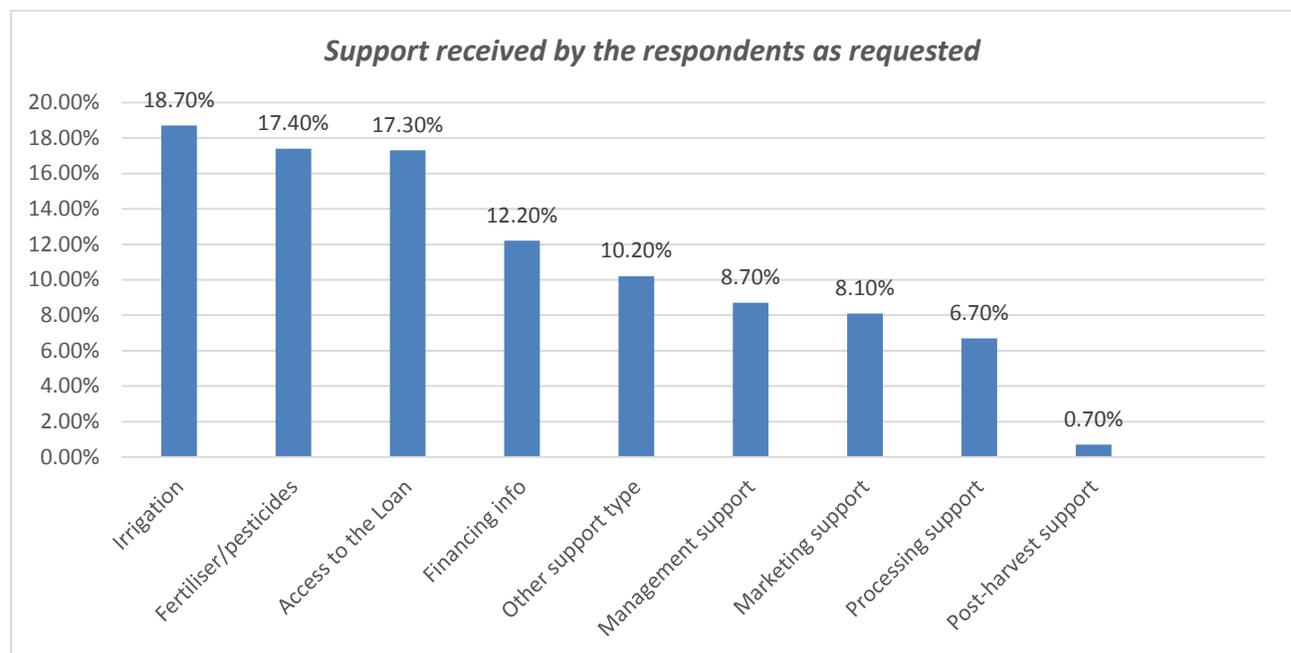
Tree tomatoes colors	Frequency	Percentage
Red	23	40.6
Orange	21	37.4
Yellow	12	22
Total	56	<b>100</b>

**Source: Primary data (2021)**

As the researcher referred to the color as one of the determinants of tree tomatoes preference on the market. the table 4.10, shows that 40.6 % of the respondents preferer to produce red coloured tree

tomatoes, 37.4% Orange and 22.0% Yellow. This means that red colored tree tomatoes are cultivated in expectation of immediate market compared to the rest of other colors.

**Figure 4.7: Support received by the respondents as requested**

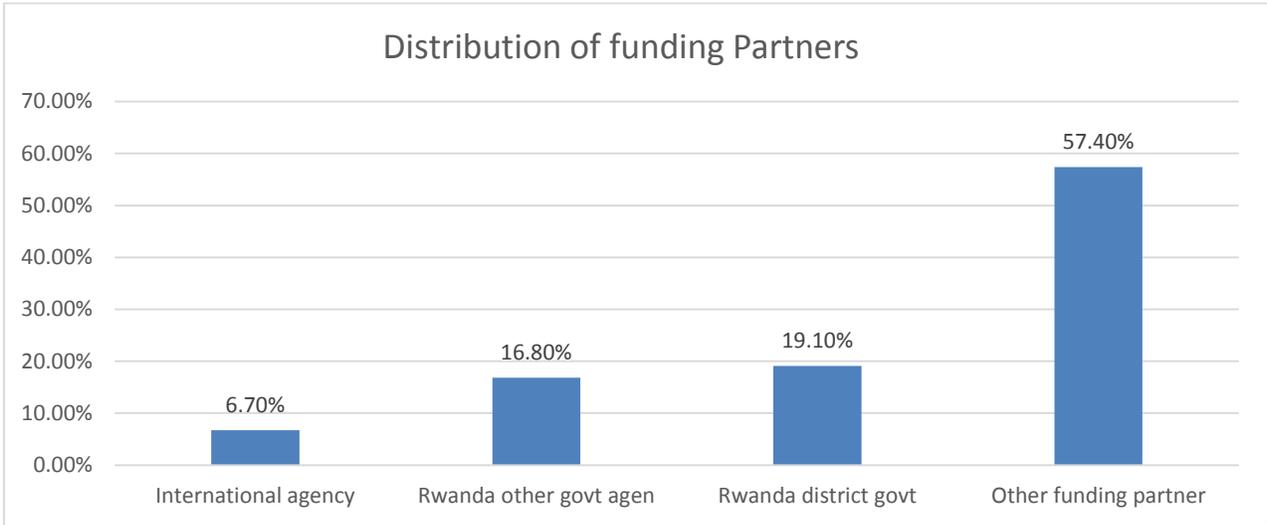


**Source: Primary data (2021)**

From the figure 4.7, one can see that irrigation is the primary support received as requested at the rate of 18.7%, fertilizers / pesticides come at the second place with 17.4 % followed by access to the loan, financing information, other types of support, management support, processing support and post-harvest support at the percentage of 17.3%,12.2%, 10.2%, 8.7%. 8.1%, 6.7% and 0.7 % respectively. Easy or

effective access to support when requested by the famers can help to build the completive value chain and thought sensitivity analysis, this research will quantify this variable.

