IMPACT OF ACCESS TO AGRO-PROCESSING TECHNOLOGIES ON GROWTH OF SMALLHOLDER AGRO-PROCESSING INDUSTRY IN BURETI DISTRICT, KENYA

BY

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DECLARATION

This Research Project is my original work and has not been submitted for any award in any other University.

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DEDICATION

To my wife Adhiambo Rawago-Odoyo, our children Ammy, Annette and Andy for their unfailing understanding and support. Not forgetting my late parents Mikaye Zebba Akoth and Jaduong' Bittar E. Ong'wen for according me valuable education and responsible upbringing.

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ACRONYMS AND ABBREVIATIONS

AFC	-	Agricultural Finance Corporation
AGRA	-	Alliance for Green Revolution in Agriculture
ASDS	-	Agriculture Sector Development Strategy
CDF	-	Constituency Development Fund
DAO	-	District Agricultural Officer
ERS	-	Economic Recovery Strategy for Wealth and Employment Creation
EU	-	European Union
FAO	-	Food and Agriculture Organization
GDP	-	Gross Domestic Product
GoK	-	Government of Kenya
IFAD	-	International Fund for Agricultural Development
IGAs	-	Income Generating Activities
$\mathbf{I_{VA}}$	-	Value Added Index
KES	-	Kenya Shilling
KIBT	-	Kenya Institute of Business Training
KWFT	-	Kenya Women Finance Trust
MDGs	-	Millennium Development Goals
MoA	-	Ministry of Agriculture
MT	-	Manufacturing Technology
NMK	-	Njaa Marufuku Kenya Programme
PSDA	-	Private Sector Development in Agriculture
SACCO	-	Savings and Credit Cooperative Society
SHoMaP	-	Smallholder Horticulture Marketing Programme
SSIs	-	Small-scale Industries
SRA	-	Strategy for Revitalizing Agriculture
TSS	-	Transaction Security Services
UN	-	United Nations
USA	-	United States of America
VISION 2030	-	Kenya's Development Plan (2008 – 2030)
YES Fund	-	Youth Enterprise Services Fund

ABSTRACT

Agriculture remains the lifeblood of many countries as exemplified by its dominance in a large number of economies across the globe. However, primary agriculture alone can no longer provide reliable livelihood. Thus, the pattern of economic growth in these countries has witnessed a gradual shift from agriculture to industry. Agro-processing, which is the stimulant for this transformation from agriculture to industry, is one of the sub-sectors now being focussed-on to provide additional income generating opportunities to support the growing population particularly in the developing economies. Inspite of the emerging importance of agro-processing in industrialization process its growth has been faced with the constraints of access to agro-processing technologies, especially among smallholder agri-businesses. Consequently high proportion of agricultural produce in developing countries is traded in raw form and fails to compete favourably in both local and international markets resulting into exploitation and poor returns. The objectives of the study were to: determine the extent to which manufacturing equipments impact on growth of smallholder agro-processing industry; establish the impact of manufacturing skills training on growth of smallholder agro-processing industry; examine the impact of access to automated functions on growth of smallholder agro-processing industry; and evaluate the extent to which training on managerial skills impacts on growth of smallholder agro-processing industry in Bureti District. The study employed a cross-sectional descriptive research design in which main emphasis was on quantitative data with limited use of qualitative data that helped to fill information gaps. The accessible target population was all the 400 agro-processing/value-addition groups and individuals as well as all the 22 technical experts offering agro-processing training and advisory services in Bureti District. Sample size of 196 comprising of 183 smallholder farmers from agro-processing groups, 3 agro-processing individuals and 10 technical experts was determined using Krejcie & Morgan table for sample size determination, and distributed proportionately across the geographical sampling clusters using Bowley's proportional formula. Sampling involved mixed techniques including area sampling, purposive sampling and simple random sampling with proportional allocation. The study employed four data collection instruments namely: structured questionnaire to be applied to technical experts; structured interview schedule for groups and individual agro-processors; observation and document analysis techniques. Data analysis involved central editing and validation, coding and processing using SPSS statistical analysis software. Findings on the impact of manufacturing equipments showed that despite the narrow diversity, high costs and long distances travelled to procure agro-manufacturing equipments, their level of access had gone up and this led to marginal increase in the number of agro-processing IGAs set up. Findings on impact of agro-manufacturing skills indicated that frequency of advisory services and training sessions was adequate .This led to increase in number of agro-processing IGAs among 54.5% of respondents. In addition, access to manufacturing skills was not uniform across all relevant skill areas due to lack of expertise in some specializations. Overall, manufacturing skills training registered a net positive impact on the number of agro-processing IGAs. The study found that diversity of mechanized agro-processing functions was very limited and evident mainly in thermal preservation, quality control and crushing operations. Most IGAs depended on manually operated equipments. However, increase in level of mechanization was perceived by 68.3% of the respondents and this resulted into a positive impact in terms number of agro-processing businesses set up. Findings on the impact managerial skills have on growth of agro-processing industry established that frequency of trainings led to rapid increase in number of IGAs among 26.9% of the farmers. Diversity of management skills was broad in scope and number with 15 modules trained-on. In effect management skills led to 40.8% of farmers indicating increase in number of agro-processing units established. In sum, access to agro-processing technologies led to positive impact on growth of smallholder agro-processing industry in Bureti district through increase in the number of agro-processing units/businesses established by the smallholder farmers. Overall, it is concluded that the combination of these four (4) has led to positive growth of smallholder agro-processing industry over the last 7 years. The study recommends that government and other development partners should establish mechanisms that will realistically increase access to friendly investment capital and processing skills to the youth as a strategy of increasing their capacity to start small-scale agro-processing businesses.

CHAPTER ONE
INTRODUCTION

1.1. Background of the Study:

The world over, Agriculture has been considered the hallmark of the first stage of development of many countries while the degree of industrialization is taken to be the most relevant indicator of any country's progress along the development path (World Bank, 2008; FAO, 1997). Jacques Diouf a former FAO Director General, quoted in FAO (1997), argued that the proper strategy for growth has often been conceived as one of a gradual shift from agriculture to industry, with the onus being on agriculture to finance the shift in this first stage of development. According to ADB (2010) and Harris (2004) agriculture is the lifeblood of many countries, especially the developing economies and societies. In the Asian continent for instance, despite the recent advances in the growth of industries, agriculture has remained the single largest sector of most national economies (Shastri, Trimpathy and Murad, 2011). In Africa, more than half a billion people, or about 65 percent of the population, depend on small-scale farming as their primary source of livelihood (Bragg *et. al.*, 2010). A great majority of these are smallholder farmers, 80 per cent of whom farm less than two hectares (MoA, 2005). This growing importance of the agro-industry sector in the various world economies makes Agriculture the cornerstone of most countries' development.

Unfortunately agriculture alone is no longer able to provide a reliable livelihood for the growing populations in most countries (Practical Action, 2011). In effect, alternative or additional income generating opportunities are needed to support the millions of poor families who can no longer support their livelihoods from the land-based activities alone (Ndlovu, 2009). This problem applies to many developing countries and is particularly relevant to the African countries such as Kenya. Agro-processing, defined by Hayani-Mlambo, Proctor and Nazare (2005) as turning primary agricultural products into other commodities for the market, has the potential to provide those additional opportunities. Indeed, recent researches demonstrate that rural households depend on a diverse portfolio of activities and income sources. Some households are looking towards activities such as food processing as a means to enhance the livelihood they can achieve from a limited area of land (Khumalo, 2010).

In the developed countries experience in economic development is replete with success stories of the role of SSIs in industrial development and export promotion. In

many of these countries, more than 90 percent of all enterprises belong to the Small and Medium Industries sub-sector accounting for between 46 and 80 percent of industrial labour. Typical case recognized worldwide, and which was part of inspiration to the Kenya's Vision 2030, is China's use of small-scale rural industry to support local self-reliance (Roemer, 2002).

In developing countries small-scale industries make relatively strong contribution to employment generation mainly due to their preference for labour intensive technology (Osunbiyi, 1987). It is worth noting that India, arguably the post-independence leader in planning for large-scale industrialization, also started with vigorous promotion of small-scale industrial development (Roemer, 2002). Much of literature argue that governments, especially in developing countries like Kenya should promote SSIs because of their greater economic benefits compared to large firms in terms of job creation, efficiency and growth. These roles of small-scale industries notwithstanding, studies the world over have shown that a number of factors constrain the ability of small-scale agro-based enterprises to effectively manufacture and market processed food products. At the centre of these challenges of agro-processing is the encompassing factor of access to agro-processing technologies. Technology is a broad concept that encompasses knowledge, skills, innovations and, tools and equipment. At macro level, many policies implemented by governments in developing countries have hindered the development of small-scale industries (Mhazo *et al*, 2003; Dawson, 1994). This is confirmed by Dandago and Usman (2011) in their study of Nigeria's SSIs when they state that:

> "*in most advanced countries, the small-scale business sector is recognised as the engine room of economic growth and development. However, when less developed countries' industrialisation policies for promoting SSIs are measured against international best practices in SSIs promotion policies they will be rated very low because of their inconsistency and lack of focus*".

An extensive effort in terms of policy re-design and implementation strategies that emphasise the need for continued government support to small scale industries is required to elevate these countries to a leading position (Dandago and Usman, 2011). At the micro or firm level limited access to: credit; appropriate technologies; technological capability; management skills; product quality control; and reliable markets are some constraints to development of small-scale industries (Nazare, 2005; McPherson, 1996;

Mugova, 1996). Such findings are corroborated by other studies among smallholder farmers in Africa. In Tanzania Goedhuys, Jainz and Mohnen (2009) found the technological gap between different institutions and entrepreneurs as the most serious technological problem encountered by agro-processing entrepreneurs. This technological gap is believed to be due to: poor functioning of field development agents, insufficient finance to use latest technology, and lack of specialized skills to use innovations (Louw, Geyser and Troskie, 2011; Da Silva, Baker, Shepherd, Jenane and Miranda-da-Cruz, 2009). Braggs (2010) and Cooper (2006) predicted that untrained workers and unskilled entrepreneurs in developing countries cannot use the available technologies effectively. Braggs (op cit) asserts that even if they were trained and skill induced into them, the outdated technology would still create bottlenecks for economic growth of the processing units. In Zimbabwe a study by Mhazo *et. al.* (2003) found constraints faced by agro-processing industry to include: poor equipment back-up service; shortages and high cost of equipment and spares; limited access to appropriate packaging material; lack of marketing skills; inadequate support services from training institutions, private sector consultants, small enterprise advisors, and engineering workshops; and failure to meet food processing regulations pertaining to food safety and hygiene practices. Very few small-scale agro-processors have received formal training in food processing techniques (NEPAD, 2009; Mosha, 1983).

In Kenya, the development blue print "The Vision 2030" has identified value addition as key in driving economic growth. Kenya's agriculture is dominated by primary production and there is little on-farm and off-farm processing of agricultural produce, which translates to low income for farmers and less jobs (MoA, 2009). The compelling reasons for encouraging agro-processing are: Firstly, it improves rural incomes by adding value to produce and saving on transport costs by delivering high-value/low-volume products and, creates opportunities for the use of by-products as inputs in other farm operations such as animal feeds, manure, and fuel. Secondly, it provides an opportunity for reducing farm losses through the conversion of perishable commodities into more durable products. Thirdly, it helps to create jobs in the rural areas, thereby contributing to the reduction of both poverty and rural-urban migration (GoK, 2009). The support to agricultural value chain development in the context of SSIs is expressed in the Agriculture Sector Development Strategy 2009 – 2020. GoK (2009) advises that in support of small-scale economic activities, there is need to identify and

utilize commensurate technologies that facilitate start-up growth and graduation of micro projects to rural agro-processing industries thus triggering transformation from primary production to commercial oriented processing towards industrial development. Development of agro processing, building small holder agriculture as a business, availing credit and farm inputs, and interesting youth in agriculture thus improving agricultural productivity and enterprise competitiveness is the aspiration of Kenya's agriculture sector.

In Bureti District opportunities for small-scale agro-processing exist in crops such as Pineapple, Sweet Potatoes, Local Market Vegetables, Bananas, Maize and other grains, and Tomatoes; and in Milk. According to DAO Bureti (2010) the potential for agro-processing has not been fully exploited in the District. Some of the major challenges facing agro-processing include lack of agro-processing equipment caused by limited sources of finance to invest in procuring processing tools and equipment. Most investors are still sceptical about investing their funds in this area due to lack of adequate knowledge on the viability of crop-based agro-processing businesses; and Poor market linkages for the processed products. Growth of smallholder agro-processing industry may only occur when the foregoing constraining factors are minimised. Improvement of access-factors of agro-processing technologies such as acquisition of agro-manufacturing equipment, agro-manufacturing skills, agro-processing management skills, and effective automation of agro-processing functions among the smallholder farmers are the key determinants of growth in this upcoming industry. This growth may be visualized in terms of the number of agro-processing units established. Other indicators include diversity and sophistication of processed agro-products, improvement in income levels of agro-processing IGAs, and the number of people employed by agro-processing units.

1.2. Statement of the Problem

Agriculture remains the lifeblood of many countries as demonstrated by its dominance in a large number of economies across the globe. However, agriculture is still largely being practised as subsistence occupation with the resulting products traded in primary form. According to Practical Action (2011) primary agriculture alone can no longer provide reliable livelihoods for the poor rural households that solely depend on it. In Africa, for instance, the burden of providing additional sources of survival to the over 65% of the continent's population that depends solely on agriculture is being placed on agro-processing (Braggs, 2010). Thus, the pattern of economic growth in these countries

has been that of a gradual shift from agriculture to industry engineered through agro-processing (Shehrawat, 2006; FAO, 1997). Kenya now puts strategic importance on agro-processing sub-sector as the driver of economic growth through modernization of agriculture and has, since 2003 developed policies aimed at improving access to agro-processing technologies among small-scale farmers and entrepreneurs. The turning of focus to smallholder agro-processing industry is, perhaps, an admission that the future growth in the levels of agro-industrialization lies not with the large corporations but with smallholders who constitute the weakest part in the agricultural product value chain. But inspite of the emerging importance of agro-processing sector in the industrialization process its growth has been faced with a number of constraints. Some of the constraints affecting access to agro-processing technologies are: unavailability of agro-processing technologies at local level; poor selection of technologies; use of obsolete and inappropriate technologies; lack of back-up service from manufacturers; and lack of trained workers etc. In far flung rural settings in Kenya, for instance, lack of local manufacture has forced groups to incur additional technology acquisition costs of up to 20% of the purchase price (Stubbs *et. al.,* 2010). Such additional costs to the small and poor agribusiness people present disincentives instead of promoting investments. These challenges raise fundamental questions about how they impact on growth of the smallholder agro-processing sub-sector in Kenya. For that reason, the past decade has witnessed a rapid movement away from provision of routine agricultural information to increased support for access to agro-processing technologies among smallholder farmers. Through the MoA alone close to KES 1 billion has been disbursed to support access to agro-processing technologies among Kenya's smallholder farmers over the last 10 years (MoA, 2012). In Bureti District, which is the focus of this study, DAO Bureti (2011) indicates that MoA has provided KES 40.2 million in grants to 18 smallholder agro-business groups in the last 7 years to acquire new technologies to modernise their enterprises. DAO Bureti (2011) reports that although 84% of the smallholder farmer groups implemented the agro-processing technology acquisition plans, only 37% of them strictly adhered to guidelines agreed upon with the funding partners. Furthermore, about 24% of the groups took longer than expected to purchase the manufacturing equipments while 11% failed totally to acquire the technologies after having received the funding. Such modest technology acquisition levels suggest there are inherent problems within

agro-processing sub-sector which hinder smallholders from accessing technologies and operationalizing agro-processing business plans.

The need for a study in this area was aptly captured by Odingo (2010) in her research project undertaken in Nyando District when she observed that; "*rural people often received technical and financial support from grassroots organizations but the often unknown is whether these groups access the right tools with the funds they get; and if they do, what has been the effect of these tools on the IGAs*". This statement summarizes the justification for this study proposing to investigate the impact of access to agro-processing technologies on growth of smallholder agro-processing industry in Bureti District in the Kericho County of Kenya.