**Figure 4.8: Respondents by the category of funding Partners**

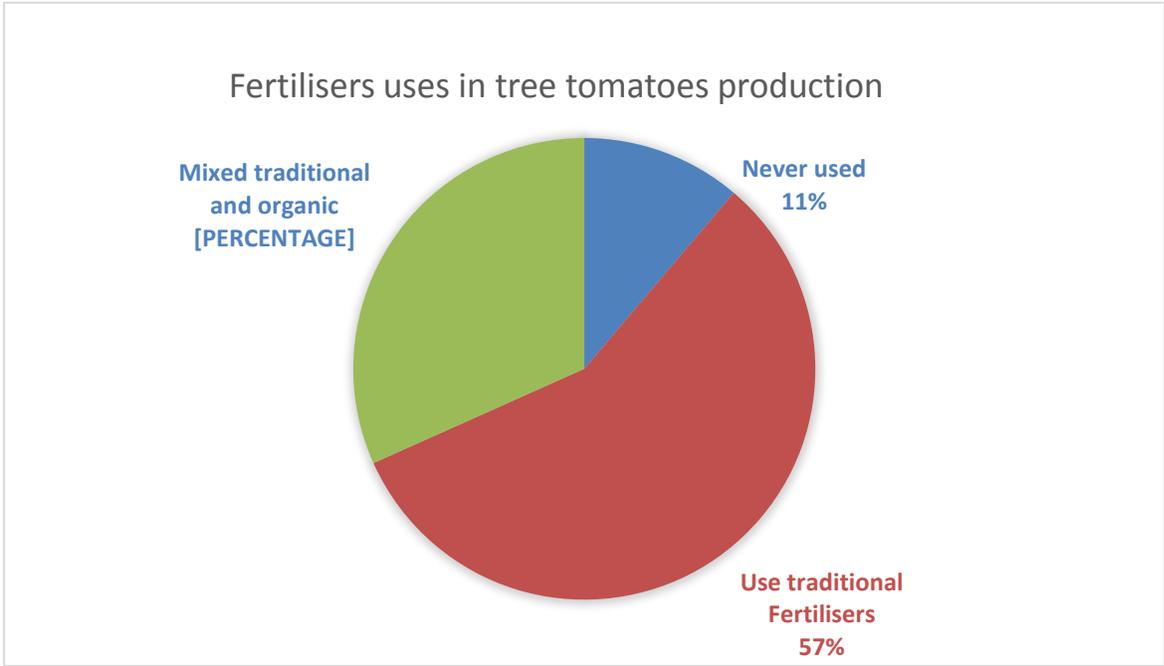


**Source: Primary data (2021)**

There exist different types of funding partners to the respondents as revealed in figure 4.8. Other funding partners constitute the highest rate of 57.4% followed by Rwanda districts partnered at 19.1%, Rwanda other government agencies at 16.8% and the international agency at 6.7%. It indicates that the government would come at the first place because it is the one which regulate agricultural production, processing, marketing and other related activities. If all funding partners increases their funding ration, tree tomatoes cultivation tomato supply chain competitiveness would be good enough because that

funding partners help in developing infrastructures, accessing the market, creating cooperative, developing market policies and providing training to tree tomatoes growers.

**Figure 4.9: Respondents by the use of fertilizers in tree tomatoes production**

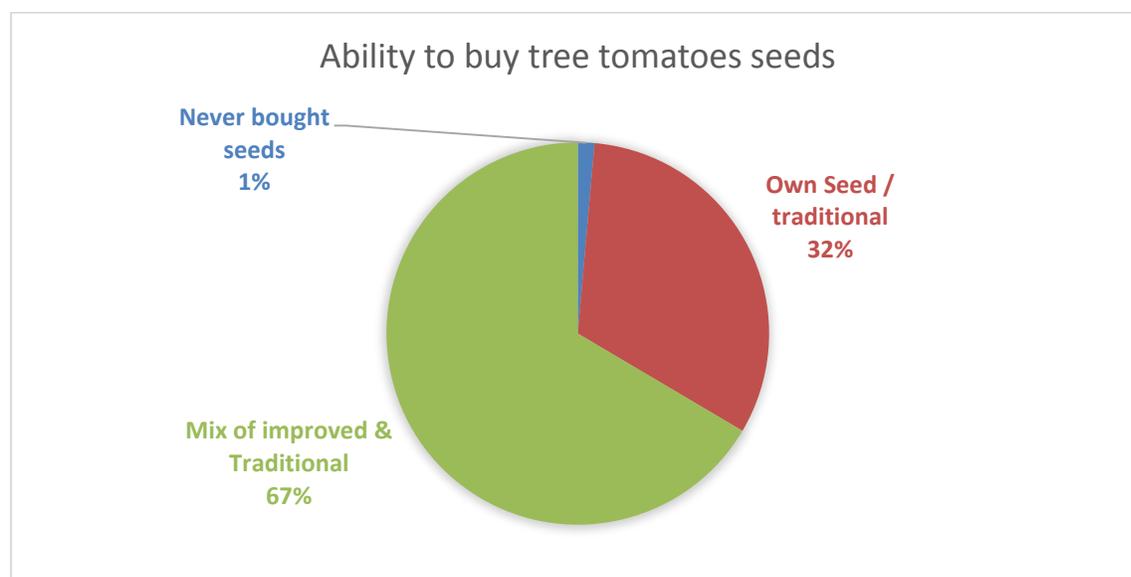


**Source: Primary data (2021)**

Figure 4.9 shows that Tree tomatoes famers use Traditional fertilizers at the rate of 57 %, 32% Mixed traditional and organic while 11% have never used fertilizers. Traditional fertilizers are kinds of organic fertilizer, tree tomatoes growers got it from livestock and developing compost same time. This mean that organic fertilizers are not used alone may be due to the desire of minimizing the costs. Inorganic

fertilizers 's usage is less in Rwanda because they are exported from abroad and the county is land locked so that transport costs are high.

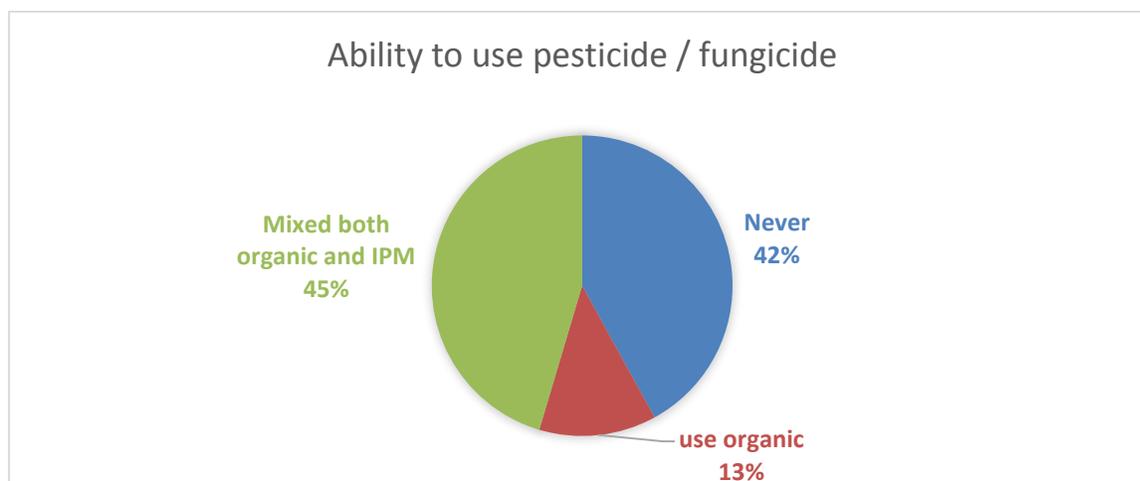
**Figure 4.2 : Respondents by the usage of kinds of tree tomatoes seeds**



**Source: Primary data (2021)**

As one can see from the figure 4.10, tree tomatoes seeds are, 32% of the respondents said that they use their own seeds / traditional, 67 % mix improved and traditional seeds and only 1% said that they have never bought seeds. The reason behind this one percent is that, some of the famers got the seeds as gifts from neighbors or from others as shown support distribution analysis.

**Figure 4.11: Ability to use pesticide / fungicide**



**Source: Primary data (2021)**

Due to some of the diseases that may attack tree tomatoes, and this undermines the production competitiveness, the research assessed the level at which pesticide / fungicide are used. Figure 4.11 shows that 45%, 42% and 12 % mixed both organic and integrated Pest Management, never used and organic respectively. The usage pattern of the pesticides/fungicides is a way to manage tree tomatoes growing without diseases attach as one way to enhance risk management with highest net return expectation. Tree tomatoes competitiveness requires efficient risk management with least cost production (CTA 2014).