1.3. Purpose of the Study

The purpose of the study was to investigate the impact of access to agro-processing technologies on the growth of smallholder agro-processing industry in Bureti District.

1.4. Objectives of the Study

Objectives of this study were to:

(i) Determine the extent to which Manufacturing Equipments Impact on Growth of Smallholder Agro-processing Industry in Bureti District.

(ii) Establish the Impact of Manufacturing Skills Training on Growth of Smallholder Agro-processing Industry in Bureti District.

(iii) Examine the Impact of Access to Automated Functions on Growth of Smallholder Agro-processing Industry in Bureti District.

(iv) Evaluate the extent to which Training on Management Skills Impacts on Growth of Smallholder Agro-processing Industry in Bureti District.

15. Research Questions

The research questions this study seeked to answer were:

(i) To what extent does access to Manufacturing Equipments Impact on Growth of Smallholder Agro-processing Industry in Bureti District?

(ii) What is the degree to which Training on Manufacturing Skills Impact on Growth of Smallholder Agro-processing Industry in Bureti District?

(iii) To what extent does Automating Functions Impact on Growth of Smallholder Agro-processing Industry in Bureti District?

(iv) How does Training on Management Skills Impact on Growth of Smallholder Agro-processing Industry in Bureti District?

1.6. Significance of the Study

It is hoped that the study has generated useful information for formulating future agro-processing development strategies for the smallholder farmers who are the majority in the Kenyan agro-industry. That study results has provided hints on the aspects which should be emphasized while allocating finances to the small-scale agro-processing businesses and development projects.

The potential users of the findings of this study are farmers or producers, entrepreneurs, government and non-government organizations, who may have interest to intervene in the agro-processing and marketing chain among the small-scale entrepreneurs. International development partners who may have interest in supporting the smallholder farming communities, and financial institutions with interest in providing development credit to the informal sector, may use the information from this study to estimate the potential of the small-scale agro-business people to effectively utilize such resources to spur development. At the macro-planning level it is hoped that the results of the study provide a basis for formulating future agriculture sector plans for the impending Kericho County government under the current constitutional dispensation. Researchers who may feel the need for further investigation on smallholder agro-processing and marketing may also use the results from this study as starting point to delve into the unknown aspects.

1.7. Basic Assumptions

One of the basic assumptions made in this study is that all members of agro-processing groups, individual agro-processors and agricultural experts who were selected as respondents provided dependable knowledge on smallholder agro-processing industry. It is also assumed that the sample taken was a true representation of the target population and that the respondents provided sincere and credible information that accurately addressed the problems of this research project. Assumption was made that agro-processing enterprises had used the grants and financial credit they had received from the government and other development partners to access agro-processing technologies. The

other assumption was that the agricultural experts, both from public and private agro-advisory services, had been providing the agro-processors with the requisite technological advice, skills and training. This technological information is important in improving agro-processing businesses. It is upon these two assumptions that the study seeked to establish the impact of access to agro-processing technologies on growth of smallholder agro-processing industry in Bureti District in Kericho County.

It was also assumed that the study undertaken would help the government of Kenya and other partners providing support to the agriculture sector in making better decisions regarding the agro-processing strategy for smallholder farmers and entrepreneurs. It was assumed that the results which came from this study reflected the status of the whole population in the county.

1.8. Limitations of the Study

Kombo and Tromp (2006) cited by Odingo (2010) defines limitation as challenges anticipated or faced by the researcher during study which could influence scope of the study, data accessibility, and unanticipated occurrence. The researcher foresaw the possibility of being faced with limitations related to storage of information at the small-scale entrepreneur level. This limitation was met in form of poor record keeping since a significant proportion of small-scale entrepreneurs did not keep physical records. They mainly relied on their ability to recall information (KIBT, 2012). This denied the study the necessary detailed and authentic data. The challenge posed by weakness in physical records was addressed by augmenting the information obtained from groups and individual processors with records maintained by the organizations that had supported these groups.

Another limitation of this study was related to time. Time constraints on the part of respondents arose due to their busy farming schedules as the data were collected during the first cropping season of 2013. The researcher planned and overcame this limitation by making prior appointments with the respondents and ensuring that as little time as possible was taken to go through the interviews. The study ought to have included all agro-processing groups and individuals supported by other development agencies but due to inaccessibility caused by time and resource constraints the research was limited to groups linked to the MoA in Bureti District.

1.9. De-limitations of the Study

De-limitation of study, according to Odingo (2010), is the purposeful actions to reducing the study population and area to be surveyed to manageable size. The study was focussed mainly on crop-based processing activities even though the wider meaning of agro-processing encompasses processing of crops, livestock, forestry, and even fisheries. This restriction was informed by the fact that crop processing offered more data compared to the other processing aspects. This was due to the numerous processing opportunities which exist for smallholder farmers and entrepreneurs who were the subject of this study.

Bureti District was been selected for the study because of the many programmes such as SHoMaP-IFAD, NMK, CDF, Kilimo-Biashara, TSS-IFAD, EADD and PSDA-gìz that are supporting the development of agro-processing sector in the area. There were therefore a relatively high number of farmer groups carrying out agro-processing/value addition activities in the District.

1.10. Definition of Significant Terms used in the Study

The following terminologies, in the context in which they were used in this study, have operational meaning as stated here-under;

Agro-processing Operation: means the process of altering agricultural produce from its natural state into a different product by grading, peeling, slicing, crushing, grinding, milling, pulping, hulling, packaging etc with the aim of improving its market value.

Agro-processing Technology: Encompasses Knowledge, Skills, and Tools & Equipment required for facilitating processing of agricultural produce.

Growth of Agro-processing Industry: as used in this study means increase in size of agro-processing industry based on increase in number of agro-processing units or businesses established.

Manufacturing Equipments: is a term encompassing the manufacturing tools and machineries that are required to facilitate processing of a particular product.

Manufacturing Skills: refers to technical knowledge and aptitude required by agro-processing employees to make them able to turn primary produce into processed products.

Automated Functions: implies those operations of an agro-processing unit that are being performed using non-manual power source. It is an indicator of level of mechanization, processing efficiency and precision.

Training on Management Skills: refers to the passing of knowledge and information to agro-processors to enable them effectively run production processes involving human, materials, machineries and financial resources interactions within the agro-processing unit.

Smallholder Farmer: is a term synonymous with small-scale farmer and refers to farmers who cultivate land sizes less than 2.0 hectares.

Value Added Index: Ratio of the market value of processed products to market value of raw produce.

Investment Finance: means funds or monies accessible to agro-processing businesses for facilitating business operations including acquisition of agro-processing technologies.

1.11. Organization of the Study

The final report from the study has been presented in five chapters. The first chapter introduces the study covering background of the problem, statement of the problem, purpose and objectives of the study, research questions, and basic assumptions, definition of key terms, significance, organization, limitations and de-limitation of the study. The second chapter reviews the literature relevant to the subject of the study; provides thematic analysis of each study objective, reviews the theoretical and conceptual frameworks, and discusses the gaps in the literature that helped to establish the rationale for the study. Chapter three covers methodology. It outlines and describes research design, target population, sampling procedures, research instruments, validity and reliability of the instruments, data collection and analysis procedures, pilot testing of instruments and the ethical issues. The fourth chapter has dealt with the results and discussions. Conclusion and recommendations are presented in the fifth chapter.

CHAPTER TWO
LITERATURE REVIEW

2.1. Introduction

This chapter reviews literature in line with selected themes considered relevant to the objectives of the study. Specifically it covers the following thematic areas: access to manufacturing equipment and how they impact on growth of smallholder agro-processing industry; access to manufacturing skills and their impact on growth of smallholder agro-processing industry; access to management skills and their impact on smallholder agro-processing industry; access to automated functions and how they impact on smallholder agro-processing industry. The chapter also discusses the theoretical and conceptual frameworks on which the study has been anchored; and finally presents the summary of literature and the literature gaps.

2.2. Access to Manufacturing Equipments and Growth of Smallholder Agro-processing Industry

Today, agriculture related industrial businesses are the main occupation of rural people in many parts of the world. FAO (1997) observes that, at global level, agro-processing industry has realized tremendous growth in size and complexity. While agro-processing industry today continues to process simple agricultural goods it is also transforming highly sophisticated industrial inputs that are often the result of considerable investments in manufacturing technology and innovation (FAO, 2003). Corresponding to this growing complexity of inputs is an increasing range of transformation processes, characterized by physical and chemical alteration, aimed at improving the marketability of raw agricultural produce. Satisfaction of these varied needs requires a wide variety of manufacturing equipments ranging from simple home tools to the advanced industrial machinery. These complexities make it increasingly crucial for agro-processors to employ varied types of manufacturing equipments in their businesses. Growth in agro-processing sub-industry is therefore dependent on, among other factors, availability and easy access to suitable manufacturing equipment.

The concept of access to manufacturing equipment has many dimensions. On one hand manufacturing equipments have to be made available to agro-processors. On the other hand, factors which make these equipments functionally accessible to the users must also be ensured. A study by Mhazo *et. al.* (2003) conducted in Zimbabwe found that

factors such as equipment purchase capital, availability of the manufacturing equipment within the locality of the businesses and the back-up service rendered by dealers, affordable cost of equipment and spares, and in-built technical skills to operate the manufacturing equipment are important variables in accessing agro-processing technology and consequently the success of agro-processing industry. These factors are especially critical in the remote settings where, as the case in Kenya, most smallholder agro-processors are located (Kachru, 2002). Furthermore, the accessed manufacturing equipment must keep abreast of the evolving demands of the product market through technology appraisal and upgrading. Yet, agro-processing industry is still faced by many technological challenges. These technology-related limitations have been reported by many studies in different regions of the world as part of the numerous constraints facing the agro-manufacturing sector along its growth path.

In Zimbabwe, for instance, Mhazo (2003) concluded that limited transfer of technologies from research; inadequate manufacturing equipment back-up service by dealers; shortages and high cost of equipment; and spares are the major impediments to the adoption of technological innovations by agro-processors. In contrast, experiences from India, Pakistan and Ethiopia single out manufacturing equipment selection and ownership by smallholder agro-processing groups or individual entrepreneurs as key hindrances to growth of agro-processing industry. As found out by Abebe (2009) in a study conducted in Ethiopia and Viswanathan and Satyasai (1997) in India such selections are often unguided and the end users are left to decide without adequate technical advice from experts. In consequence, small-scale agro-processors end up with manufacturing equipments that are inappropriate and inferior (Kachru, 2002; Rosset, 1999). In some cases the government policies on duty and taxes charged on imported equipment discourage local manufacture thus reducing availability and accessibility of manufacturing technologies by the agro-processing industry (Mhazo, 2003; Aghion and Bolton, 1997). The industry has also been affected by poor quality of manufactured equipment especially from the informal sector. Poor quality of manufacturing tools and equipment has pervaded the market due to the ineffective enforcement of standards. In the downstream segment of agro-processing value chain Rosset (1999) found that in most African countries small-scale agro-processors lack manufacturing equipment as well as the information and technology that could help them meet the quantity and quality requirements of buyers such as supermarkets, agricultural processing enterprises, wholesalers or export firms. In Kenya

these manufacturing equipment access factors have not been empirically evaluated to determine the influence they have on growth of agro-processing industry.

Technology-related constraints which face smallholder agro-processors in developing countries have had strong bearing on the rate of growth of the agro-processing industry. Positive and faster growth of the sector is dependent on several factors one of which is the minimization or total elimination of manufacturing technology access constraints. Some factors which promote effective access to manufacturing technology in smallholder agro-processing industry may be summarised as: availability of affordable financial credit to acquire the manufacturing tools and equipment; availability of the relevant tools and equipment in the local outlets; affordable prices for the tools and equipment; good and reliable supply of spares, equipment maintenance and other after-sale services; presence of requisite knowledge and skills for operating and maintaining the manufacturing equipment; efficient technology upgrading system; availability of efficient technology advisory services; favourable taxation regime for manufacturing tools and equipment, and effective enforcement of manufacturing standards to ensure quality tools and equipment. Although many researchers have mentioned lack of access to manufacturing equipment as one of the constraining factors to the growth of agro-processing enterprises, equally many studies indicate remarkable successes made in the smallholder agro-industry attributable to use of improved processing equipment.

In developed countries studies indicate that tremendous industrial development has been realized in the small-scale sector as a result of favourable policies in support of access to appropriate manufacturing tools and equipment. Contribution of access to manufacturing equipment to growth of agro-processing industry in developed countries has been recorded in the aspects such as: employment creation; national income generation; agro-product diversification; increase in the number of small-scale rural industries; rural-urban product integration; import-export substitution; and level of sophistication of inputs and products. For example, according to Udechukwu (2003) better access to manufacturing equipment and other technologies by entrepreneurs resulted in growth in the number of SSIs in countries such as Japan, Germany and USA. This increase in number of SSIs further led to absorption of about 80 percent of total industrial labour force in Japan, 50 percent in Germany and 46 percent in the USA. In terms of national income generation Udechukwu (2003) found that small-scale businesses in the USA contributed an estimated 39 percent of GDP. In contrast, Kenya has in the last decade given smallholder agro-

processing industry development policy recognition through development plans such as ERS, Vision 2030 and ASDSS. These efforts have placed Kenya's agricultural sector in the same path with the advanced economies and make achievements in such developed countries of significant research interest.

In China Roemer (2002) reported that small-scale rural agro-industries are promoted by the state as a strategy to support local self-reliance, rural-urban integration and import-export substitution. Through promoting access to manufacturing technologies the Chinese Government managed to facilitate the establishment of modern small-scale factories in the country side. These factories have now matured to producing a wide range of products not only for the rural areas but also for urban sector and export as well (Roemer, 2002).

For the developing countries it has been argued by Beck, *et. al.* (2003) that such countries should promote small-scale industries as either a complement or an alternative to large-scale modern manufacturing. Indeed most literature reviewed argued that governments, especially in developing countries like Kenya where over 80 percent of the population depends on small-scale agriculture, should promote access to agro-manufacturing technologies for SSIs because of their greater economic benefits compared to large firms in terms of job creation, efficiency and growth. In support of this argument Osunbiyi (1987) observed that technologies that lead to establishment of SSIs make strong contribution to employment generation mainly due to their preference for labour dependent manufacturing equipment and machineries. India, which shares many agro-economic characteristics with Kenya and is arguably the post-independence leader in planning for large-scale industrialization, also started its journey with vigorous promotion of small-scale industrial development (Roemer, 2002). India laid more emphasis on eliminating bottlenecks that prevented small-scale businesses from easily acquiring agro-processing tools and equipment. In result this strategy led to considerable expansion and contribution to industrial development across nearly all states (Shehrawat, 2006). This result is therefore possible also for Kenya's agro-industry.

In Ecuador, availing manufacturing tools and equipment to SSIs is reported to have enabled small firms with fewer than 50 employees to account for 99 percent of the total firms and 55 percent of employment in 1980s (Udechukwu, 2003). In Bangladesh Udechukwu (2003) found that enabling small-scale processing businesses to acquire manufacturing equipment made enterprises with fewer than 100 workers to account for 99

percent of total enterprises and 58 percent of employment in 1986. Given that agro-manufacturing sector in developing countries is still in its infant stage this scenario is applicable in a large number of such countries. For Bangladesh whose people's entrepreneurial attitude was described in a study by Saikia (2012) as "less motivated and fatalistic" such performances by the small-scale industrial sector, to a country like Kenya with vibrant and innovative industrial *Jua Kali* (informal) sector, is an encouragement which deserves to be ascertained.

In India, Saikia (2012) reports that focus on strategies to improve access of manufacturing equipments among rural businesses has enabled the country to set up 3.6 million SSIs that have played a very important role in the socio-economic development of India during the past 50 years. It has significantly contributed to the overall growth in terms of the Gross Domestic Product (GDP), employment generation and exports. The performance of the small-scale industries, therefore, has a direct impact on the growth of the overall economy. In India, SSIs constitutes 95 per cent of the industrial units and contributes 40 per cent to the total industrial output of the country and 35 per cent of the direct export. There are about 3.6 million small-scale industrial units in India and these have employed approximately 19.3 million people, which are second highest after agriculture (MSME, 2010).

In Kenya where the importance of agro-industry is underpinned by the fact that approximately 80 percent of the population derive their livelihood from agriculture and its linkages with other sectors such as agro-manufacturing the results of Government efforts in improving access to manufacturing equipment are still un-quantified (GoK, 2009). Although access to agro-processing equipment has gained recognition in policy circles due to its potential to commercialize and industrialize the whole agricultural-sector, its impact on agro-processing industry at smallholder level is still not estimated (SRA, 2005). However, the evidence of the impacts created through access to manufacturing equipment by SSIs in other regions, particularly the developing countries suggest that similar results are possible in Kenya. Thus, the need to establish the extent to which smallholder agro-processing industry in Kenya has grown as a response to the effort by GoK to promote access to agro-processing equipment by smallholder farmers is urgent. An empirical study conducted in Kenya by Odingo (2010) found that small-scale entrepreneurs often received technical and financial support from grass-root organizations. This position is confirmed by GoK (2009) and MoA (2005) reporting that Government of Kenya employed a two pronged approach involving public and private institutions to increase funds access to

small-scale enterprises for acquisition of agro-manufacturing equipment. The GoK recapitalized Agricultural Finance Corporation (AFC) which enabled the disbursement of loans totalling KES 5.0 billion to 27,000 farmers over five year period. The GoK has also undertaken the guaranteeing of loans to farmers through commercial banks and other programmes that address the needs of the resource poor smallholder farmers. Through engagements with institutions such as AFC, Equity Bank, K-Rep Bank, Cooperative Bank, IFAD, AGRA and many others, credit packages have been developed where farmers get loans at affordable 10 percent interest rate (GoK, 2009; MoA, 2005). In addition, MoA supports mobilization of financial resources through SACCOs and community based lending systems. Aid funds, grants and credit to small-scale agro-processing enterprises have therefore been channelled to entrepreneurs through these programmes and organizations to support acquisition of input factors including agro-processing manufacturing equipment (DAO Bureti, 2010; GoK, 2009). Odingo (2010), however, reckons that the often unknown is whether these groups access the right tools and equipment with the funds they get; and if they do, what has been the impact of these equipments on the IGAs. One way the impact of access to agro-processing technologies on smallholder agro-processing industry would be seen is through the effect such acquired tools and equipments have on agro-processing IGAs.

The critical moderator in the pursuit by small-scale agro-processors to access manufacturing equipment required to establish processing enterprises is the factor of finance. Access to finance to facilitate acquisition of agro-processing tools and equipment is a paradigm that has occupied the rural development planners in many countries for several decades (NEPAD, 2009; Ndlovu, 2009; OECD, 2009). In the context of small-scale agro-processors this financing must be affordable and tailored to their circumstances. In the words of DAO Bureti (2010) “access to smallholder friendly financial resources in Bureti District enabled small-scale agro-processors to acquire the requisite agro-manufacturing tools and equipment necessary for establishing processing units or enterprises”. This experience confirms that when investment finances are easily accessible agro-producers commit such funds to the purchase of agro-processing technology and manufacturing tools that eventually lead to increase in number of agro-processing units set up. Improved access to agro-processing manufacturing equipment, driven by the economic benefit promised by value-added products resulting from processing, therefore results in

growth of the industry manifested in the increased number of agro-processing units or enterprises established.

Agro-processing industry is characterized by seasonality of raw material supplies and perishability of products. Good performance of agro-processing enterprises demands that the negative seasonal and perishable attributes of both the raw produce supplies and processed products are minimised through process planning. One such aspect of process planning is that of ensuring diversity of products. The role of product diversity is underscored by Berges-Sennou and Waterson (2005) as an important determinant for business growth and profitability. Agro-processing unit that processes a variety of agro-produce circumvents the problem of seasonality of raw material supplies by targeting crops with different harvesting cycles. Diverse products emanating from a processing unit brings into play product complementarity and supplementarity, a situation in which products with weak market potential are cushioned by those with strong market leverage (Khumalo, 2010). Different agricultural products possess different and distinct processing characteristics which demand unique types of manufacturing tools and equipment. Thus, the benefits of producing diverse products can only be realized if the range of manufacturing tools and equipment available to the agro-processors is wide enough to match the diversity of raw material desired to be processed. Narrow range of processing tools means only a limited range of crops, that is those whose characteristics fit with the manufacturing equipments available, can be processed. Access to diverse types of agro-processing manufacturing equipment by smallholder farmers therefore implies that equally diverse types of processed agro-products are possible to be realized thereby leading to growth in size and sophistication of the industry.

2.3. Access to Manufacturing Skills and Growth of Smallholder Agro-processing Industry

Respective studies done in India and Zimbabwe by Shehrawat (2006) and Nazare (2005), and many others, cite the factor of manufacturing skills and competence as a major determinant for either success or failure of agro-processing industry. Agro-processing industry, being one of the drivers of agricultural sector modernization efforts, is globally recognized for its capacity to reduce poverty, particularly in the developing world (World Bank, 2008; Tarmidi, 2005). NEPAD (2009) underscores this role bestowed on agro-processing industry through a statement that “the sector is being looked upon as key to the achievement of global commitments on the Millennium Development

Goal number one (MDG1) on poverty and hunger". The problem of poverty and food security is therefore related in a significant measure to the role manufacturing skills play in the growth of agro-processing industry. Through its contribution to the efficient processing and distribution of agricultural products, acquisition of manufacturing skills offers opportunities to poor smallholder farmers to escape the cycle of food and economic poverty. Agro-processing industries represent, in many countries, an important component of the overall economic activity and trade, as well as being a sizeable source of employment and income and, thus, access to food (De Janvry *et. al.*, 2001).

In the Asian, Pacific, East European and Caribbean (APEC) countries the relevance of access to manufacturing and managerial skills by small-scale sector on overall economic and industrial growth was evaluated in 2011 by Saikia (2012). In Indonesia Saikia (op cit) established that micro and small enterprises could not grow on-their-own without external assistance because they lacked technical, managerial and marketing skills. Tarmidi (2005) explained this thus: *"the exclusion of local people by the Dutch colonial rule from taking part in business activities denied the Indonesians the benefit of transfer of agro-manufacturing skills"*. Data available from the work of Saikia shows the importance of manufacturing skills in SMEs to growth of economy in terms of number of firms and their contribution to overall employment. For the majority of APEC economies such as Malaysia, Russia, Brunei, Canada, Singapore, Indonesia, Philippines etc the percentage share of SMEs of the total number of enterprises ranged between 90 and 100 percent. The only exception was Chile which had a share of SMEs of only 15.7 percent. However, the contribution to industrial growth in terms of employment created was quite varied. Some countries with high share of SMEs in their industry sector such as Brunei, Canada, China, Hong Kong, USA, Taipei and Vietnam registered corresponding employment share of SMEs of between 60 and 94 percent. Six countries (Malaysia, New Zealand, Papua New Guinea, Russia, Singapore and Thailand) had, despite relatively high percentage share of SMEs, only a relatively low share of employment. Two countries even showed extreme cases: Malaysia had 84.0 percent share of SMEs but only 12.3 percent share in employment, while Thailand had 95.8 percent share of SMEs but only 18.1 percent share in employment. In total there were an estimated 6 million SMEs in APEC, which employed about 25 billion people and commanded a share of exports of 30 percent of a total value of US$ 3 trillion (Saikia, 2012). These sets of data indicate that access to manufacturing skills affected the industry growth factors differently in the different APEC countries, an experience which could easily be realizable in any other parts of the world including Kenya.

India is a developing country whose small-scale entrepreneurs, like Kenya's, are described by Saikia (op cit) as hard working and highly motivated. A study in India by Shehrawat (2006) established that providing agro-manufacturing skills to entrepreneurs not only increased the number of agro-processing units established but also enabled the owners to run them effectively and economically. Training on manufacturing skills was found to be important in equipping the entrepreneurs with capacity to produce quality finished products and therefore, better product competition in the market.

In Africa results of a survey by ASFG found that in most countries of the continent smallholder farmers are deeply vulnerable to economic shocks because of lack of access to markets (Bragg *et. al.*, 2010). Yet the experiences of ASFG show that, with the access to appropriate agro-processing skills and financial support majority of Africa's small-scale producers were able to increase their incomes in ways that are economically sustainable. In Uganda's Nakasongola District, with a farming system similar to Kenya's, access to agro-manufacturing skills by some 500 smallholder farmers helped them to exit chronic cycle of dependence on food aid. The acquired agro-manufacturing skills enabled Nakasongola farmers to set up two new cassava processing facilities which have created market to cassava farmers through backward linkage with production. As a result cassava production is reported to have increased 10-fold, per unit product prices increased 19-fold from 1.0 to 19.0 US dollars and food security for the smallholder rural families increased drastically (ASFG, 2010).

In Zimbabwe, a developing African country whose once thriving economy has retrogressed to levels below that of Kenya, 26 case studies conducted by Mhazo *et. al.* (2005) concluded that small-scale fruit and vegetable processing has the potential to provide improved returns to horticultural producers as long as appropriate processing equipment, processing skills, packaging material, and marketing information are made available. Mhazo *et. al.* found that access to food processing skills increased the value of crops to poor farmers and thus yielded higher returns, expanded marketing opportunities, improved shelf-life and furthermore overcame seasonal and perishability constraints. By adopting improved and validated processing technologies, good standards of quality and hygiene small-scale horticultural producers in Zimbabwe managed to overcome some of the problems experienced in the fresh produce market such as lack of market integration, reliance on spot markets, and wastage. Access to agro-processing skills also led to establishment of agro-processing activities which in return contributed to socio- economic development through improved incomes, employment, food availability and nutrition.

One pragmatic method that has been used to measure the contribution of agro-manufacturing skills to agro-industrial growth is the concept of Value Added Capability (Hossain and Islam, 2007). Value Added Capability is an empirical model providing a general measure of growth of smallholder agro-processing businesses attributed to existing manufacturing technology. Hossain and Islam (2007) emphasise that for processing of raw materials to occur in any manufacturing unit, there must exist a technological capability or a manufacturing technology (MT). One of the critical components of MT is the manufacturing skills of employees. According to VAC model existence of manufacturing skills can help in the establishment and instituting effective operation of agro-processing enterprises which leads to production of high value-added products. These high value-added products in turn lead to increase in employment opportunities and contribution to GDP which are some of the indicators of growth of the agro-processing sector.

Some critical factors required in increasing the level of manufacturing skills among agro-processing business operators are training on technical skills and continual dissemination of manufacturing knowledge. Effective dissemination of manufacturing skills depends on availability of sufficient number of technical specialists to offer training and advisory services to agro-processors. The level of agro-processing skills and information outreach to smallholder farmers is determined by ratio of technical advisors to farmers or agro-processors (DAO Bureti, 2010). High ratios imply high levels of manufacturing skills dissemination and vice versa. Lambert (2001) notes that in most developing countries, smallholder agro-processors rely almost entirely on public agricultural advisory services to gain knowledge and skills on agro-processing. Despite the challenges of resource constraints, the desire to have their agricultural products get better competitiveness in both domestic and international market has forced many developing countries to employ strategies to build manufacturing skills capacity of agricultural producers on agro-product processing (Kansal and Sonia, 2009; GoK, 2009). Agro-producers with high levels of awareness on manufacturing knowledge and skills are more pre-disposed to adopt agro-processing as a strategy of making their products penetrate markets and survive competition with agro-products from developed countries. Khumalo (2010) while studying success cases for rural development in agro-processing in South Africa concluded that adoption of technology depends, in the first instance, on degree of change in attitude occasioned by the level of knowledge and skills acquired

and, secondly, on the resource capability of the smallholder processor. Thus, knowledge and skills are necessary but not sufficient conditions for adoption of any new technology such as smallholder agro-processing. The relationship that exists between manufacturing skills dissemination and the growth of agro-processing businesses or units, then, can partly be seen in the context of the number of agro-producers who have adopted agro-processing technology as a result of knowledge and skills gained from agro-processing training and advisory services. The rate of agro-processing technology adoption thus determines the rate of establishment of agro-processing units, which is one indicator of growth of the sector.

Farming in developing economies such as Kenya, though still far from the status in the developed world is increasingly becoming commercialized due to the influences of globalization and the spectre of rising unemployment (Kansal and Sonia, 2009; Kindness and Gordon, 2001). Developing countries, in their effort to stem the problem of rising unemployment especially among the youth, are re-orienting their approach to agriculture sector development from purely food provision to agri-business (Agrifica, 2012; GoK, 2009; Hazell *et. al.*, 2006). Farming in terms of business helps in creating opportunities for jobs for the un-employed population, particularly the educated youth. Attracting educated youth to farming requires modernization of technologies in a manner that makes its job features similar to that of formal industry. Agro-processing industry provides this link between formal industry and farming. Agro-manufacturing skills are, in this way, avenues of growing the agro-processing industries in the developing countries like Kenya to create employment to stem the problem of under-employed young generation.

Research has established that there exists a relationship between technical skill levels of the people running the businesses and the income that accrues from such enterprises. This relationship is confirmed by Gitonga *et. al.* (2010), in their study in Kenya on; "enhancing small-scale farmers' income in mango production through agro-processing and improved access to markets". Training of farmers and small-scale agro-entrepreneurs on agro-processing skills built their capacity in fulfilling manufacturing operations of the businesses. Agro-manufacturing skills are critical in ensuring efficiency and effectiveness of production processes which together contribute to business health. Gitonga *et. al.* found that farmers who had received basic training in agro-processing skills from extension service providers executed their production processes better and recorded higher net returns compared to untrained category. Well trained agro-

entrepreneurs are the most likely to manage their businesses to higher profitability levels in comparison to enterprises run by untrained people. Hazell *et. al.* (2006), in their intriguing study; "*Is there a future for small-scale farms?"* found making small-scale farms profitable through technology and intensification the only option for future survival. They warn that future small-scale farmer must be one who keeps abreast of new skills to make micro-scale farming profitable. The competition to gain space in future farming environment is thus about knowledge and skills to guarantee sustainable profitability levels.

2.4. Access to Managerial Skills and Growth of Smallholder Agro-processing Industry

Every agro-processing enterprise makes use of manpower, money, materials, machinery and other productive inputs. According to Spriegel (2003) management is that function of an enterprise which concerns itself with the direction and control of the various activities and inputs to attain business objectives**.** Management therefore performs the coordinating role of these functions or inputs in-order to obtain maximum possible results. That means in any agro-processing unit or enterprise management occupies the central place among the factors of production. The relative importance of management is illustrated in Figure 1.

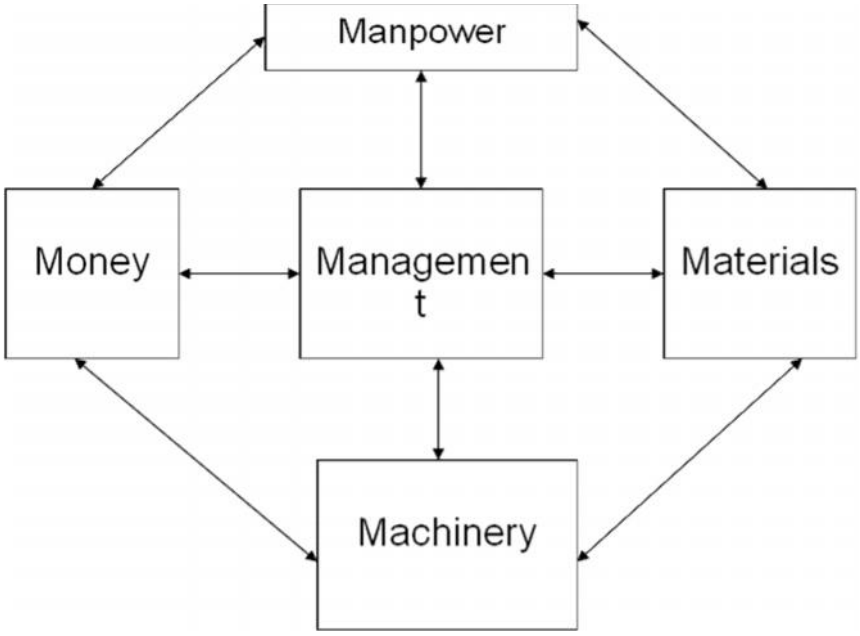

Figure 1: Conceptual Diagram Showing the Coordinating role of Management in the Enterprise unit

Source: *Adopted from C. M. Rambo: Principles of Management-Lecture Notes for Master of PPM, UoN - 2010.*

Among the major challenges to the growth of smallholder agro-processing industry is lack of management skills and competence. According to Matoha (2007) and Odunfa (1995) lack of management skills is one of the major causes of smallholder agro-processing enterprise failures. The significance of the role of management skills in determining the success of smallholder agro-processing units has been emphasised by many studies. Padachi (2006), for instance, in a survey conducted in the United Kingdom reported that more than 20 percent of firm failures were caused by poor skills in managing business finances. But successes in the use of management skills for realizing growth in small-scale agro-industry have also been abundantly reported all over the world.