**Table 4.11: Respondents by tree tomatoes market destinations**

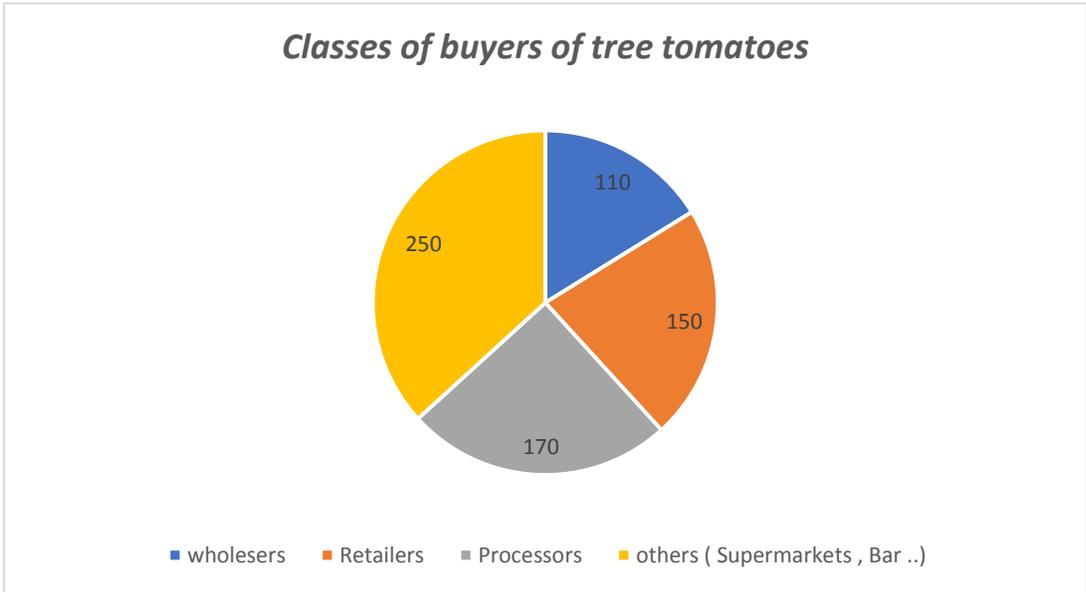
Markets Destinations	Kigali	South	West	North	East	Totals
Home districts	61.8	82.1	76.0	71.7	80.3	76.3
Home Province	9.9	8.0	5.5	6.4	4.3	6.4
Other provinces	11.6	2.0	3.5	4.2	2.2	3.7
In Kigali	16.6	7.1	9.9	15.5	12.6	11.6
African countries	-	0.8	4.9	1.9	0.3	1.8
Europe	-	-	0.3	0.4	0.4	0.2

**Source: Primary data (2021)**

Marketing is one of the factors that contribute to tree tomatoes competitiveness. The respondents were asked to reveal their tree tomatoes' market destinations. According to Table 4.11, the respondents sold tree tomatoes in their home districts, others in home provinces, other provinces, in Kigali, African countries and Europe. As by the data shown in the Table 4.14, the south province sold 0.8 % of tree

tomatoes in other African countries, western province 4.9 %, 1.9 % North province and 0.3 % by Eastern province. This is a lower percentage compared to the percentages sold locally.

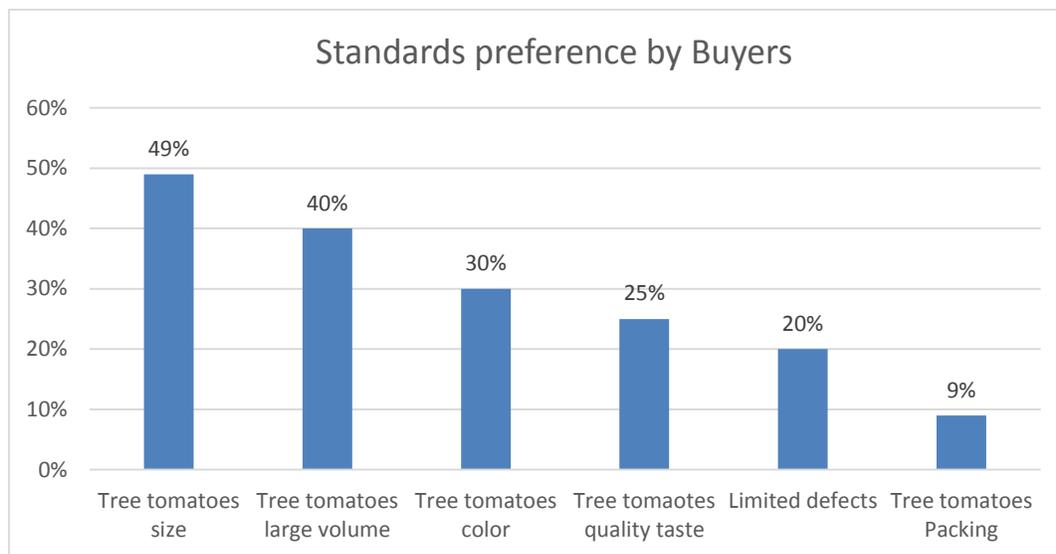
**Figure 4.3 :Respondents by the class of buyers of tree tomatoes**



**Source: Primary data (2021)**

According to figure 4.12, a big number of buyers are other category including Supermarkets, bar & Restaurants with a count of 250, 170 are processors, 150 retailers and 110 wholesales. The last ones are few while they are the ones who have ability to export the production.

**Figure 4.13: Respondents' perception of buyers' preferences, for tree tomatoes standards**



**Source: Primary data (2021)**

The respondents shared their views, as shown in figure 4.13 respondents said that 49 % of the buyers prefer tree tomatoes size. In terms of volume 40% prefer large volume, 30% prefer the color, 20% tree tomatoes with limited defects and lastly 9% prefer the way tree tomatoes are packed. The standards preference by buyers can be a base to decide about what can be joined and done to win the competitive market.

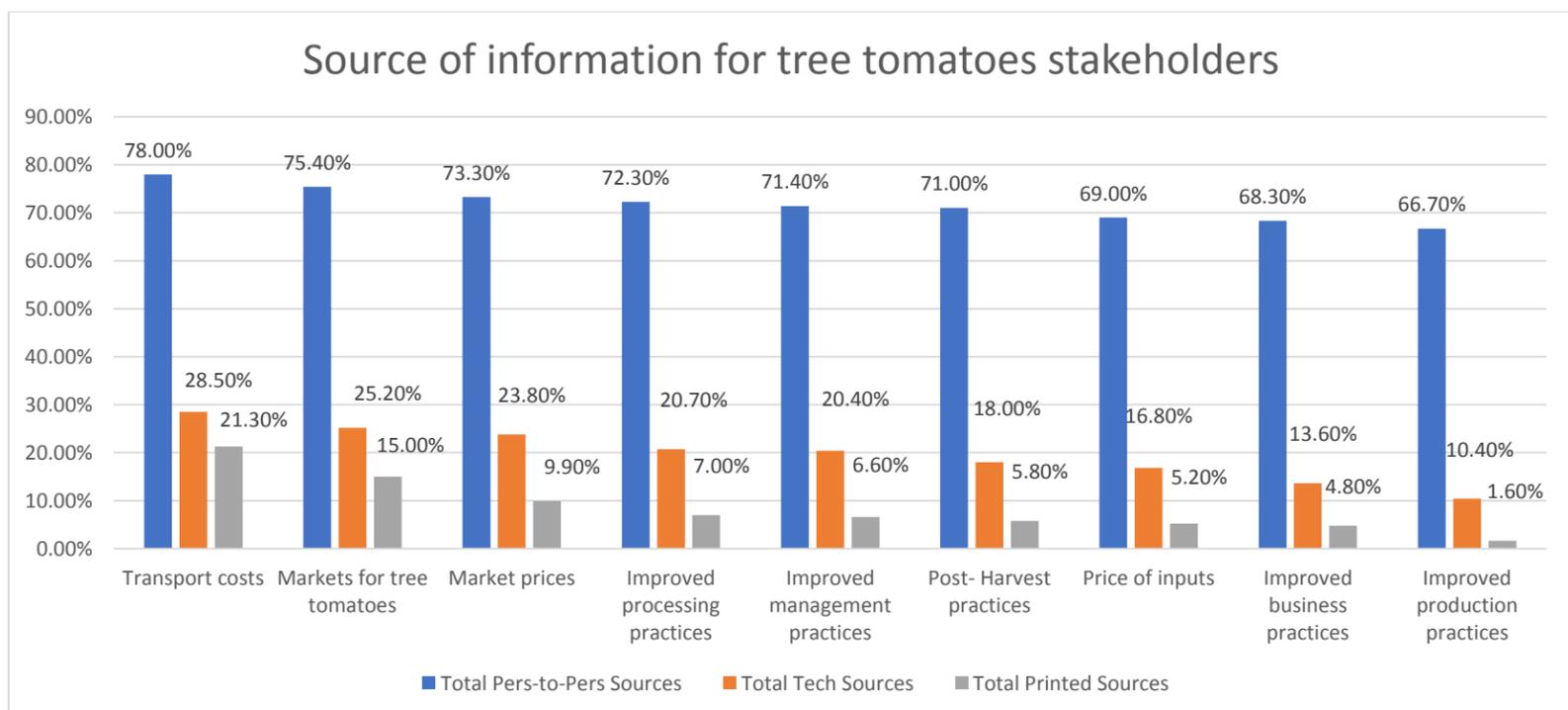
**Table 4.12: Availability of types of information by sources for tree tomatoes cultivation and management**