At global level Bragg *et. al.* (2010), drawing on evidence from a number of studies from smallholder agro-processing units across the world, assert that small-scale multi-product firms are more efficient than large mono-product firms. Guided by the right managerial skills and supported with suitable manufacturing skills small-scale agro-processing activities have registered growth levels of between two and ten times more than large firms.

At Africa continental level, a consortium of NGOs making up the African Smallholder Farmers' Group (ASFG) is convinced that access to agro-product managerial skills, technical knowledge and investment finance can turn smallholder agro-processing industry into viable source of livelihood for millions of farmers across the continent (ASFG, 2010). Access to management skills therefore can lead to remarkable growth of smallholder agro-processing industry exemplified by the creation of employment opportunities for the rural population. However, ASFG acknowledges that this growth can only be achieved when smallholders scale-up their activities, a process which can be lengthy and requires more effective planning and management skills. The role of management skills in influencing growth of smallholder agro-industry has been recorded in many African countries. A case study of Darfur in Sudan reported by ASFG demonstrates how access to management skills by poor rural farmers can lead to better performance and sustenance of smallholder agro-industry. Through mentorship and training on food processing management skills the poor Darfur farmers were reported to have succeeded in raising employment opportunities beyond project expectation. Acquiring management skills helped the farmers to increase their capacity to make better decisions and thereby unlocking their confidence and capacity to make a

difference to their lives. When the conflict in the region escalated the project management skills transferred to local farmers and the ownership of activities that resulted ensured that the industry continued uninterrupted even when outside development agents found it difficult to enter the area. The industry expanded to offer livelihood to about 25,000 individual members of the Women Development Association and 38,000 households (Bragg *et. al.)*. Empowerment of poor small-scale agro-producers is therefore as important as any measurable gains in productivity or incomes. ASFG reported that improved management by the Darfur farmers catalyzed further improvement in the smallholders' capacity to access other productive resources such as agro-processing tools, credit and markets thereby resulting in expansion of the size of agro-processing industry.

In Zimbabwe's Guruve District agro-management skill transfer strategy called participatory market system development approach is reported to have transformed livelihoods of marginalized livestock farmers (Bragg *et. al.*). Through market opportunity groups the farmers were trained on negotiation skills which enabled them to get better access to productive inputs and prices for their meat products. Access to managerial skills helped the farmers to transform their relationships with other market chain players thus making the system more efficient and beneficial to the poor smallholders. As a result, according to Bragg *et. al.* prices of meat products increased by at least 8 percent between 2005 and 2008 leading to improved incomes for 20,000 livestock farmers and their families totaling to over 100,000 people. Another study, Zimmer (2009), quoted by Langat (2012) indicated that success of South African smallholder agro-businesses resulted largely from sound managerial practices and proper control of business resource inputs including manpower, money and capital investments.

In Kenya the training of vegetable farmers around Nairobi on agro-business management skills by Farm Concern International enabled the farmers to secure regular supply contracts with supermarkets in Nairobi metropolis. The 'push' effect created by the improved management led to production of vegetable products growing by almost 300 percent and average gross margin per unit of land rising by over 400 percent from 1,213 to 5,274 US dollars (ASFG).

Hitchens (2006) recognised that there are both internal and external firm factors that play an important role in speeding up the growth and performance of smallholder agro-processing enterprises by transforming raw materials to highly value added finished

products. These factors are associated with technological capability of an agro-processing enterprise unit. Technological capability is a function of management skills, business capital, manufacturing skills of employees and the available manufacturing equipments or technology. In the findings of studies by McPherson (1996) and Mugova (1996) lack of technological capability among agro-processing entrepreneurs has led to failures in small-scale businesses across the globe. Thus, the factor of management skills, being an integral component of technological capability of agro-processing enterprises, also has influence on the performance and growth of agro-processing industry.

In the words of Spriegel (2003) "the purpose of management in an enterprise unit is to guide, direct and unify human efforts and activities of the enterprise for the realization of definite results". Borrowing from Spiegel, management thus embraces all duties and functions that pertain to the initiation of enterprises, it's financing, the establishment of all major policies, the provision of all necessary equipment, outlining of the general form of organization under which the enterprise is to operate and the selection of the employees. Performance of these functions require broad spectrum of managerial skills ranging from financial, strategy development, business planning, group dynamics to operation planning among others. According to Philip (1996) such diverse range of skills can be met by an enterprise unit only through a well planned training programme. He asserts that training and development programmes are necessary in any organization for purposes of improving the quality of performance of employees at all levels of management, especially in a world of fast changing values, technology and environment. Training of small-scale agro-entrepreneurs on managerial skills builds their capacity in management of the businesses which in the end result in improved performance and growth of the entire industry. The benefits of managerial skill enhancement training was demonstrated in a study in Australia by Gibbs (1988), quoted in Langat (2012). The study reported that due to business management skills obtained through training the enterprises managed by youth recorded a failure rate of only 7 percent out of 150 enterprises.

In Bureti District which is the focus of this study, SHoMaP progress report (2012) lamented that agro-processing training and advisory service providers have ignored for long one critical component needed in their extension package to smallholder agro-enterprises. It reiterated that imparting technical skills alone has not guaranteed the expected performance among smallholder agro-business farmers, and that carefully

developed management skill packages should be included as part of entrepreneurial mentorship programme. Cooper (2006) reinforced this perception by predicting that even if smallholder agro-processors were trained and technical skills induced into them, the lack of managerial skills and the competence to coordinate the other input-factors would still create bottlenecks for economic growth of the agro-processing industry. The studies reviewed show adequate evidence that access to managerial skills has impacts on the growth of smallholder agro-industry, and that these impacts have occurred in all regions of the globe. Kenya's up-coming agro-processing industry has not been empirically evaluated in respect of the dynamics of the smallholder agro-processing growth-factors. The factor of managerial skills and competency to grow agro-industry activities has attracted rural development workers as it emerges that technical skills alone has not guaranteed successful implementation of development projects and businesses. The contribution of access to managerial skills to the growth of agro-processing industry in Kenya needs to be contextualized and quantified to shed light on whether the efforts GoK has put since 2003 has born fruits.

2.5. Access to Automated Functions and Growth of smallholder Agro-processing Industry

Alam (2007) refers to automation as the interjection of machinery between men and materials handled by them. In the developing world, including Kenya, it tends to be synonymous to mechanization and broadly means the use of any improved tool, equipment or machinery that assists in enhancement of workers' output, multiplies the human effort, supplements or substitutes human labour, avoids drudgery or stresses that adversely affect human mental faculties leading to errors, imprecision and hazards and eventually loss of efficiency (Alam, 2001).

Globalization and its demand of competitiveness calls for greater timeliness, precision in manipulation of manufacturing inputs that have become increasingly costlier, minimisation of losses and, product value addition for additional income and employment. Automation contributes to greater sustainability to farm families and makes farming and associated agro-processing activities less arduous and economically rewarding and satisfying (FAO, 2007). According to World Bank Report (2006), firms that are automated grow faster, invest more, and are more productive and profitable than those that do not.

In the Asia Pacific Region, Hicks (2007) reported that the Newly Industrialized Economies of the East Asian Region relocated labour intensive-industries to South-East Asia partly because of the rising costs of labour. This “industrial flight” negated the growth of the industrial sub-sector in those countries and could have been arrested if semi-automated but cheaper production systems were adopted. Hicks also found that there was time lag between technologies used in the agro industries and technical practices taught in educational institutions. Thus there was lack of high level technical understanding of production processes among the workforce which ended up restricting consistent performance. This case presents a striking similarity with Kenyan food manufacturing industry. As the costs of living in Kenya is rising demand for higher pay packages has become more earnest and Kenya Association of Manufacturers has warned this may make manufacturing costs of goods more expensive and uncompetitive thus retarding growth of the sector. Full or semi automation of agro-processing operations is perhaps the preparedness that Kenyan small-holder processing units require to remain on the growth path in view of globalization and market competition.

In Brazil, Costales (2008) found that processing of tropical juices increased more than twenty-fold in the 1980s as a result of adopting a more efficient automated process of stabilizing chemical characteristics of the fruit juices to a commercially acceptable level.

In Philippines Costales (op cit) cites the inadequacy in automating processing technology as the cause of wastes and cost inefficiencies since the current technology cannot address perishability of commodities and processed output. Costales observes that technology limitations in packaging have decreased effective utilization of raw material in Philippines as the potential shelf life of raw materials is not met. Several reasons are cited for this failure. One most important is the lack of a competitive strategy or development plan for the industry in the context of globalization. Due to globalization processing industry is no longer competing against the best firms in one country but also with the best in the world. Studies have shown that countries that successfully adopt and adapt technology are those that were able to develop competitive and sustainable industries. Case in point is Japan during the period of 1950 to 1970, where adoption and diffusion of automated technology was mainly responsible for the development of its industries and economy in general (FAO, 2007). Problems related to shelf life are some of the major causes of product losses and wastage in rural agro-processing enterprises in

Kenya (GoK, 2009). The level of farm product wastage in Kenya is estimated to be up to 30 percent, which is a big drawback to the development of agro-industrial sector. This could be reduced if more effective technologies of preservation were used.

The success of developing countries lies in their ability to facilitate automated technology diffusion in the early stages of development and generate technology in the advance state of development. This has been the case of Japan and Taiwan, two of the most progressive countries in the world (Costales, 2008). Smallholder agro-processing industry in developing countries is characterized by manual and batch type processes, labour intensive, with minimal sophistication. In consequence the overall result is low productivity and efficiency. Quality and hygienic aspects are also often minimal and little. Smallholder sub-sector therefore offers little competition to the modern agro-processing businesses, although their products are sought after by local populations (Koumboulis and Pavlovic, 2010). Manufuture (2006) underscores the shifting of focus from manual-dependent processing by stating that:

> "*Much of industry that is dependent on handmade construction has moved from Europe to less developed countries with low skilled workers or with very cheap labour. Hand labour has minimal attraction, except for niché markets, with automation accepted by everyone and everywhere, and considerable demand for new techniques and machines that enhance control*".

Alam (2001) reported that agricultural working groups, policy makers and social scientists in India promoted automation or mechanisation to remove drudgery from agricultural operations so that rural educated youth do not run to urban areas in pursuit of jobs which are already in short supply. Given the massive youth unemployment and the overcrowded informal settlements in urban areas in Kenya, policy planners are looking at agro-industry to absorb a large proportion of this group. Small-scale rural agro-processing units in Kenya therefore should embrace automation as part of the strategy to make agro-industry appealing to the youth or "e-generation". Assessing the level of mechanization or automation of small-scale agro-processing activities in the rural areas and their impact in terms of making the industry attractive to the youth is therefore an imperative. Upgrading of such industries through mechanization or automation also offers a window of opportunity to local markets by enabling them to

feed their partially processed products into larger agro-processing operations (FAO 2007).

The development of the smallholder agro-processing industry will require a parallel growth of the other sub-sectors of the agribusiness system that include the input, production, marketing, and the support subsystems. According to Costales (2008) the anaemic growth of the agro-processing industry in developing world could be attributed to major constraints in competitive assets and processes. These competitive assets include: technology, finance, infrastructure and transportation, and human resources. Competitive processes cover: quality, cost efficiency, reliability, and dependability. In India Alam (2008) found that agricultural produce market prices are engineered to be low for food and nutritional security and food accessibility to the masses. This together with the rising labour wages has forced agro-producers to look for labour saving devices to remain competitive more so with the globalization of the world markets. With the level of food and nutritional poverty in Kenya standing at more than 50 percent and the constant rise in food commodity prices since 2008 this situation in India finds perfect relevance for Kenya. And agro-processors in Kenya must start re-evaluating their production technologies to make them more efficient and cost effective to bring down the cost of food while at the same time remaining competitive for market penetration.

Smallholder agro-processing industry currently relies on substantial manual labour at low skill level. Apart from reducing loads on workforce, automation can also bring in higher skilled employment associated with new machinery management (Ting and Gift, 2005). Overall, automation should be looked at in terms of its capacity to facilitate efficient processes in smallholder agro-industry and related areas: it enables reduction of human workload in fields of agricultural processes and ensures high efficiency in agro-processes. Objectives of automation in promoting the growth of smallholder agro-processing industry are therefore to reduce manufacturing costs, create unique products of consistently high quality, and ensure flexibility needed to adjust to changing markets. Automation is necessary here to achieve quality and reliability of products. Production facilities should conform to world standards and best practices should be adapted to achieve higher productivity. Moreover, agriculture is becoming more commercialized, as farmers are competing with other farmers all over the world. To face these challenges

modern agricultural practices such as agro-process automation must be adopted (Abdon and Raab, 2004).

2.6. Theoretical Framework

Theoretical framework is defined by Kombo and Tromp (2006) as a collection of interrelated ideas based on theories. This study will be anchored on the theory of Value-added Capability developed by two professors; Anwar Hossain and Shahidul Islam of the American International University in Bangladesh (Hossain and Islam, 2007) and the Hirschman's Linkage hypothesis.

Value-added Capability concept is an empirical model which provides a general measure of growth of agro-processing enterprises attributed to technological capability or technology density within the enterprises. The theory suggests that among farmers and agri-business operators, the decision to employ specific agro-processing technologies in their operations is guided by the capability of those technologies to create more value or benefits than already exists. Hitchens (2006) affirms that, for processing of raw agricultural produce to occur, the enterprise unit must acquire a technological capability or, in other words, a manufacturing technology (MT) relevant to the end product. Hossain and Islam (2007) breaks down MT into four complementary components namely; manufacturing equipment, automated or semi-automated functions, skills of manufacturing employees, and skills of management employees. These ingredients of MT are critical for growth of any agro-processing unit. They further argue that technology density is proportional to and dependent on MT. Thus, when the concentration of MT in an industry or enterprise is increased then the density of technology also increases. This relationship may be expressed mathematically as:

$$\text{Technology density } (\gamma) = \frac{\text{Available Technology, } T_a}{\text{Demand of Technology to meet processing requirement, TD}}$$

$$= Ta/TD$$

Hirschman's linkage hypothesis is a theoretical rationale which emphasizes the importance of matching the agro-processing activity with the agro-processing

technologies selected. It postulates that the best growth path lies in selecting those activities where the resulting progress will induce further progress elsewhere. Thus, an activity that shows a high degree of interdependence, as measured by the proportion of output sold to or purchased from other industries, can provide a strong stimulus to economic growth.

These theories; the Value-added Capability Concept and Hirschman's Linkage Hypothesis are interlinked, and are relevant to this study. Similar to the Value-added Capability Theory this study takes into account the fact that access to agro-processing technologies can be functional only when both direct and indirect factors that impact on access are included. The approach must be a multi-faceted and deliberate plan that involves the upgrading of technical and managerial skills of employees, the manufacturing tools and equipment as well as the level of automation and accuracy of machineries used in the processing unit. The study proposes to evaluate the processing skill levels of employees, availability of processing tools and equipment, the degree of automation of processing operations, and managerial capability of the employees as parameters of access to agro-processing technologies.