Sources	Type of Information by sources of availability (in percentages)								
	Improved production practices	Price of inputs	Post-Harvest practices	Improved processing practices	Transport costs	Markets for tree tomatoes	Market prices	Improved management practices	Improved business practices
<b>Total Tech Sources</b>	<b>28.50</b>	<b>25.20</b>	<b>12.80</b>	<b>20.40</b>	<b>10.80</b>	<b>16.70</b>	<b>15.80</b>	<b>20.70</b>	<b>23.80</b>
Radio	22.60	18.80	9.20	13.70	4.90	6.90	6.80	9.60	17.70
Television	1.00	0.70	0.60	2.00	0.20	0.40	0.50	0.30	1.80
Internet	0.70	0.30	0.90	1.70	0.20	0.60	0.50	0.50	2.30
Mobile phone	4.20	5.40	2.00	2.90	5.50	8.80	8.00	10.30	2.00
<b>Total Pers-to-Pers Sources</b>	<b>68.30</b>	<b>73.20</b>	<b>85.60</b>	<b>75.40</b>	<b>88.90</b>	<b>82.20</b>	<b>82.80</b>	<b>78.50</b>	<b>71.40</b>
Org. members	16.40	12.80	34.20	23.50	35.40	25.50	22.00	22.40	14.90
Friends/family	4.40	5.20	7.50	8.00	11.20	8.70	6.80	8.50	2.80
Other producers	13.20	14.80	17.70	15.20	25.50	25.10	25.20	23.80	12.30
Product sales agents	1.40	18.00	4.40	9.80	13.80	18.30	21.00	20.10	4.50
Extension agents	25.80	20.20	18.00	14.00	2.10	3.40	6.30	2.90	29.00
Project/NGO	7.00	2.10	3.90	5.00	0.90	1.20	1.50	0.90	7.90
<b>Total Printed Sources</b>	<b>3.20</b>	<b>1.60</b>	<b>1.60</b>	<b>4.20</b>	<b>0.30</b>	<b>1.10</b>	<b>1.40</b>	<b>0.80</b>	<b>4.80</b>
Extension publications	1.70	0.50	0.80	1.90	0.20	0.20	0.30	0.20	2.20
Commercial pubs	0.70	0.70	0.70	1.50	0.10	0.30	0.40	0.40	1.50
Newspapers	0.70	0.40	0.10	0.90	0.10	0.60	0.80	0.30	1.20

Source: Primary data (2021)

Table 4.12 shows different Sources of information and types of information received by tree tomatoes famers during last 3 years. Famers got tech sources of information, peer to peer sources of information and printed sources of information. From each type of information source, the table quantify total percentage for improved production practices, price of inputs. post- harvest practices, improved processing practices, transport costs , markets for tree tomatoes, market prices, improved management practices and improved business practices. For effective analysis the research figure 4.15 as flow:

**Figure 4.14: Source of information for tree tomatoes stakeholders**



Source: Primary data (2021)

Figure 4.14 presents the different types of information from their sources received by the respondents during last 3 years. Pers - to -pers sources comes at the first press to communicate about improved production at the rate of 28.5%. The information about the price of inputs with 78%, markets for tree tomatoes at 75.4%, market prices at 73.3%, Improved processing practices at 72.3%, improved management practices at 71.4%, post-harvest practices at 71%. 69% price of inputs, 68.3 improved business practices and 66.7 % improved production practices. In line with that information, the research by (Adekunle et al 2013) confirm that that having enough information can positively impact the value chain competitiveness since the information enable value chain development. To make this clearly, he pointed out that information is focal point of decision-making vis a vis local and regional development policies, sector policies, social infrastructure, research and development, training. advice on development of good agricultural, value additional to the production, implementation of market surveys, etc.

**Table 4.13: Respondents by sales volume collected from tree tomatoes in 2020**

Crop & Crop Group	Mean Volume of Sales (000.000 KG)	Mean Value of Sales (000.000 FRW)	Percent of Total Value of Sales (%)
Pineapple	3,793,914	1,457,790	26.20
Passion fruit	1,033,050	3,102,506	20.00
<b>Tamarillos</b>	<b>781,218</b>	<b>2,055,580</b>	<b>17.00</b>
Mango	124,990	456,736	10.20
Banana (fruit)	64,880	810,470	8.10
Strawberry	62,617	2,609,375	5.40
Other fruit	32,495	239,069	4.10
Avocado	24,603	120,489	3.10
Lemon	11,800	303,333	3.00
Orange	2,550	198,627	2.00
Apple	1,325	522,500	0.50
Papaya	1,116	27,417	0.30
Cape Gooseberry	1,000	125,000	0.10

**Source: Primary data (2021)**

To know the impact of tree tomatoes cultivation to farmers, the researcher asked to estimate the value in francs gained comparing to other fruits. All respondents estimated base on his experience whether he/she got when cultivating, buying form the market. The results are presented in table 4.13. The table 4.13 shows that tree tomatoes come at the at third place with 17% of the total sales volume of fruits marketed during the year 2020. This shows the likelihood to generate more money in case the competitiveness improved but it requires policy and investment to ensure that tree tomatoes famers increase the income from their production (Jennifer 2015) .

**Table 4.14: Respondents' opinions about factors that determine the competitiveness of tree tomatoes**

Factors Determining Competitiveness	Number of Respondents	Percentage to total
Effective information exchange (Production, processing and marketing)	13	23.7
Supporting us to get seeds, irrigation and fertilizers and pesticides	20	36
Get training support under cooperatives	10	17.8
Got control to minimize tree tomatoes production costing and pricing and rivalry cost	4	7.8
Get allowed Bargaining Power (Suppliers & Buyers)	4	7.6
Effectiveness policy (Threats Entrants)	3	4.7
Get help to do marketing locally and outside the country	1	2.4
Total	56	100

The researcher asked the respondents to list what they think can determine the competitiveness of tree tomatoes. The results are presented in table 4.14. 23.7% of the respondents listed that effective information exchange about how to produce, effective and efficient processing and marketing can contribute to tree tomatoes competitiveness. 36 % constituting a large percentage of respondents reported that once they got seeds, irrigation and fertilizers and pesticides support, their tree tomatoes production can be competitive. Also 17.8 % reported that once they get trainings about how professional they can produce tree tomatoes; this can help to produce the competitive tree tomatoes. 7.8%, 7.6 % ,4.7 % and 2.4 % listed that getting control to minimize tree tomatoes production cost, pricing and rivalry cost, allowed to maximize their bargaining power, complying to effective policies and get help to do marketing locally and outside the country respectively can contribute more to the tree tomatoes competitiveness. The listed factors are discussed together with other factors in discussion part of this thesis.

## Summary

Section two responded to the first objective of the study, starting from the demographic presentation of the respondents. Out of the five provinces of Rwanda, Northern has the highest participants, 14 (24.5%) and Kigali city has the lowest number of participants, 7 (12.5%) of the 56 participants. This research found out that female out-competed males with 64% compared to 36%. As presented under table 4.3, 14.4% of the respondents have secondary level of education, 60% have bachelor's education level of education and 25.6 % have master's degree. Most of the respondents 's age ranges between 35 - 39 at

the rate of 39.6 % followed by those whose age ranges between 40-44 at the rate of 26.1%, the lower age group 18 – 24 is at 2.8% while there are no respondents whose age ranges from 60 and +.

The land ownership is described by tree tomatoes farmers. 64% of the respondents said that they cultivate tree tomatoes in their own land, 29% rented the land while 7% responded that they produced tree tomatoes on both their own and rented lands. Reflecting to 40.6 % of the respondents prefer to produce red coloured tree tomatoes, 37.4% Orange and 22.0% Yellow, red colored tree tomatoes are cultivated in expectation of immediate market compared to the rest of other colors.

This section also present funding partners to the respondents, the highest rate of 57.4% followed by Rwanda districts partnered at 19.1%, Rwanda other government agencies at 16.8% and the international agency at 6.7%. Tree tomatoes farmers use Traditional fertilizers at the rate of 57 %, 32% Mixed traditional and organic while 11% have never used fertilizers. The figure 4.10 present tree tomatoes seeds usage, 32% of the respondents said that they use their own seeds / traditional, 67 % mix improved and traditional seeds and only 1% said that they have never bought seeds. Figure 4.10 shows that 45%, 42% and 12 % mixed both organic and integrated Pest Management, never used and organic respectively. Marketing is one of the factors that contribute to tree tomatoes competitiveness, South province sold 0.8 % of tree tomatoes in other African countries, western province 4.9 %, 1.9 % North province and 0.3 % by Eastern province. This is a lower percentage compared to the percentages sold locally.

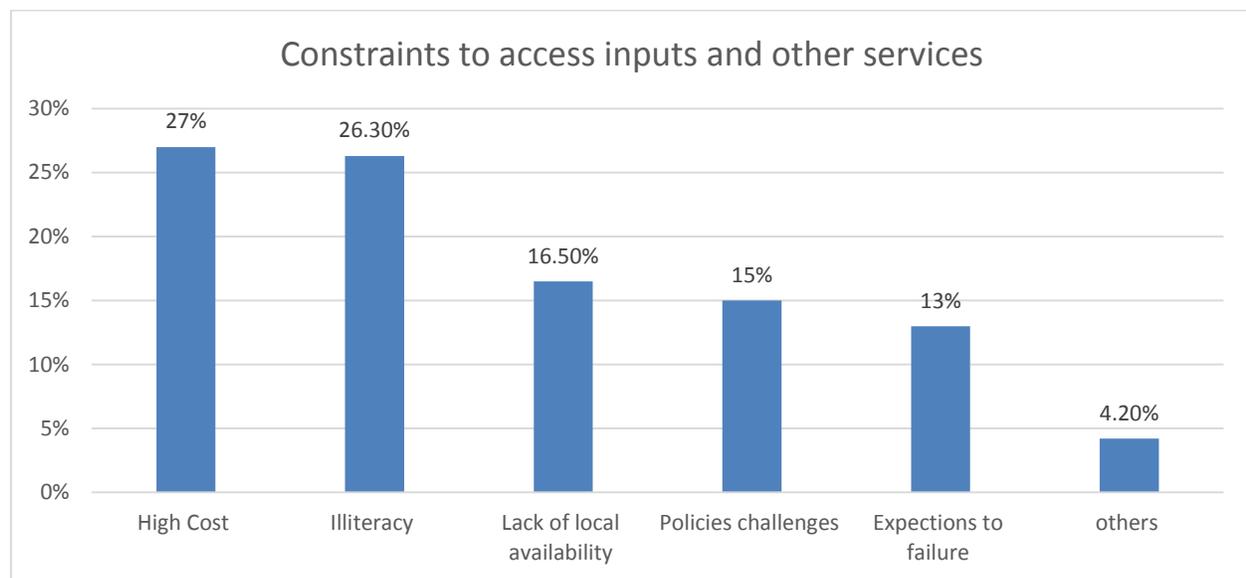
According to figure 4.12, a big number of buyers are other category including Supermarkets, bar & Restaurants with a count of 250, 170 are processors, 150 retailers and 110 wholesales. Respondents' perception of buyers' preferences, for tree tomatoes standards, 49 % of the buyers prefer tree tomatoes size. In terms of volume 40% prefer large volume, 30% prefer the color, 20% tree tomatoes with limited defects and lastly 9% prefer the way tree tomatoes are packed. different types of information from their sources received by the respondents during last 3 years was assessed and found that pers - to -pers sources comes at the first press to communicate about improved production at the rate of 28.5%. The information about the price of inputs with 78%, markets for tree tomatoes at 75.4%, market prices at 73.3%, Improved processing practices at 72.3%, improved management practices at 71.4%, post-harvest practices at 71%. 69% price of inputs, 68.3 improved business practices and 66.7 % improved production practices.

The last question under section asked the respondents to list what they think can determine the competitiveness of tree tomatoes. 23.7% of the respondents listed that effective information exchange about how to produce, effective and efficient processing and marketing can contribute to tree tomatoes competitiveness. 36 % constituting a large percentage of respondents reported that once they got seeds, irrigation and fertilizers and pesticides support, their tree tomatoes production can be competitive.

#### 4.4 SECTION THREE: Challenges facing by tree tomatoes’ farmers

Section three of this thesis highlights the challenges to farmers of tree tomatoes in making their supply chains competitive. Respondents were required to list them; the research quantify them and analyzed in the following paragraphs.

**Figure 4.4: Constraints to access inputs and other services**



**Source: Primary data (2021)**

Figure 4.16 quantifies the constraints to access inputs and other services. The respondents reported that 27% of those are too expensive (High cost), 26.3 % illiteracy about tree tomatoes productions, 16.5 % lack of local inputs availability, 15% policies challenges, 13% expectations to business failure and 4.2% for others. Tree tomatoes cultivation to be competitive requires adequate to access inputs, equipment and services. As shown by the figure 4.16 challenges of high costs are for seeds, organic and commercial fertilizers, pesticides , illiteracy is lack of skills required to grow tree tomatoes, illiteracy leads to poor

quality production, use of inappropriate varieties and fertilizers, lack of local market availability leads to low prices reduce future capital for investment and re-investment, policies challenges and expectations to failure are in line with treat of new entrance and lack of power of in inputs suppliers which confirm what (CTA 2014) reported “In many countries famers are constrained by the price of inputs through price ceiling and other controls which limit the competitiveness of their production in one way”. Others (4.2%) includes tree tomatoes cold storage equipment / facilities, packing materials and equipment, transportation and market info for tree tomatoes.

**Table 4.15: Challenges vis a vis accessing pesticides in future by tree tomatoes farmers**

Challenges	Number of Respondents	Percentage
Other challenges	15	26.1
High quality standard	12	22
Certification	8	13.7
lack of packing materials	6	11.4
Lack of market information	5	8.4
Poor infrastructure	5	8.3
Price competition	4	6.8
Distance to market	2	3.3
Totals	56	100

**Source: Primary data (2021)**

Other challenges include economic short down (inflation issues), respondents reported also that they do not involve in policies formulation (No never asked them about what they think can be included), climate change, lack cultural to conduct researches and have access to recommendation and lower level of experts’ collaboration.

According to table 4.15, there are different kind of challenges (titled other challenges) facing by tree tomatoes famers which count (15) 26.1% those includes inadequate processing facilities, lack of adequate clean planting material, lack of cutting or seeds from local planted trees , This may lead to disease transfer of diseases if cuttings or seed are obtained from unhealthy plants, and rain fed growing of tamarillo needs grass for mulching which is also not very easy to find by small holder farmers due investment capacity. Further the table 4.18 shows 22% of the respondents are challenged by high quality standards requirements, 13.7% certification, 11.4% lack of packing materials, 8.4 % lack of market information, 8.3% poor infrastructures, 6.8% price competition and 3.3% distance to the market. challenges of long distance and poor market undermine tree competitiveness supply chain because those

impact to meet market price and to attract wholesalers and retailers who involve in tree tomatoes business.