Both theories view growth of agro-processing industry in terms of the extra value and other benefits created by the agro-processing technologies employed in executing the processing of agricultural products. Value-added Capability Theory argues that by accessing agro-processing technologies the smallholder agro-processing units develop the capability of producing high value-added products which in turn leads to creation of opportunities of employment and contribution to GDP. According to Hirschman's Linkage Hypothesis agro-processing industry possesses high degree of interdependence with other sectors. Through its forward and backward linkages, agro-processing technologies can play a very important role in accelerating economic activity and eventual overall growth. Use of agro-processing technologies enables agro-industrial sector to create linkage with other sectors of the economy such as retail supermarket chains, hotel industry, wholesale suppliers and rural agricultural production etc.

These two theories are sufficient to support the objectives of this study in that they adequately elaborate on the factors of access to agro-processing technologies (independent variable) and that of growth of agro-processing industry (dependent variable) and, how that growth can be estimated. In relying on these theories the researcher is, however, cognizant of their limitations. Access to agro-processing

technologies, especially among smallholder farmers, predominantly depends on access to investment finance or business capital and rate of technology diffusion in the society. Since smallholder farmers rely mainly on public advisory services, and with the prevailing budget constraints in most governments, the farmers may not be at the technology densities envisioned by the theories. In measuring growth agro-processing industry must be understood as part of the wider development environment. Some external factors not taken into account by the theories such as economic, social and political stability may also affect the overall performance of the industry.

2.7. Conceptual Framework

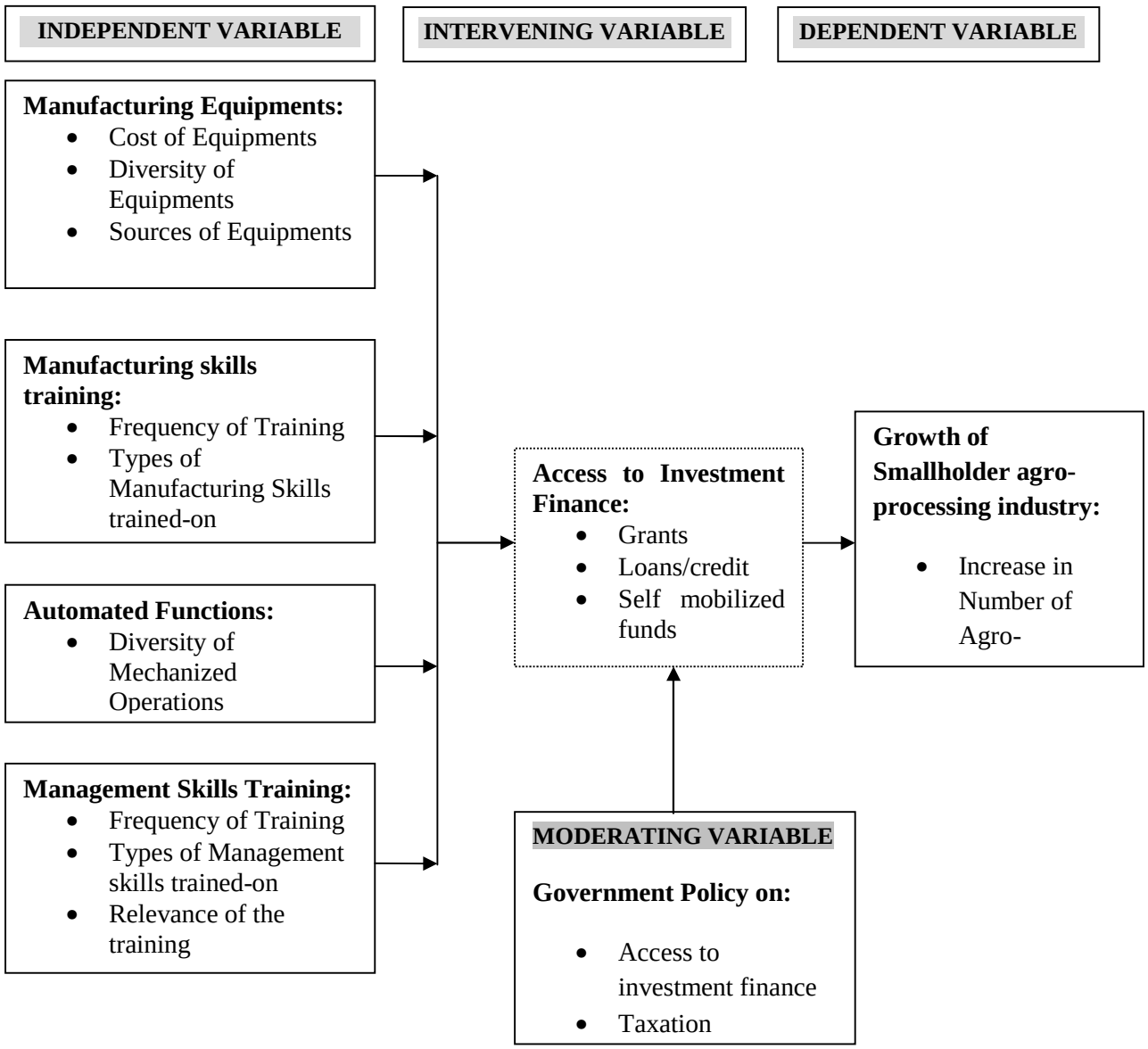

Figure 2: Schematic Diagram of the Conceptual Framework

This study sets to determine the impact of access to agro-processing technologies on the growth of smallholder agro-processing industry in Bureti District, Kericho County. It postulates that the level of growth of smallholder agro-processing industry is affected by the degree of access to agro-processing technologies. These technologies include manufacturing equipment, manufacturing skills of employees, automated or semi-automated functions and management skills of employees that are required in establishing and operating agro-processing units or enterprises.

The variables in the study are; access to agro-processing technologies, which is the independent variable and level of growth of smallholder agro-processing industry (Dependent Variable). The relationship between the independent and dependent variables is regulated by access to investment finance (Intervening Variable). When finances are accessible to smallholder entrepreneurs it is expected that they use the funds to acquire inputs such as manufacturing equipment, manufacturing skills and managerial skills to help set up and operate agro-processing units.

The study will examine access to agro-processing technologies in the context of manufacturing equipment, level of automated functions, manufacturing skills and, management skills of employees as important factors of access to technological capability. The impact of access to agro-processing technologies on growth of the smallholder agro-processing industry will be measured in terms of the increase in size of the industry. Parameters of increase in size include; increase in number of agro-processing units; increase in the value-added index of agro-products; increase in profits of agro-processing units; increase in number of people employed in the industry; and increase in diversity of agro-products processed etc. However, the study will limit its scope of investigation to the increase in number of agro-processing units as the indicator of growth of the sector.

2.8. Summary and Gaps in Literature

The literature reviewed confirms that agriculture is still the mainstay of economies of many countries across the globe. However, deficiencies in the capacity of agriculture to adequately provide for livelihoods of rural poor, particularly in the developing countries are continuing to worsen. Focus on dealing with the limitations of traditional agriculture is turning to agro-processing as a new approach to tackling growth, hunger and poverty issues among smallholder farmers. Literature from the developed countries such as USA, Japan, Germany and United Kingdom indicate that policies which favour

access to agro-processing technologies are important for the success of small-scale industries in stimulating industrial development and technological innovation. In developed countries impacts of access to agro-processing technologies on growth of small-scale industry has been registered in aspects such as employment creation, national income generation, product diversity, rural-urban product integration, import-export substitution and increase in number of manufacturing units. In many of these countries, more than 90 percent of all enterprises belong to the small and medium industries sub-sector with agro-processing input accounting for over 40 percent. The picture is different in developing countries as the small-scale agro-processing industry is still in its formative stages taking a share of less than 10 percent in most of the countries. Literature suggests that developing countries like Kenya should promote access to agro-processing technologies for SSIs because of their greater economic benefits (job creation, efficiency and growth) compared to large firms. Small-scale agro-processing industry in these countries, like the wider agriculture sector, is experiencing limitations most of which relate to access to technology. The major constraints to agro-processing as evidenced from the reviewed literature include lack of: equipment purchase capital; manufacturing skills; management skills; technical advice from experts; technology upgrading system; product quality and manufacturing standards. The literature surveyed has enumerated the problems which agro-processing industry encounters and indicated how some regions of the world have overcome them in support of small-scale agro-industrial growth. For most of the developing world, particularly Africa, the literature reviewed falls short of qualifying and quantifying the extent to which these limitations have affected specifically the growth of the agro-processing sector.

In regard to impact of manufacturing equipment on growth of agro-processing industry the literature reviewed has established that there is direct relationship between access to agro-processing equipment and the level of growth of agro-processing industry. In most developed countries and some developing countries such as India, Ecuador and Bangladesh access to manufacturing technologies led to the general expansion of the small-scale industrial sector reflected in form of increased employment, exports and gross domestic product (GDP). However, in Africa, studies such as those by Braggs (2010), Mhazo (2003) and Chakwera (1996) found an indirect relationship through availability of finances. This relationship is premised on the assumption that access to finance would facilitate acquisition of agro-processing technologies, especially the manufacturing

equipment that are required in setting up processing units. The glaring gaps in this conclusion are; one, its assumption that when smallholder agro-processors get funds they rank purchase of manufacturing equipment above all other requirements; two, its assumption that establishment of agro-processing units results from mere acquisition of agro-processing equipment alone. The concept of functional accessibility of technology points out that there are technology-facilitating factors e.g. repair and maintenance service, operating skills etc that must be in place to assure usability which may then lead to growth of the industry.

In relation to manufacturing skills literature suggests that the rate of adoption of new skills is directly proportional to amount of knowledge residing in the farmers and entrepreneurs. The relationship stated by the reviewed works are drawn from studies carried out in countries such as India (Saikia, 2012; Shehrawat, 2006), Zimbabwe (Nazare, 2005; Mhazo, 2003; Mugova, 1996; McPherson, 1991) and South Africa (Louw, 2010; Madima, 2006) where the level of agro-processing expertise, sophistication and awareness is relatively more advanced than in Kenya. For a study area such as Bureti District where agro-processing is relatively a new subject among agricultural experts it would be justified to establish the level of available expertise and its linkage with the growth of smallholder agro-processing industry.

On management skills literature reviewed concluded that training of farmers on management skills leads to better enterprise performance and low failure of projects thus better financial returns. Lack of management skills is recorded to have been responsible for more than 20 percent of firm failures in the developed world. It is therefore important to establish the degree of agro-processing management skill training offered to farmers and if this has led to the benefit of higher profits and expansion among existing enterprises.

Literature shows that automated functions in an agro-manufacturing unit have direct benefit in terms of efficiency, effectiveness and accuracy in performing operations. In result these lead to lower cost of production, lower comparative prices of products, higher profits, high productivity and waste reduction. These results of automation are indicators of how it impacts on growth of the industry. The literature however failed to evaluate the level of attraction of the youth to agriculture which is an important aspect in finding a solution to the problem of unemployment.

Overall, none of the studies reviewed focussed distinctly on the impact of access to agro-processing technology on the growth of the agro-processing sub-sector. No work has isolated, from the combined effect of all the factors which lead to the growth of agro-processing industry, the singular contribution of the access to agro-processing technologies. The reviewed literature has demonstrated that even in situations where technology has been accessed new challenges emerge in terms of technology-related disparities among entrepreneurs. Odingo (2010) in her study of factors affecting sustainability of IGAs in Nyando District recommended that the effect of tools and equipment on sustainability of IGAs should be studied. When an IGA is self sustaining it can lead to growth. Similarly, growth of IGA can also lead to sustainability. Thus, Odingo's proposition, in addition to the gaps in the other academic works evaluated by this researcher, informed the motive to investigate this important stimulus to the growth of Kenya's agricultural sector. The thrust of this study was to examine the impact of access to agro-processing technologies on the growth of small-scale agro-processing industry in Bureti District.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1. Introduction

This chapter gives the description of methods that were used in carrying out the study. It covers the following sub-headings: Research Design; Target Population; Sampling Procedures and Sample Size; Data Collection Instruments; Pilot Testing of Instruments; Validity of Instruments; Reliability of Instruments; Data Collection Procedures; Data Analysis Techniques, and Ethical Considerations.

3.2. Research Design

Cross-sectional descriptive survey design was the basis of this study. According to Kombo and Tromp (2006) descriptive research is a process of explaining the state of affairs as it exists. It seeks to ascertain respondents' perspectives or experiences on specified subject in a pre-determined structured manner (Gay, 1993). Descriptive research investigates populations by selecting samples to analyze and discover occurrences. As Kerlinger (1969) notes, the description in this design is not only restricted to fact finding but also results into formulation of important principles of knowledge and solution to significant problems. This research design was used because it takes into account factors such as economy of design, rapid data collection and ability to understand a population from a part of it and its suitability for extensive research (Oso and Onen, 2009). A mixture of both quantitative and qualitative empirical data was collected to aid in analyzing the performance of small-scale agro-processing enterprises or activities. The study mainly relied on primary data collected from individual agro-processors, members of agro-processing groups and MoA technical officers in Bureti District through complementary use of questionnaires and interview schedules. Secondary data was obtained from journals, theses and dissertations, Government documents and books.

3.3. Target Population

Mugenda and Mugenda (2003) define target population as that population to which a researcher wants to generalize the result of a study. Mugenda also notes that due to resource or logistical constraints researchers sometimes draw samples from 'accessible population' as long as the validity of target population is maintained. The accessible target population was 400. This included 373 farmers from 26 agro-

processing groups, 5 individual agro-processors and 22 technical officers of the MoA who offered training and professional advice on agro-processing activities.

The sampling frame for both agro-processing IGAs and technical staff are provided in table 1.

Table 3. 1: Target population in Bureti District, 2012

Geographic Cluster	Agro-processing Group Members (stratum 1)	Individual Agro-processors (stratum 2)	No. of Technical Experts (stratum 3)	Total population
District HQ	0	0	4	4
Roret	172	2	5	174
Cheborgei	98	1	7	99
Bureti	103	2	6	105
District Total	**373**	**5**	**22**	**400**

Source: MoA Bureti District Profile, *updated December 2012.*

3.4. Sample Size and Sampling Procedures

In this section the sample size and sampling procedures are presented.

3.4.1. Sample Size

According to Kothari (2011) sample size should be neither too large nor too small, respectively due to cost effectiveness and accuracy in meeting the objectives. Studies require optimum sample size from the accessible population in order to meet requirements for research (Mugenda and Mugenda, 2003). The sample size in this study was determined using research sample determination table adopted from Krejcie and Morgan (1970) presented in appendix 5. The sample was comprised of 196 individuals drawn from target population of 400 members of agro-processing groups, individual processors and Agricultural experts. The sample size consisted of 183 smallholder agro-processors drawn from farmer groups, 3 individually practising agro-processors and 10 agro-processing technical advisors.

According to Amin (2005), for a population of 400 a larger sample than 196 will not make any difference in the study results. This sample was distributed in the four

geographical areas and three population strata using the Bowley's Formula for proportional allocation. The distribution is presented in Table2 under section 3.4.2.

3.4.2. Sampling Procedures

The study used mixed sampling techniques. Flow of sampling techniques involved area sampling, followed by purposive sampling in specific aspects and stratified sampling enriched with simple random method without replacement. Stratified random sampling is a modification of random sampling in which population is divided into two or more relevant and significant strata or groups based on one or more attributes (Saunders, Lewis and Thornhill, 2007). Stratified sampling was used to separate agro-processing stakeholders into individual processors, group processors and processing advisory experts. Synergy brought into the design by these different techniques was expected to yield balanced and generalizable outcome.

In the first stage, the researcher identified 4 administrative blocks (Bureti, Cheborgei, Roret and District HQ) in the District to form the geographic clusters. Groups, agricultural experts and individuals doing agro-processing activities were then selected from each cluster using purposive sampling method. In second stage, three separate strata namely; processing groups, individual processors and agro-processing experts were formed from each sample block/cluster based on the nature of agro-processing service or activity they perform. The sum of these strata constituted the accessible target population from which final sample was derived using random sampling method with proportional allocation.

The researcher determined the proportion of study subjects in the final sample by adopting Bowley's proportional allocation formula as follows:

$$nh = \frac{nNh}{N}$$

Where
- nh = number of units allocated to each stratum or sample division.
- n = total sample size
- Nh = number of items in each stratum (sample division) in the Population
- N = Population

Sample sizes for the different study respondents calculated using Bowley's formula gave 183 agro-processors from groups, 3 individual agro-processors and 10 agro-processing experts. Practically, the final sample was selected through simple random method. The names of the agro-processing individuals were written on pieces of

papers which were then folded and put in a bag. After mixing the slips thoroughly, the researcher selected one slip at a time. The name on the slip was then recorded and returned to the bag. The method of sampling is called balloting – with- replacement.

Each time the slips were mixed up before another slip was selected. This operation was continued until the proportion needed for the agro-processing respondents was completed. This process of sample selection gives each unit of the population an equal chance of being selected.

Table 3.2: Distribution of Sample by Population Strata and Geographic Area

Population Strata/Geographic Area	District HQ	Roret	Cheborgei	Bureti	Sample Size
Agro-processing Group Members	0	85	48	50	183
Individual Agro-Processors	0	1	1	1	3
Technical Experts	2	2	3	3	10
Total per Geographic Area	**2**	**88**	**52**	**54**	**196**

Source: Developed by Researcher from MoA Agro-processing Inventory using Stratified Sampling and Proportionate Allocation, 2012

3.5. Research Instruments

Ouko (2012) describes research instruments as tools used to collect data. Some of the common research tools include interviews, questionnaires, focused group discussions, observation and document analysis. According to Kothari (2004) the choice of which instruments to use in a study depends on the nature of the problem, time and resources as well as the degree of accuracy. Selection of instruments for this study was made with the four factors in mind, choosing to have a mix of four data collection tools to build on the strengths of each of them and neutralize any inherent weaknesses. The tools used in this study were; questionnaires, structured interviews, observations and documentary analysis.

A questionnaire comprises a collection of items to which a respondent is expected to react, usually in writing (Oso and Onen, 2009). Questionnaires were used mainly for their ability to capture variables that could not be directly observed such as opinions, views, perceptions and feelings of respondents. Questionnaires were administered on agro-processing experts from the MoA who formed part of the sample population. The questionnaires largely contained closed-ended questions that helped respondents to focus on the issues under examination but included limited number of open-ended questions that allowed the researcher to learn any new perspectives. The key areas of inquiry in the questionnaires included; agro-processing expertise capacity, farmers' agro-processing training and technology diffusion, agro-processing equipment access and enterprises, agro-processing financing, agro-products and value-added capacity, smallholder resource integration and linkages, and degree of interdependence.

According to Kothari (2011) interviews involve presentation of oral-verbal questions and responses through personal involvement of the interviewer using a schedule. An interview schedule is a set of questions the interviewer asks when collecting data using interview method. It makes it possible to obtain data required to meet specific objectives of the study (Mugenda & Mugenda, 2003). This study used structured interview schedule to solicit information from sampled smallholder agro-processors drawn from groups and independent categories.

Observation is used to record what is observed during data collection (Ouko, 2012). Observation in this study was guided by a pre-determined matrix of issues covering the following: variety of processed products; level of sophistication of manufacturing equipment and products; scale of production; product quality factors; process automation levels, and impacts on livelihood and lifestyles.

Document analysis will focussed on information from magazines, periodicals, reports, journals, newspapers and official records related to the title of the study. The researcher searched information available with the MoA Library, Kenya Agricultural Documentation Centre, Industrial Development Offices, IFAD Knowledge Management database, NGOs, Other relevant Kenya Government Departments, Egerton University Library and University of Nairobi Library

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3.5.1. Testing

In connection to data collection instruments Malusu (1990) defines pilot testing as a preliminary survey that helps to reveal and adjust ambiguous items. It involves the researcher trying out the study on a small scale in-order to detect and correct any challenges that might occur during the actual study. According to Mugenda and Mugenda (2011) piloting also determines whether or not the study will yield the expected results. The interview schedule and questionnaire were constructed by the researcher. In-order to identify the variables to be used in the instruments, the researcher conducted a trial interview with 4 small-scale agro-processing entrepreneurs and 2 agricultural experts. A rough draft of the interview schedule and questionnaire were prepared and circulated among selected professional researchers for critical evaluation. The draft was then revised in the light of their comments. The revised instruments was thus prepared and administered to 4 other small-scale agro-entrepreneurs and 2 agricultural experts for a pre-test. Their suggestions and lessons learnt were thereafter incorporated in the data collection tools.

Most items of questionnaire and interview schedule were tailored to elicit quantitative information on the four research questions stated in section 1.5. Some interview schedule and questionnaire questions were developed to capture qualitative aspects of the research questions and filled gaps that emanated from the quantitative answers.

3.5.2. Validity of the Instruments

According to Kuhn (2003) validity is the degree to which empirical measures of a concept accurately measures that concept. It is an indicator of the extent to which study results can be accurately interpreted and generalized to other populations (Oso and Onen, 2009). Instrument validity therefore refers to the method of determining the extent the instrument measures what it purports to measure. In order to validate the instruments, every item of the questionnaire and interview guide was first evaluated by the two academic supervisors to determine their relevance to the study objectives. Evaluation was against a scale of 1 to 4, in which 1 meant ‘not relevant’; 2 meant ‘somewhat relevant’; 3 meant ‘relevant’; and 4 meant ‘very relevant’. Validity index was then determined from the supervisors’ agreement on items rated 3 or 4 by both of them. Content validity index was calculated as $n^{3/4}$ /N, where $n^{3/4}$ is the number of

items marked as ‘good’ by both experts and N is the total number of items assessed. The instruments was acceptable because validity index was ≥ 0.7 (Oso and Onen, 2009).

3.5.3. Reliability of the Instruments

Reliability is a test of the degree of consistency of responses collected by the use of the . It indicates the extent to which research results are consistent over time, over place and over methods (Oso and Onen, 2009). Test re-test method shall be used to ensure the reliability of the instruments. The instruments were administered twice within a span of 14 days to a convenient sample of 30 agro-processors from Belgut District selected at random. The results from test were correlated using Karl Pearson’s product moment correlation until they got some internal consistency. Karl Pearson’s product moment coefficient of correlation is given by:

$$r = \frac{N\sum x\,y - (\sum x\,y)(\sum y)}{\sqrt{(N\sum x^2 - (\sum x)^2 (N\sum y^2)}}$$

Where:

x	=	group 1 Scores
y	=	group 2 Scores
$\sum x$	=	sum of x Scores
$\sum y$	=	sum of y scores
$\sum x^2$	=	sum of squares of x scores
$\sum y^2$	=	sum of squares of y scores
$\sum x\,y$	=	sum of products of x and y scores
N	=	sum of paired scores

The value of the coefficient must be ≥ 0.7 for the reliability of the instruments to be acceptable since the closure the value of r is to 1.00 the higher the reliability of instrument becomes (Punch, 1998).

3.6. Data Collection Procedures

Immediately the study proposal was presented by the researcher and approved by the University's Research Panel, application to the National Council for Science and Technology for a research permit was made. Permission was also sought from the Ministry of Agriculture, Livestock and Fisheries in Bureti District that helped to gain access to Agricultural technical personnel and agro-processing groups. Thereafter a research team of six research assistants and the researcher was formed. The research assistants were consequently trained on data collection techniques and the overall research planning. After finalizing logistical arrangements the research team embarked on data collection which took 8 days. Administration of questionnaires and interviews were executed with the aid of research assistants. The researcher was particularly involved in interviewing and making direct observations among the agro-processing entrepreneurs.

3.7. Data Analysis Techniques

Langat (2012) defines data analysis as categorizing, ordering, manipulating and summarizing data to obtain answers to research questions. It involves synthesizing, breaking into manageable units, searching for patterns, and deciding what is important and what to tell others. The collected data was first edited and corrected centrally in a validation meeting comprising the researcher and field enumerators. Second, the data was coded, entered into SPSS programme and analysed with the assistance of both qualitative and quantitative approaches. Statistical procedures included descriptive statistics and inferential analysis. Using percentages, comparative relationships were established. The researcher also used frequency tables to present the data.

3.8. Ethical Considerations

In conducting this study the researcher committed himself to the fulfilment of the following ethical issues: one, that there was reasonable justification for incurring the costs of data collection. The Government of Kenya had made substantial investment through her various plans and programmes to promote agro-processing and value-addition among smallholder farmers over the past decade (GoK, 2009; MoA, 2005). This lent credence to the need to investigate if there were any impacts created by such efforts. The intended benefits of this study therefore outweighed its costs. Two, confidentiality of the subjects of this study were ensured to the fullest extent possible. Only a limited number of people involved in the survey were permitted to know the identity of the

respondents. Three, researcher obtained informed consent from the subjects to be used in the study and also ensured that all subjects participated voluntarily. The researcher achieved this by fully explaining the research in advance to gain informed consent. Four, the researcher maintained an open and honest dealing with the subjects and other researchers. Fifth, researcher took full responsibility for this work. He accepted individual responsibility for the conduct of the research and the consequences thereafter.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSIONS

4.1. Introduction

In this chapter is presented the study findings which were analyzed and discussed in line with the objectives under the following thematic areas: response return rate, general characteristics of the agro-processing respondents, professional characteristics of agricultural expert respondents, impact of manufacturing equipments on growth of smallholder agro-processing industry, impact of manufacturing skills training on growth of smallholder agro-processing industry, impact of access to mechanized/automated functions on growth of smallholder agro-processing industry, and impact of management skills training on growth of smallholder agro-processing industry.

4.2. Response Return Rate

Poor return rates reduce sample size which leads to imprecision, and is therefore a potential source of bias. Consequently poor return rate lessens the confidence with which the findings can be accepted and generalized. This study intended to collect and collate data from a total of 196 participants who were selected from 378 small-scale agro-processors and 22 Agricultural Extension Experts from the Ministry of Agriculture. The sample of 196 was broken into 186 agro-processors and 10 agricultural experts. Data emanating from the agro-processors was collected using structured interview schedules which were administered using trained research assistants. Information from agricultural experts was collected through the use of questionnaires.

Out of the total 10 questionnaires issued to Agricultural Experts, all (10) were returned representing a total response return rate of 100 percent. A total of 186 structured interview schedules were administered to agro-processors and 186 were returned giving a return rate of 100 percent. This high return rate was made possible because the researcher, after randomly selecting the respondents from the inventory provided by the Ministry of Agriculture, allocated each of the 6 research assistants specific respondents in specific administrative units to interview. The assistants then booked appointments with the agro-processors on different days based on the respondents' convenience. Agricultural Experts were coordinated through their District Headquarter Officers, who ensured that all questionnaires were returned.

4.3. Characteristics of the Agro-processing Respondents and Agricultural Experts

In order for the researcher to understand the operational factors surrounding smallholder agro-processing income generating activities (IGAs) some key characteristics of the agro-processing respondents were examined. These included the distribution of respondents by: the duration their IGAs had been in operation, age bracket, level of education, mode of practicing agro-processing business and the legal status of the IGAs. The findings are presented in the succeeding sub-sections.

4.3.1. Distribution of Agro-processing Respondents by the Duration of IGA Operation

The study inquired about the number of years the agro-processing IGAs owned by the respondents had been in operation. The number of years an agro-processing IGA has been in existence is important for explaining the experience that the owner has in observing IGA operations. It gives the owner the capacity to provide reliable accounts of the performance of the agro-processing business in terms of access to technologies and their impacts on the different growth indicators such as diversity of products, profits, expansion of business and change in number of agro-processing units. Table 4.4 gives the distribution of agro-processing respondents based on the length of time their agro-processing businesses had been in operation.

Table 4.4: Age Distribution of Agro-processing IGAs represented by the Respondents

Age of Agro-processing IGAs	Frequency	Percent (%)
Less than 2 years	66	35.4
From 2 to 3 years	14	7.3
From 4 to 6 years	79	42.7
From 7 to 10 years	9	4.9
NR*	18	7.9
Total	**186**	**100.0**

Source: Own computation from the study data – July, 2013

NR* - Refers to some 18 (9.7 percent) Agro-processors who failed to respond to the question inquiring about this aspect of the Agro-processing IGAs.

Results from the study showed that out of the 186 sampled Agro-processing respondents 66 (35.4 percent) had been in operation for less than 2 years, 14 (7.3 percent) had been in operation for 2 to 3 years, and 79 (42.7 percent) had been operating for 4 to 6 years. Only 9 (4.9 percent) had operated for 7 to 10 years. From the findings it can be observed that an aggregate of about 85.4 percent of the smallholder agro-processing IGAs had been in operation for less than 7 years. Fourty two point seven (42.7) percent of them were less than 4 years old while another 42.7 percent were 4 to 6 years old. This means that over 85.0 percent of agro-processing outfits owned by the respondents were started after 2006. It may thus be concluded that agro-processing activity is a rather new occupation among farmers in Bureti District with a history dating back 6 to 7 years ago. Coincidentally, this period falls in phase with the time the government of Kenya made policy re-alignment to focus on value-addition and agro-processing through her development blue prints, ERS and Vision 2030, launched in 2003 and 2008 respectively.

It is worth noting that Kenya's MoA, in an effort to actualize the policy aspirations for the agricultural sector, developed sector strategy papers; SRA in 2004 and ASDSP in 2009. These strategic papers led to the formulation and implementation of Njaa Marufuku Kenya Programme and SHoMaP in Bureti District (DAO Bureti, 2012). Both Programmes emphasized agro-processing of agricultural produce as a strategy to commercialize and improve profitability of small-holder agriculture. The advent of agro-processing IGAs in Bureti District may therefore be linked, to a large measure, to the implementation of NMK and SHoMaP activities.

The findings show that 102 (54.9 percent) of the agro-processing IGAs were older than 2 years in operation and have survived the critical failure period. Based on observation by Langat (2012) that after 2 years most businesses stabilize their operations the researcher considered most respondents to have been in agro-processing industry long enough to be able to provide reliable information for the study. These results are therefore in agreement with the previous studies by Kimuyu and Omiti (1999) and Mwomo (2004) cited in Langat (2012), and McCormick and Pedersen (1996) who found that most businesses fail within the first year of start-up.

4.3.2. Distribution of Agro-processing Respondents by Age

The study explored age of the agro-processors because it is an important indicator in explaining a person's activeness. For instance, the youth are expected to be more bodily active than the elderly and in consequence should have more abilities to engage better in business activities compared to the older generation. Table 4.5: shows the age distribution of the agro-processing respondents.

Table 4.5: The Age Distribution of the Respondents representing Agro-processing IGAs

Age Bracket of Agro-processors	Frequency	Percent (%)
Below 20 years	2	1.2
20 - 29 years	32	17.1
30 – 39 years	77	41.5
40 – 49 years	23	12.2
Over 50 years	50	26.8
NR*	2	1.2
Total	**186**	**100.0**

Source: Own computation from the study data – July, 2013.
NR* - Refers to two (2) Agro-processors (1.2 percent) who failed to respond to the inquiry on the age aspect.

From the findings presented in table 4.5 it can be seen that, out of the 186 respondents from Agro-processing IGAs, the age category that had the highest involvement in agro-processing IGAs was that of 30 to 39 years consisting of 77 (41.5 percent) of the small-holder agro-processors. Overall, the young generation falling below the age of 40 years constituted 111(59.8 percent) of the agro-processors covered by the study. This category included the post-college youth (20 – 39yrs) which represented a significant 58.6 percent of all the agro-processors implying that this group of potential job seekers found small-scale agro-processing industry a suitable source of employment. The older generation defined by the age above 40 years constituted 83 (39.0 percent) of the small-holder agro-processors. People above 50 years also had significant involvement in agro-processing activities with participation level of 50 (26.8 percent).

These results bring out that the younger generation with less than 40 years (59.8 percent) more than the older agro-processing respondents above 40 years (39.0 percent). These results further indicate that most (70.8 percent) of the agro-processing entrepreneurs were found in the second and third quartile. The rest were skewely distributed in favour of older generation with 2 (1.2 percent) youth below 20 years found in the first quartile and 50 (26.8 percent) old people above 50 years in fourth quartile. Overall, these findings conform to the expectation that more relatively younger people would participate in business since they are still energetic and within the most productive age bracket. This conclusion agrees with Lee's (1997) observation that this is the most productive ages for any sector. The fact that a significant 50 (26.8 percent) old respondents above 50 years compared to the 2 (1.2 percent) young respondents below 20 years were participating in the agro-processing IGAs could be attributed to the experience and resource endowments disparity between the two age groups.