## **Summary**

In summary, section three reveals the challenges that the respondents are facing include; for 27% of respondents, inputs are too expensive (High cost), 26.3 % illiteracy about tree tomatoes productions, 16.5 % lack of local inputs availability, 15% policies challenges, 13% expectations to business failure and 4.2% for others. Tree tomatoes cultivation to be competitive requires adequate to access inputs, equipment and services. Also, tree tomatoes famers which count (15) 26.1% those includes inadequate processing facilities, lack of adequate clean planting material, lack of cutting or seeds from local planted trees, this may lead to disease transfer of diseases if cuttings or seed are obtained from unhealthy plants, and rain fed growing of tamarillo needs grass for mulching which is also not very easy to find by small holder farmers due investment capacity.

## **4.5 SECTION FOUR: Answers to the research questions and testing of the relationship between independent and dependents variables.**

### **4.5.1 Review the findings, whether aligned to the research objectives or not**

After reviewing the research findings, the researcher confirmed their alignment to the research objectives. The first objective was to establish the determinants of tree tomatoes value chain competitiveness, through primary data provided by NAEB (2018) the findings aligned this research objective by showing the picture of all fruits production under which the part of tree tomatoes was focused particularly. Also, through the secondary data collected from 56 respondents, the research findings aligned this research objective by reflecting to the research questions answered, this confirms the existence of the determinants of tree tomatoes value chain competitiveness. the second objective was to analyze the trends in the value chain competitiveness of tree tomatoes in Rwanda. The research findings are aligned to this second research objective due to the fact that the available data facilitated to answer the research question that subject to this second research objective. The findings show a gradual decrease if tree tomatoes production. the findings also are aligned to research objective titled to find out the challenges facing by actors in tree tomatoes value chains in Rwanda because the respondents confirmed the existence of those challenges and listed theme as used to answer the research question hypothetically.

#### 4.5.2 Relationship between independent and dependent variables

Section four deals with the relationship between independent and dependent variables of the study and clarifies the research questions with evidence-based answers. This research performed regression analysis to know the behavior of the model.

**Table 4.16: Model Summary output**

Regression Statistics					
Multiple R	0.979				
R Square	0.96				
Adjusted R Square	0.94				
Standard Error	9.713				
Observations	73				

ANOVA					
	df	SS	MS	F	Significance F
Regression	6	144926.481	24154.414	307.228	0.000
Residual	67	6321.079	94.344		
Total	73	151247.560			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%
Intercept	22.755	10.455	-2.176	0.033	-43.623
Inputs (seeds & fertilizers)	1.752	0.814	2.152	0.035	0.127
Pesticides/fungicides (kgs /litters)	0.006	0.004	1.663	0.101	-0.001
Processed tree tms in(100kgs)	-0.049	0.041	-1.191	0.238	-0.131
Employment over time (1000)	0.046	0.022	2.104	0.039	0.002
Finance in (100,000 RWF)	0.000	0.000	19.982	0.000	0.000
Marketed (Y=1/N=0)	0	0.000	65535.000	#NUM!	0

**Source: Primary data (2021)**

Table 4.16 titled model summary shows Adjusted R squared which is the coefficient of the determinant. Adjusted R Square tell us the variation in the dependent variable due to change in independent variables, from the table 4.19 Adjusted R Square is 0.94, due to the fact that Adjusted R Square is not 100% more variable can explain the income that is generating form tree tomatoes and that model is adequate though another meaning of Adjusted R Square ( 0.94) is that 94 % change is income generated from tree tomatoes could be accounted by Inputs (seeds & fertilizers) , pesticides/fungicides, tree tomatoes processing , Employment over time and Financing tree tomatoes growers . base on table 4.19 findings

one can also say that there is a strong positive relationship between the study variables marked by  $R = 0.94$ .

The table 4.16 has a part of ANOVA test which shows a p-value of 0.000 less than alpha (5%), the significance level. This means the given data fit well with the multiple regression model. Decision may be based on the comparison of F-calculated (Fisher value) and F-tabulated. The calculated value was greater than the critical value ( $307.228 > 3.01$ ) an indicator that Inputs (seeds & fertilizers), pesticides/fungicides, tree tomatoes processing, Employment over time and financial provision significantly influence tree tomatoes income generation. The significance value was less than 0.05, an indication that the model was statistically significant.

Another part of the table 4.169 shows the coefficients. those helps to establish the regression equation,  $Y = 22.75 + 1.75X_1 + 0.006X_2 + 0.049 X_3 + 0.046X_4 + 0.0014X_5$  .  $X_1$  stands for inputs (seeds & fertilizers),  $X_2$  for pesticides/fungicides,  $X_3$  for processed tree tomatoes (kgs),  $X_4$  employment over time and  $X_5$  for Finance in (100,000 RWF). From this equation, one can reveal that holding inputs (seeds & fertilizers), pesticides/fungicides, tree tomatoes processing, Employment over time to a constant zero, income generated from tree tomatoes would be 22.75. Indeed, this intercept means that having another variable equal to zero, income generated from tree tomatoes will be 22.75. The coefficient under the model means that one unit increase inputs (seeds & fertilizers) would leads to the income generated from tree tomatoes by a factor of 1.75, a unit increase in pesticides/fungicides would lead to increase in income generated from tree tomatoes by a factor of 0.006, a unit increase in processed tree tomatoes (kgs) would lead to increase in income generated from tree tomatoes by a factor of 0.049, a unit increase in Employment over time ( number of employees) would lead to increase in income generated from tree tomatoes by a factor of 0.046 and lastly , one unit increase in Finance received by tree tomatoes growers would lead to increase in income generated from tree tomatoes by a factor of 0.0014 . From all those variables the P- value is less than 0.05, which indicate that all the variables are statistically significant in influencing income generated from tree tomatoes. The research assumes that the high the income generated from tree tomatoes the better the tree tomatoes supply chain competitive.

Base on the fact that all the variables are statistically significant, Inputs (seeds & fertilizers), pesticides/fungicides, tree tomatoes processing, employment over time and financial provision are found as the determinants of competitiveness of Tree Tomato Value Chain in Rwanda.

### **4.5.3 Validation of theoretical framework**

The theoretical framework of this research valid due to the relationship found between the independent and dependent variables. A well build tree tomatoes value chain has a positive Tree tomatoes competitiveness due to the positive signs found under this research regression model. The increase in one unit to the variables including Inputs (seeds & fertilizers), pesticides/fungicides, tree tomatoes processing, employment over time and financial provision over time cause a positive impact to Tree tomatoes competitiveness. The sub dependent variable was realized to be the main drivers of respondents during the challenges elaboration. this is also the fact to validate the valid of the theoretical framework one side because the respondents listed the challenges related Information exchange, Tree tomatoes quality, Tree tomatoes production costing and pricing, Rivalry cost, Bargaining Power (Suppliers & Buyers), Threats (Entrants & Substitute products) and Turnover.

## **CHAPTER 5. SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **5.0. Introduction**

This chapter presents the summary of major findings, the conclusions derived from the study and recommendations suggested to MINAGRI, RAB and NAEB based on research findings of the study on Determinants of competitiveness of tree tomato value chain in Rwanda. Apart from highlighting recommendations for improvement, this chapter also outlines recommended topics for further research.

### **5.1. FINDINGS**

The study titled determinants of competitiveness of tree tomato value chain in Rwanda had 3 main objectives: to establish the determinants of tree tomatoes value chain competitiveness, to analyze the trends in the value chain competitiveness of tree tomatoes in Rwanda and to find out the challenges facing by actors in tree tomatoes value chains in Rwanda.