4.3.3. Distribution of Agro-processing Respondents by Level of Education

Level of education was explored because it is an important indicator in explaining a person's ability to understand conceptual issues. For instance, it is expected that a person who has formal education can be able to understand, accurately interpret situations and make effective decisions. It is also expected that a person who has education above secondary level of education has professional education. Table 4.6 shows the level of education of the agro-processing respondents.

Table 4.6: Level of Education of the Respondents representing Agro-processing IGAs

Level of Education of Agro-processors	Frequency	Percent (%)
Primary	52	28.0
Secondary	91	48.8
Middle College	34	18.3
University	2	1.2
NR*	7	3.7
Total	**186**	**100.0**

Source: Own computation from the study data – July, 2013

NR* - Refers to seven (7) Agro-processors (3.7 percent) who failed to respond to the inquiry on this aspect

The findings indicated that 179 (96.3 percent) of the respondents had achieved some formal education and were able to understand and interpret the interview questions which were the main instruments of data collection and give reliable results for the study. From the study results 91 (48.8 percent) of the small-scale agro-processing respondents comprised of people with secondary level of education (Table 4.6). Those with middle college and university education combined were 36 representing 19.5 percent of the agro-processing respondents. Primary education contributed 52 (28.0 percent) respondents. The spread of respondents across the different levels of education depicted an almost normal curve distribution with 52 in primary, 91 in secondary and 36 in college and university. These results may mean that people with secondary education found the formal job market too competitive to enter and had to revert to informal sector through agro-processing IGAs. This could be partly due to lack of professional skills since secondary school leavers have no job-oriented or professional training. Small-scale agro-processing industry therefore became an attractive alternative for self-employment.

Tremendous growth of the small-scale agro-processing industry in the rural areas can only be achieved as envisaged by the Kenya Vision 2030 when highly skilled people invest their knowledge in the sector. University and other college leavers should therefore transfer their knowledge and skills to these rural-based value-adding activities as a way of improving the management and operation of development initiatives. The results showed comparatively low participation (18.3 percent) of middle college professionals in small-scale agro-processing industry in the rural area. People with university education, at only 1.2 percent involvement, seemed not to have recognized the potential of small-scale agro-processing sector in terms of creating employment opportunities. It is also worth noting that cumulative total of 143 (76.8 percent) of respondents had not attained any form of tertiary education. This could be a pointer to the possibility that not many IGA operators had received formal training on agro-processing skills by the time the IGAs were started since most had not gone past secondary education. Based on the work of Lantos (2000) who found that education is related to good management, it was expected that running of these IGAs could not be effective because inadequate professional education would hinder access to productive inputs including agro-processing technologies, investment finance and materials. Owing to the professional training of farmers by the MoA from 2007 onwards these results concur with Lantos's (2000) observations since majority of the agro-processing IGAs

did not exist 6 or 7 years ago. Hence the springing up of agro-processing IGAs after 2006 could be attributed to the training and advisory services offered to farmers.

4.3.4. Distribution of Respondents by the Mode of Practicing Agro-processing IGAs

The mode of practicing agro-processing businesses among smallholders was examined due to its influence on success and sustainability. Agro-processors who operate as a group acquire the capacity to overcome operational challenges related to low financial capability, poor distribution of risks, sharing of costs, unfavourable price bargains and marketing among others. Stand-alone operators have the advantage of higher trickle-down benefits but usually suffer several disadvantages such as higher per capita cost of operations like in transportation, and poor bargaining power. Table 4.7 gives the distribution of respondents according to the mode in which they practice agro-processing businesses.

Table 4.7: Respondents' Mode of Practicing Agro-processing Activities

Mode of Practicing Agro-processing	Frequency	Percent (%)
Individual	20	11.0
Group	143	76.8
NR*	23	12.2
Total	**186**	**100.0**

Source: Own computation from the study data – July, 2013

NR* - Refers to 23 (12.2 percent) of the study population who failed to respond to the inquiry about this aspect.

Although 23 (12.2 percent) of the study population did not indicate their mode of practicing agro-processing activities, a significant 143 (76.8 percent) said that they operated as members of farmers' agro-processing groups. The findings showed that the remaining 20 (11.0 percent) of the respondents practiced as stand-alone individuals. This is an indication that most small-scale agro-processing entrepreneurs preferred to operate in a group rather than as individuals. Probing of Agricultural Extension Officers and Agro-processors revealed that group affiliation was preferred by most farmers because

of the high cost of acquiring processing equipments, ease of accessing training and advisory services, and ease of access to markets.

4.3.5. Distribution of Agro-processing Respondents based on Legal Status of the IGAs

Legal status of IGAs is important because it is a requirement by the Kenyan law that all business entities be registered for purposes of taxation and development monitoring. In addition, registration widens the scope of business networks and thus may lead to better performance. The findings of the distribution of agro-processing respondents according to the legal status of their IGAs are shown in Table 4.8.

Table 4.8: Distribution of Respondents based on Legal Status of Agro-processing IGAs

Legal Status of Agro-processing Businesses	Frequency	Percent (%)
Registered with dept. of Social Services	147	79.3
Registered with register of businesses	0	0
Registration in process	23	12.2
Not Registered at all	2	1.2
NR*	14	8.5
Total	**186**	**100.0**

Source: Own computation from the study data – July, 2013

NR* - Refers to 14 (8.5 percent) of the study population who failed to respond to the inquiry about this aspect.

The results show that only 2 (1.2 percent) of the small-scale agro-processing respondent IGAs were not registered with government authorities implying that a large majority (90.3 percent) were either in the process or had already acquired legal recognition, an attribute which is important for success. Legal compliance is critical in forging partnerships and networks with other sector players such as buyers, raw material suppliers, technical service providers, financial service providers and other development partners. However, all the agro-processing businesses surveyed had not upgraded their registration to business status by registering their operations with the register of businesses/companies based at the State Law Office. This limits the nature and extent of

partnerships and networks a business can engage in thereby restricting the IGA from exploiting available opportunities to realize its full potential.

4.3.6. Distribution of Agro-processing Experts based on Level of Professional Training

Agricultural Extension Experts of the Ministry of Agriculture were included as part of the respondents because they are key to the provision of agro-processing skills and knowledge to the rural smallholder farmers. Examination of their professional characteristics considered relevant to this study was undertaken to help understand the capacity and preparedness of the public agricultural extension service to transform farming from production based to commercial and market-oriented occupation as envisioned in the Kenya Vision 2030. The study reviewed the level of professional training of the Agricultural Extension Experts due to its relationship with the depth of knowledge and capacity to deliver skills. It is expected that an expert with Diploma training will be more knowledgeable and effective in passing on skills to intended recipients than a certificate level expert. Similarly a university degree expert is supposed to be better than diploma and certificate experts. The result of the distribution of Agricultural Experts based on their level of training is summarized in Table 4.9.

Table 4.9: Distribution of Agricultural Expert based on Level of Professional Training

Level of Training of Experts	Frequency	Percent (%)
Certificate	2	20
Diploma	7	70
Degree	1	10
Total	**10**	**100.0**

Source: Own computation from the study data – July, 2013

The study found that the ten (10) agricultural expert respondents comprised of 7 (70.0 percent) officers with diploma training, 1 (10.0 percent) with degree level training and 2 (20.0 percent) with certificate level training. These findings failed to conform to the general assertion by National Agricultural Sector Extension Policy that public

agricultural extension service in Kenya is 'top heavy' meaning that there are more university level experts serving at the top management compared to diploma and certificate holders serving at grassroots where farmers are found (MoA, 2009). This assumed imbalance has been partly blamed for the failures of the public agricultural extension service.

4.3.7. Distribution of Processing Experts based on Area of Professional Specialization

Specialization in professional training of experts is crucial in ensuring effectiveness in delivering skills in specific subject matters. It is expected to bring to action the insight, breadth and depth of knowledge required to pass-over maximum understanding of the skill to the recipient. For example agricultural experts passing on skills to farmers on agro-processing technologies should essentially have training specialty relevant to the subject of agro-processing. The distribution of agro-processing experts' areas of specialization is presented in Table 4.10.

Table 4.10: Distribution of Agro-processing Experts based on Professional Specialization

Area of Specialization	Frequency	Percent (%) of Respondents
General Agriculture	4	40.0
Agribusiness and Entrepreneurship	1	10.0
Agriculture and Home Economics	2	20.0
Agricultural Engineering	0	0.0
Horticulture	2	20.0
Agricultural Economics	0	0.0
Agriculture and Biotechnology	1	10.0
Total	**10**	**100.0**

Source: Own Computation from the Study Data – July, 2013

The area of subject matter specialization which had the highest representation among the agricultural experts was general agriculture with 40.0 percent. Horticulture was 20.0 percent while Agriculture and Biotechnology was 10.0 percent. Agricultural Engineering, Agribusiness and Entrepreneurship, Agricultural Economics and, Agriculture and Home Economics which are the most relevant for promoting agro-processing entrepreneurship returned 0.0 percent, 10.0 percent, 0.0 percent and 20.0 percent representation respectively. These findings imply that the aspects of expert specializations relevant for agro-processing businesses were inadequately represented in the District. The results of this study thus exposed a serious weakness in the preparedness of the public agricultural extension machinery in fulfilling the aspiration of Kenya Vision 2030 of commercializing agriculture through agro-processing and market-oriented interventions (GoK, 2009).

4.3.8. Agro-processing Technologies Awareness Rating among Farmers

Agricultural Extension Experts were asked to compare the degree of agro-processing technologies awareness among farmers between now and 3 years ago. This was aimed at estimating the change in awareness attributable to agricultural extension efforts. The results are presented in Table 4.11.

Table 4.11: Awareness Rating of Agro-processing Technologies among Farmers

Percent of Experts (%)	**Percent (%) of Awareness**		**Percent Change in Awareness (%)**
	3 Years Ago(2010)	*Now (2013)*	
50.0	4-5 *(4.5*)*	21-40 *(30.5*)*	+26.0
25.0	6-10 *(8.0*)*	16-20 *(18.0*)*	+10.0
25.0	41-50 *(45.5*)*	51-70 *(60.5*)*	+15.0

Source: Own Computation from the Study Data – July, 2013
*****_average percent awareness rating_

Results show that there have been varied degrees of increase in awareness among smallholder agro-processing farmers in Bureti District ranging from 10.0 to 26.0 percent. Fifty (50.0 percent) of agricultural extension experts perceived an average change of about 26.0 percent in awareness among farmers they advise. Twenty five (25.0) percent

of the experts reported 10.0 percent increase, while another 25.0 percent indicated a 15.0 percent increase in awareness.

4.4. Manufacturing Equipments and Growth of Smallholder Agro-processing Industry

This factor constituted the first objective of the study which sought to investigate the extent to which access to manufacturing equipments has impacted on growth of smallholder agro-processing industry in Bureti District. The key parameters used for the attainment of this objective included: cost of acquiring agro-manufacturing equipments, diversity of the accessed agro-manufacturing equipments, distances to the sources of agro-manufacturing equipments, and the level of access of agro-manufacturing equipments.

4.4.1. Cost of Manufacturing Equipments and Number of Agro-processing IGAs

Cost of acquiring agro-manufacturing equipments has been discussed under two sub-themes namely; access to investment finance and agro-manufacturing equipment costs, and cost of Agro-manufacturing equipments and the number of Agro-processing IGAs/Units.

4.4.1.1. Access to Investment Finance and Cost of Agro-manufacturing Equipments

Access to investment finance is an important intervening factor in stimulating growth of agro-processing industry due to its influence in helping farmers to acquire manufacturing technology and other inputs. The findings on how agro-processing respondents accessed finances for their IGAs are given in Table 4.12.

Table 4.12: Distribution of Agro-processing IGAs based on Sources of Finance

Source of Agro-processing Funding	Frequency[m]	Use of the Funding Source by Agro- processing Respondents (%)		
		Those who Used the Source	*Those who didn't Use the Source*	*Total*
Own Funds	171	92.0* *(55.0)*	8.0	100.0
Government Grant	78	41.7* *(24.2)*	58.3	100.0
NGO Grant	39	20.8* *(12.2)*	79.2	100.0
Loan from MFIs	8	4.2* *(2.9)*	95.8	100.0
Fund Raising	8	4.2* *(2.9)*	95.8	100.0
Loans from Friends	8	4.2* *(2.9)*	95.8	100.0

Source: Own computation from the study data – July, 2013

[m] - Denotes multiple use of funding sources by some Agro-processing respondents

( ) – Figures in brackets denote the percent (%) use of the source when all sources are put together

* - Denotes the percent (%) use of the source based on the agro-processors' sample population of 186 when only that single source is considered.

Statistics from the table of results indicate that 171 (92.0 percent) agro-processing respondents relied on self-mobilized funds to run their operations, 78 (41.7 percent) used Government grants and 39 (20.8 percent) used NGO grants. Other sources namely loans from micro-financing institutions, fund raising from well-wishers and loans from friends each assisted 8 (2.9 percent) respondents. These statistics generated from this study suggest that a large proportion of agro-processing businesses still depended mainly on funds generated by the proprietors. Of the total funds accessed by the agro-processing respondents 55.0 percent were sourced from own funds; 36.3 percent from Government and NGOs in form of grants; and only 5.8 percent generated through loaning facilities (Table 4.12). This may be an indication that the apathy about loaning facilities among small-scale farmers is also affecting small-holder agro-processing industry. However, the results confirmed findings by Kibas (2001) on sourcing of start-up capital. Kibas (2001) found that start-up capital generated from personal savings and money from relatives are normally the least expensive and therefore attractive to smallholder businesses. These findings also concurred with World Bank Report (1999) which pointed out that financial institutions provide small start-up capital as well as operating expenses to new businesses.

Small-scale entrepreneurs thus find financial institutions unfavourable as sources of start-up financing.

The general apathy about loans notwithstanding, it is significant to note that 41.7 percent and 20.8 percent of agro-processors managed to benefit respectively from Government and Non-government grants thereby demonstrating the commitment by government and other development agencies to improve access to investment capital among small-scale rural agro-businesses.

Cost factor is an important determinant in adoption of technology as it may also hinder access to manufacturing equipments and technologies required to set up agro-processing units or businesses. Table 4.13 presents the results of the distribution of agro-processing IGAs based on the expenditures incurred on agro-manufacturing equipments.

Table 4.13: Distribution of Agro-processing IGAs based on Cost of Agro-Manufacturing Equipments

Agro-processing Equipment Investment Cost*, Kshs	Frequency	Percent (%)
Less than 10, 000	0	0.0
10, 000 – 50,000	49	26.3
50,001 – 100,000	0	0.0
100,001 – 300, 000	98	52.6
300, 001 – 500,000	0	0.0
Over 500,000	39	21.1
Total	**186**	**100.0**

Source: Own computation from the study data – July, 2013

* - Denotes the average expenditure incurred over 3 year period (2010 – 2012)

The study findings show that most smallholder agro-processing businesses (52.6 percent) spent between KES 100,000 and 300,000 in purchase of agro-processing tools and equipments during the period 2010 to 2012. In the same period another 21.1 percent spent more than KES 500,000 to acquire agro-processing equipments. On average this level of expenditure translated to between KES 70, 000 and 170, 000 annual investment in agro-processing equipments. For rural small-scale farmers this magnitude of equipment

investment demonstrated the increasing importance they attach on agro-processing as a livelihood activity in place of, or alongside, primary agricultural production.