Before presenting the findings about those three objectives, the research assessed the status of fruits production in Rwanda and found that the total land on which tree tomatoes are cultivated and found 3627 Ha on which the production is 91293 tonnes. 1127 produces involves in horticultural with 17 processors and 14 marketers across the country. There are 11 types of fruits that are producing in Rwanda and those includes pineapple, tree tomatoes, passion fruits, orange, orange, mango, banana, Lemon and Papaya both, and strawberry.

Horticultural production was processed 1392500 kgs in Kigali, 645449 kgs in North province, 15740 kgs in western province and 13092 in eastern province. All horticultural production generated 1,081,250,000 francs and tree tomatoes comes at the third place generating 318,615,000 francs. The available dataset also shows the irrigation practice and by analysis, the research found methods available in Rwanda including: Drip, hand use, ground water, irrigation by gravity, pumped and other methods. Also, there the reach found greenhouse availability and other buildings for horticultural production, the figure four presented a distribution of greenhouses available in each province, office building, warehouse, collection centres, pack houses, cold storage and other types of buildings.

Briefly, the study vis a vis the first objective revealed seven main determinants of tree tomatoes competitiveness and those includes effective information exchange about how to produce, effective and efficient processing and marketing ,Getting seeds, irrigation and fertilizers and pesticides support , getting control to minimize tree tomatoes production cost, pricing and rivalry cost, allowed to maximize their bargaining power, complying to effective policies and get help to do marketing locally and outside the country .

As the second objective was to analyze the trends in the value chain competitiveness of tree tomatoes in Rwanda, the study found that the study interested first to know the total land on which tree tomatoes are cultivated and found 3627 Ha, that is Eastern province: 2530 ha, western province with 520ha, northern province with 259 ha, south province with 296 ha and Kigali province with 22 Ha. To this land, during the last three years, the country produced 91293 tonnes, that is 23507 for the 2016, 18811 tonnes, 16191 tonnes, 15404 tonnes ,15985 tonnes for the years 2017, 2018, 2019 ,2020 and for January 2021 respectively.

The third objective was about to find out the challenges facing by actors in tree tomatoes value chains in Rwanda and the research found that tree tomatoes famers are facing different kind of challenges. but specifically, they are challenged by high quality standards requirements, certification, lack of packing materials, lack of market information, poor infrastructures, price competition and distance to the market. The research also found some other changes reported by the respondents and those includes High-cost high cost of inputs, the illiteracy about tree tomatoes productions, lack of inputs locally, policies challenges, fear tree tomatoes business to failure and others.

## **5.2 Discussions**

### **5.2.1 The determinants of tree tomatoes value chain competitiveness**

The respondents listed Effective information exchange about production, processing and marketing, supporting them to get seeds, irrigation and fertilizers and pesticides, get training support under cooperatives, got control to minimize tree tomatoes production costing and pricing and rivalry cost, get allowed Bargaining Power (Suppliers & Buyers), have Effectiveness policy (Threats Entrants) and Get help to do marketing locally and outside the country. This first confirm what CTA (2014) report: Farmers have never been able to get an opportunity to interact and share information (CTA 2014) on one side and to help preserve moisture in the soil and it can also be a strategy to suppress weeds, as other soil management techniques. All those factors explain the key a key framework for understanding how inputs and services is brought together and then used to grow, transform, or manufacture a product; how the product then moves physically from the producer to the customer; and how value increases along the way.

The literature review revealed different methods that can lead to tree tomatoes competitiveness including the willingness to adopt innovative timing approaches, this is not mutually exclusive since true the training that our respondents report as one of tree tomatoes competitiveness, they may end up innovating as after training they make sure about the awareness of the new methods or bring something that doesn't exist in the market.

### **5.2.2 Trends in the value chain competitiveness of tree tomatoes in Rwanda**

Analysing the trends in the value chain competitiveness of tree tomatoes in Rwanda, we found a gradual decrease in production. This shows a gap in compliance of five activities as pointed out by bopinc (2020). According to him the tree tomato value chain analysis is made of up five activities, and those are: diagnose, mission and workshop, design and final reporting, support and implementation, and monitoring. If diagnose were respected time by time, the current situation of the value chain and supply chain would be responded by tree tomatoes actors. Also, they would be workshops missioning to report the issues early possible so that they get support from regulators and other concerned stakeholders.

### **5.2.3 The challenges facing by actors in tree tomatoes value chains in Rwanda**

This research found a number of constraints that impact tree tomatoes competitiveness, at the first place, there are constraints to access inputs and other services (High cost, illiteracy, lack of local availability, policies challenges, expectations to failure in future and others). there are also challenges which impact the famers to access the market (High quality standards, hard to get a certification, lack of packing materials, lack of market information, poor infrastructures and long distance to the market. This confirms what Deval (2016) has pointed out. According to him, there are many challenges including insufficient knowledge and lack of access to new technologies and process innovations limit the adaptability and competitiveness of value-chain actors. Having reciprocal information can help to have effective consumer – Producer rivalry, consumer – consumer rivalry, producer – producer rivalry and government and the market. Each rivalry among the above serves as a disciplining device to guide the market process and it is good to meet performance challenges removal as it is the competing interests of both consumers and producers.

## **5.3 CONCLUSION**

### **5.3.1 The determinants of tree tomatoes value chain competitiveness**

This research concludes that the determinants of tree tomatoes value chain competitiveness in Rwanda includes the role of information sharing between all tree tomatoes stakeholders, then effective access to the finance as this help in doing the preliminary including (getting land , seeds and pesticides , pay contribution to irrigation as government program requires a partial contribution to get a facility in irrigation) ,Provide trainings , allowing the stakeholders in policy formulations because through policies which are research based they are no treat of new entrance, and all bargaining power are effective , the last conclusion about the determinants of tree tomatoes competitiveness is to respect of value chains activities (production marketing and provision of after-sales service.

### **5.3.2 Trends in the value chain competitiveness of tree tomatoes in Rwanda**

Secondary, the research concludes that the trend of tree tomatoes production is not good enough to satisfy the market, the research found a gradual decrease in production. the challenges that listed by the responds come at the first place to explain this issue but also this research conclude the issues of maximizing data records. if they were a long time series for at least 10years, the research may perform some other analysis to see if there a chock and analyse when it may die. also, if they were dataset which includes many variables, the research may perform sensitivity analysis to which variable that would have influence to tree tomatoes competitiveness more than others.

### **5.3.3 The challenges facing by actors in tree tomatoes value chains in Rwanda**

The study concludes that there are a number of changes facing by the tree tomatoes actors. Starting from the sector in general, there are issues concerning pests and diseases. this is in touch with issues of climate changes under which tree tomatoes production may be undermined by erratic rainfalls. The study also confirms that there are issues of insufficient knowledge and lack of access to new technologies and process innovations as well as issues of accessing the finance. The Financial constraints affect the sector particularly at the rime of acquiring required inputs and at the post-harvest stage. Also Access to finance is a big challenge, especially for young agronomists willing to start a business in horticulture. Reflecting to what Scielo (2020) as well as respondents said, the availability of packaging material is limited in Rwanda. Challenges are many but the research conclude that they can be controlled. the study recommends about control strategy in our next pages.

## 5.4 Recommendations

### 5.4.1 Recommendation for improvement

This research recommends NAEB and RAB to help in improving the determinants of tree tomatoes value chain competitiveness by focusing on making policies based on research conduct findings, this will open doors to adopt tree tomatoes agricultural technology, which will be a first step to implement the French Systematic Method (approach which emphasizes the inputs and outputs between firms), this also will help to deal with agricultural risks and to respond to the insufficient knowledge and lack of access to new technologies and processes that innovations limit the adaptability and competitiveness of value-chain actors. It is not only the above since technology can contribute to the market information exchange reciprocally so that to boost up the business relations as well how productive activities are brought into harmony with the demand for goods and services through some organizing mechanism such as free market, and how variations and imperfections in the organizing mechanism affect the success achieved in satisfying an economy's wants (SCP model by Scherer & Ross, 1990).

The research continues to recommend the below:

- ✓ Introduce technology in tree tomatoes. There is a need to set up a tree tomatoes growing management information system to support communication between producers, processors as well as other stakeholders. Having direct access to the information can be one pillar and first step to provide responses to challenges facing by tree tomatoes growers. Technology on the other side can help in irrigation.
- ✓ The government and other supporters should help in placing fresh graduates with tree tomatoes growing relevant educational background to help in organizing specific needed practical short courses on tree tomatoes and fruits production, processing and marketing to address the issues of illiteracy, and other challenges that need educated persons.
- ✓ NAEB, MINAGRI and RAB should collaborate with other relevant government institutions in charge of developing and enforcing food safety regulations to see how to intervene better. Tree tomatoes growers need to be well informed on the benefits of being certified, which certificates are needed, what are the requirements and how to apply to such certificates. The issue of certification is among other challenges raised by most of respondents.

- ✓ Academic and research institutions, Universities have staff who may be familiar and know how to solve some of the issues that tree tomatoes and fruits processors face. However there seem to be no collaboration as reported by the respondents. such collaborations will have a channel of communication through to share problems and propose solutions. Academic institutions and other tree tomatoes stakeholders can put in combined efforts for the development of specialized training programs and courses to provide technical expertise on processing optimization, technology and production, cold storage warehousing and distribution aspects, maintenance of equipment.
- ✓ Encouraging or interesting private investors into setting up packaging manufacturing factories by letting the potential investors know the market demand in packaging materials (types, sizes). This will result in a dynamic packaging supply chain in the country which will not only solve the existing packaging material problem but also encourage exporting products that are packaged to the international standards.
- ✓ Transportation of raw materials is conducted in sacks, bags, baskets and to a very less extent in wooden and plastic crates. While use of wooden crates may be appropriate, there is need to further improve on handling of tree tomatoes and other fruits during transportation to avoid spoilage. As recommended the government to intervene in building infrastructures to facilitate transport. Extra investment is also required to purchase plastic crates but this cost can be off set over time due to reduced postharvest losses and high quality of produce delivered.

Providing the responses to challenges found by this research will be a good tool to improve the determinants of tree tomatoes competitiveness as also the Neo-Institutional Approach advises ( removing the humanly value chain constraints is a key tool to build the structure political, economic and social interactions to build agricultural vale chain) and providing supports actors in activities like the production of training materials, establishment of quality infrastructure boost production and productivity, as well as quality of the tree tomatoes .

#### **5.4.2 Recommendation for further studies**

This research recommends other researchers to conduct the studies about;

- 1.To conduct the impact evaluation for tree tomatoes agricultural interventions
2. Analysis of postharvest handling of fresh fruits prior to processing in Rwanda

3.The contribution of infrastructure and better supply chain planning in fruits production performance in Rwanda

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Appendix

GASENGAYIRE Solange

MBA FINANCE

UR CBE GIKONDO CAMPUS

Student N<sup>o</sup>: 219015151

Phone: 0785808243

Cell phone: +250788682971

E-mail: [gasengsolange2020@gmail.com](mailto:gasengsolange2020@gmail.com)

September, 2020

**Re: Thesis questionnaire fulfillment Request**

Dear Respondents,

With address missioned on this letter, I am carrying out a research titled determinant of competitiveness of tree tomato value chain in Rwanda. As we talked on our portable telephone, I got your contact mail as well the telephone from RAB, it is therefore in this regard that I am humbly requesting to fill the attached questionnaire and I am assuring that the information you provide on this questionnaire will be used for academic purpose only.

Thank you for your good collaboration

Sincerely,

GASENGAYIRE Solange

## Tree tomatoes stakeholders 's Questionnaire

### PART I. Survey information

Please list tell me about your socio – demographic and your education level

<b>Q1. Province or city (Please put v on the province or city you are located in</b> Kigali Western Eastern Northern Southern	<b>Q2. Sex</b> M 01 F 02	<b>Q3. What is “ _____ ” age?</b>  Write the number.	<b>Q4. Please tell us about your level of education “ _____ ”</b> No formal education .....00 Pre-primary.....01 Primary.....02 Post primary.....03 Vocational.....04 Secondary .....05 Tertiary .....06 Don't know.....98
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### PART II.Tree tomatoes production

1.Please specify about the land ownership

Criteria	Yes	No
I own my land on which I cultivate tree tomatoes		
I rent the land to cultivate tree tomatoes		
I use both my land and rent to cultivate tree tomatoes		

2.Tree tomatoes color preference (Please tell us which color you experienced that is preferred on the market)

Tree tomatoes colors	Yes	No
Red		
Orange		
Yellow		
Purple colors		

3. May be there are some support received vis a vis tree tomatoes production, processing or supply (Please tell us the ones you requested and received among the below)

Support	Yes	No
Irrigation support		
Fertilizers / pesticides		
Received a loan		
Received financial information		
Management support		
Marketing support		
Processing Support		
Post-Harvest support		
Other types of support		

4. You told us that you have got support received vis a vis tree tomatoes production, processing or supply, can you please list the funding partners?

- 1).....
- 2).....
- 3).....
- .
- .
- n) .....

5. Ability to use fertilizers in tree tomatoes production (Please tell us about the use fertilizers in tree your tomatoes production)

Fertilizers' uses	Yes	No
Never used		
Used both traditional and fertilizers		
Mixed traditional and organic		

6. Ability to buy tree tomatoes seeds (Please tell us whether you bought tree tomatoes seeds or not)

Ability to buy tree tomatoes seeds (Scenarios)	Yes	No
I use my developed seeds (Traditionally)		
I mix bot improved and traditional seeds		
I never bought seeds		

7.Ability to use pesticide / fungicide (Please tell us whether you used pesticide / fungicide)

Ability to use pesticide / fungicide	Yes	No
I never buy pesticide / fungicide		
I used organic fertilizers		
I mixed both organic and IPM		

N. B can you please provide comments about the use pesticide / fungicide ( eg. They improve production or not)

8.Tree tomatoes market destinations (Please tell us where you sell your production (Tree tomatoes)

Market destinations	Yes	No
Home districts		
In another neighboring district but the same province		
Outside the home province (Locally)		
In Kigali city		
Other African countries		
Outside the continent (Please Specify)		

9.Please specify the type of selling person you are entitled?

Type of selling person	Yes	No
I sold/bought tree tomatoes as wholesaler		
I sold/bought tree tomatoes as retailer		
I sold/bought tree tomatoes as processor		
I sold/bought tree tomatoes as other types (Not mentioned in the above)		

10. By experience, please list for us the Tree tomatoes standards preferred by the Buyers on the market ( Eg size , color ....)

- 1).....
- 2).....
- 3).....
- .
- .
- n) .....

11. Please tell us about where get tree tomatoes information and the types of those information ( Eg radio , television..... )

Sources	Type of Information			

12. Please estimate for us the kgs you sold during the last 3 year and the turnover collected from tree tomatoes

13. Please list the challenges in accessing inputs and other services

- 1).....
- 2).....
- 3).....
- .
- .
- n) .....

14. Please list the challenges you expect in accessing preferred markets in future

- 1).....
- 2).....
- 3).....
- .
- .
- n) .....

15. Please list what you think can what determines the competitiveness of tree tomatoes

- 1).....
- 2).....
- 3).....
- .
- .
- n) .....

Thank you for your good collaboration!!!!

# Determinants of Competitiveness of Tree Tomato Value Chain in Rwanda

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## ORIGINALITY REPORT

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