4.4.1.2. Cost of Manufacturing Equipments and the Number of Agro-processing IGAs

Determination of impacts of agro-manufacturing equipment costs on the number of agro-processing units was accomplished by directly asking the respondents to indicate their perceptions on the question: *"What is the impact of cost of agro-manufacturing equipments on the number of agro-processing units or IGAs established in your area?"* Responses were obtained on the basis of three (3) parameters namely; Rapid increase, No increase and Slowed increase. The computed summary of responses elicited is given in Table 4.14:

Table 4.14: Impacts of Agro-manufacturing Equipment Costs on Agro-processing IGAs

Response Parameter	Frequency	Percent (%)
Rapid Increase in Number of IGAs/Units	9	5.0
No Increase in Number of IGAs/Units	28	15.0
Slowed Rate of Increase in Number of IGAs	149	80.0
Total	**186**	**100.0**

Source: Own Computation from the Study Data – July, 2013

The study found that 149 (80.0 percent) of Agro-processing respondents perceived that the cost of manufacturing equipments reduced the rate of growth in number of agro-processing IGAs established in their areas. Five (5.0) percent of the agro-processing respondents, however, noted rapid increase in number of IGAs. Fifteen (15.0) percent of the agro-processors did not notice any change in the number of agro-processing IGAs. These results imply that, generally, the cost of agro-manufacturing equipments was a factor that constrained the establishment and expansion of smallholder agro-processing businesses. This could perhaps be attributed to cost affordability of the equipments by smallholder agro-processors given that average annual expenditure on equipments ranged between KES 70,000 and 170,000 as seen in Table 4.12, a cost which many rural farmers may not access for business start-up. These results confirm the findings by Mhazo *et. al*.

(2003) who concluded that unaffordable costs of agro-processing equipments and lack of equipment purchase capital are the greatest impediments to adoption of technological innovations by small-scale processors. Mhazo *et. al*. also observed that affordable cost of equipment is an important variable in setting up agro-processing units.

4.4.2. Diversity of Manufacturing Equipment and Growth of Agro-processing Industry

Under this sub-theme, findings on the types of agro-manufacturing equipments available in the study area and impacts of their diversity on the Number of Agro-processing IGAs are presented.

4.4.2.1. Diversity or Types of Agro-processing Equipments Available in Bureti District

Diversity in the types of agro-manufacturing equipments is an important enabler when diverse types of agricultural raw materials have to be processed. Access to diverse types of agro-manufacturing equipments thus leads to diverse processed agro-products which may lead to growth in number, size and complexity of the processing businesses. Table 4.15 provides the results of the investigation on diversity of agro-manufacturing equipments based on the distribution of agro-processing IGAs.

Table 4.15: Diversity of Agro-manufacturing Equipments Available in Bureti District

Type of Agro-processing Tool	Percent Availability (%)	Percent Distribution of Power Source (%)	
		Manual	*Automatic/Electric*
Crushing Tool	21.4	64.0	36.0
Grinding Tool	0.0	-	-
Slicing Tool	30.3	97.2	2.8
Thermal Preservation Equipment	19.0	63.6	36.4
Sorting Equipment	2.6	100	0.0
Packaging Equipment	17.2	100	0.0
Non-thermal Preservation Tool	9.5	0.0	100
TOTAL	**100**	**-**	**-**

Source: Own Computation from the Study Data – July, 2013

The findings indicate that there were six (6) major types of agro-processing tools available with small-holder agro-processing respondents (Table 4.15). These included tools and equipments used for crushing, slicing, thermal preservation, sorting, packaging and non-thermal preservation of agricultural produce. However, the level of access to these equipments among small-holder agro-processing respondents was low with less than 31.0 percent indicating ownerships. Slicing equipments and crushing tools were the most available with about 30.3 percent and 21.4 percent of agro-processing farmers, respectively, reporting ownership. The extent of use of grinding equipments and sorting tools was insignificant as less than 3.0 of agro-processors were using them in their business operations.

Use of mechanized equipments in small-scale agro-processing IGAs owned by the respondents was limited mainly to crushing operations, thermal and non-thermal techniques of preservation. Approximately 36.0 percent, 36.4 percent and 100.0 percent of agro-processors who had these equipments respectively reported using electrically powered devices to carry out crushing, thermal and non-thermal preservation operations within their business units. Most agro-processing operations in the district therefore largely depended on manually operated tools and equipments. The degree of dependence on manual equipments ranged between 63.6 percent in thermal preservation and 100 percent in sorting and packaging.

4.4.2.2. Diversity of Manufacturing Equipments and the Number of Processing IGAs

The impact of diversity of agro-manufacturing equipments on the number of agro-processing units established was determined by asking the respondents to indicate their experiences based on a number of pre-determined indicators. The question was: "*Do you think diversity of agro-manufacturing equipments had any impacts on number of agro-processing businesses set up, and if yes, what were the impacts?"* The summary of the results is presented in Table 4.16 and Table 4.17.

Table 4.16: Diversity of Agro-manufacturing Equipments on Numbers of IGAs

Responses	Frequency	Percent (%)
YES	112	60.0
NO	74	40.0
Total	**186**	**100.0**

Source: Own Computation from the Study Data – July, 2013

From Table 4.16 it can be observed that the proportion of farmers who noted positive impact of the diversity of agro-manufacturing equipments on the number of agro-processing IGAs or units established in their areas was 60.0 percent. Fourty (40.0) percent of the respondents did not experience any impacts brought by diversity of agro-processing equipments.

Table 4.17: Diversity of Agro-manufacturing Equipments and Numbers of IGAs

Impact	Frequency	Percent (%)
Rapid Increase in Number of IGAs/Units	112	60.0
No Increase in Number of IGAs/Units	74	40.0
Slowed Rate of Increase in Number of IGAs	0	0.0
Total	**186**	**100.0**

Source: Own Computation from the Study Data – July, 2013

From Table 4.17 the nature of impacts reported by the respondents included rapid increase in the number of agro-processing businesses indicated by 112 (60.0 percent) agro-processors. The remaining 74 (40.0 percent) of the respondents indicated no increase in the number of agro-processing businesses.

These findings suggest that diversity of agro-manufacturing equipments may lead to rapid increase in the number of agro-processing businesses. This increase could be occasioned by the wider processing options brought about by the diverse types of processing equipments. Interview with agro-processors established that there has been an emergence of different types of agro-processing tools in the district brought about by the inception of MoA-supported programmes which promoted value addition of agricultural produce. Such programmes included SHoMaP and NMK through which farmers were

linked to equipment manufacturers. However, the 40.0 percent 'no increase' rating by respondents could be attributed to other constraining factors like lack of equipment purchase capital, lack of technical skills and inadequate raw materials.

4.4.3. Distances to Manufacturing Equipment Sources and Growth of Processing Industry

This sub-theme presents findings on the distances to sources of agro-manufacturing equipments used by smallholder farmers in Bureti District and their impacts on the number of agro-processing IGAs established.

4.4.3.1. Distances to the Sources of Agro-manufacturing Equipments

The distance to the sources of agro-manufacturing equipments has a significant bearing on accessibility especially among rural smallholder farmers who have limited financial capability. Far off sources limit farmers' access to the required equipments due to high costs of acquisition. The study results on distances to equipment sources are given in Table 4.18. They indicate that 83(44.4 percent) agro-processing entrepreneurs relied on local markets within the radius of less than 50 km to purchase their tools and equipments for agro-processing operations. Interviews with these farmers found that for the agro-processors who were able to satisfy their processing equipment needs from within the locality this resulted into lower costs of acquisition and thus better access to agro-processing equipments.

Table 4.18: The Distances to the Sources of Agro-manufacturing Equipments

Distance to the Sources of Agro-processing Equipments(Km)	Frequency	Percent (%)
Radius of less than 50	83	44.4
50 – 100	10	5.6
101 – 150	0	0.0
151 – 400	62	33.3
-	31	16.7
-	**186**	**100.0**

Source: Own Computation from the Study Data – July, 2013

It is however significant to note that 103 (55.6 percent) farmers had to move distances ranging from 50 to more than 400 Km to search for agro-processing

equipments. This suggests that equipment needs of the majority of the agro-processors could not be met by the local sources and thus additional costs were incurred to access the equipments from far-off markets such as Nairobi (151 – 400 km) which supplied 62 (33.3 percent) of the respondents with equipments. Regions in the 50 – 100 km zone, which is the second nearest source after those less than 50 km, supplied only 10 (5.6 percent) of the respondents while nobody relied on the 101 – 150 km region for equipment supplies. Explanation provided by Agricultural Extension Advisors was that farmers only seeked relatively more sophisticated equipments from regions outside South Rift and such tools were found almost exclusively in Nairobi/Central region.

4.4.3.2. Distances to Agro-Equipment Sources and the Number of Processing IGAs

Responses from agro-processors indicated that 149 (80.0 percent) of them felt that long distances to the sources of manufacturing equipments slowed the rate of growth in the number of agro-processing IGAs established in their areas (Table 4.19). Twenty (20.0) percent or 37 agro-processors did not notice any change in the number of agro-processing IGAs due to the distances from the sources where they acquired agro-manufacturing equipments.

Table 4.19: Impact of Distance to Equipment Sources on Number of Processing IGAs

Nature of Impact	Frequency	% of Agro-processing Farmers
Rapid Increase in Number of IGAs	0	0.0
No Increase in Number of IGAs/Units	37	20.0
Slowed Rate of Increase in Number of IGAs	149	80.0
Total	**186**	**100.0**

Source: Own Computation from the Study Data – July, 2013

Long distances to the sources of equipments were found to be critical impediment to growth in number of agro-processing businesses particularly because the smallholder agro-entrepreneurs lacked financial capacity to incur additional costs. Such costs included transportation charges, food and accommodation expenses for the proprietors and their technical guides. It was reported by the respondents that delays in acquiring equipments sometimes occurred by up to one (1) year when farmers lacked capacity to cater for these

additional costs thus substantially delaying the establishment of the planned businesses. Farmers who returned a 20.0 percent 'no increase' verdict on the impact of distances to equipment sources were associated with simple tools which were easily sourced from the locality. To such farmers distance did not have any appreciable impact on their businesses since they could easily satisfy their equipment requirements from within the local region.

Cross-tabulation between the distances to agro-manufacturing sources and number of agro-processing IGAs indicated that 80 (61.5%) of those who responded experienced increase in the number of agro-processing IGAs while 50 (38.5%) did not realize any change (Table 4.20). The results showed that shorter distances had greater positive impact on the number of agro-processing IGAs established than longer distances. Distances less than 50 Km recorded the highest impact with 70 (53.8%) followed by 50 – 100 Km with 10 (7.7%) and 151 – 400 Km with 0.0 percent.

Table 4.20: Cross-tabulation of Distances to Equipment Sources and Number of IGAs

Distance to the Source of Agro-manufacturing Equipments	**Impact on the number of Agro-processing IGAs Established (Number of farmers)**		
	Gone Up	*Remained Same*	*Total*
Less than 50km	70 (53.8%)	0 (0.0%)	70
50 – 100km	10 (7.7%)	0 (0.0%)	10
151 – 400km	0 (0.0%)	50 (38.5%)	50
Total	**80 (61.5%)**	**50 (38.5%)**	**130**

Pearson Chi-square Test was conducted to establish whether there was a relationship between distances to equipment sources and the number of smallholder agro-processing IGAs set-up in the rural areas. The findings are shown in Table 4.21.

Table 4.21: Pearson Chi-square Test for the Relationship between Distances to Equipment Sources and the Number of Agro-processing IGAs Established

	Value	*p* -value
Pearson chi-square	130.000[a]	0.002
N of valid cases	130	-

a. 6 cells (100.0%) have expected count less than 5. The minimum expected count is 0.38.

Source: Own Computation from the Study Data – July, 2013

The results revealed that there was a significant relationship between distances to agro-manufacturing equipment sources and the number of agro-processing IGAs set-up by smallholder famers (chi-square p - value = 0.002, $p < 0.05$). The chi-square (X^2) value 130.00 was significant at 0.05 confidence level, indicating that shorter distances to sources of agro-manufacturing equipment caused a statistically significant influence on the number of smallholder agro-processing IGAs set-up in Bureti District. These findings are in agreement with Mhazo *et. al*. that when agro-processing equipments are available at the local level smallholder farmers find it easy to access them for setting-up processing businesses. When the sources of processing equipments are nearer there are higher chances of establishing agro-processing IGAs or units.

4.5. Manufacturing Skills Training and Growth of Smallholder Processing Industry

The second objective of the study was to establish the impact of manufacturing skills training on growth of smallholder agro-processing industry in Bureti District. Attainment of this objective was sought through exploration of training parameters including frequency of expert-farmer exchange of manufacturing information, frequency of farmers' manufacturing skills training sessions, types of manufacturing skills passed to farmers, and relevance of the manufacturing skills trained-on.

4.5.1. Frequency of Training/Exchange of Information and Number of IGAs Set-up

Under this sub-theme two factors namely; frequency of routine information exchange between experts and farmers, and manufacturing skills training sessions conducted for farmers have been discussed.

4.5.1.1. Frequency of Experts and Farmer Exchange of Agro-processing Information

Frequency of interaction between agro-processing technology experts and smallholder farmers is important for exchange of information and consequent adoption of agro-processing practices. This exchange can occur either by farmers making visits to experts or when they are visited by the experts. The results of cross-tabulation between the frequency of contacts between agricultural experts and agro-processing farmers, and the number of agro-processing IGAs established by smallholder farmers were presented in Table 4.22.

Table 4.22: Advisory Services to Farmers and Number of Agro-processing Units Established

Frequency of Experts' Visits to Farmers (No.)	**Impacts on the number of Agro-processing IGAs Established**			
	(No. of farmers)			
	Gone Up	*Remained Same*	*Gone Down*	*Total*
1 – 2 times per month	33 (17.7%)	14 (7.5%)	5 (2.7%)	52
3 – 4 times per month	5 (2.7%)	0 (0.0%)	0 (0.0%)	5
1 – 2 times per 3 months	52 (27.9%)	19 (10.2%)	19 (10.2%)	91
3 – 4 times per 3 months	10 (5.4%)	28 (15.1%)	0 (0.0%)	38
Total	**101(54.3%)**	**61 (32.8%)**	**24 (12.9%)**	**186**

Source: Own Computation from the Study Data – July, 2013

The results indicated that 91(48.9 percent) of the information exchanges occurred 1 – 2 times in 3 months, 52(27.9 percent) 1 - 2 times per month, 38(20.5 percent) 3 – 4 times in 3 months, and 5(2.7 percent) 3 – 4 times per month. Further, the results showed that a significant101 (54.3 percent) respondents perceived that the number of agro-processing IGAs had increased while 61 (32.8 percent) and 24 (12.9 percent) indicated

that number of IGAs remained same and gone down, respectively. Information exchanges that occurred 1- 2 times in 3 months registered the highest increase in the number of agro-processing IGAs with 52 (27.9 percent) followed by 1 – 2 times per month at 33 (17.7 percent).

Pearson Chi-square Test was conducted to establish whether there was a relationship between frequencies of experts' visits to farmers and the number of smallholder agro-processing IGAs set-up in the rural areas. The findings are shown in Table 4.23.

Table 4.23: Pearson Chi-square Test for the Relationship between Frequencies of Expert Visits to Farmers and the Number of Agro-processing IGAs Established

	Value	***p* -value**
Pearson chi-square	216.422[a]	0.009
N of valid cases	186	

a. 3 cells (25%) have expected count less than 5. The minimum expected count is 3.63.

The findings indicated that there was a significant relationship between the number of visits to farmers made by agricultural experts and the number of agro-processing IGAs set-up by smallholder farmers in the study area (chi-square p - value = 0.009, $p < 0.05$). The chi-square (X^2) value 216.42 was significant at 0.05 confidence level, indicating that the frequency of visits to farmers by agricultural experts caused a statistically significant influence on the number of agro-processing IGAs established by smallholder farmers in Bureti District.

4.5.1.2. Frequency of Farmers' Manufacturing Skills Training Sessions

Technical training on agro-processing technologies is deemed an effective way of passing manufacturing skills to farmers. When farmers acquire manufacturing skills they develop capacity to start and operate agro-processing businesses in the rural areas where they live. How often these skills are passed or refreshed is an important factor in capacity building. The numbers of agro-manufacturing training sessions held for agro-processing farmers are given in Table 4.24.

Table 4.24: Average Number of Farmer Agro-manufacturing Training Sessions Held

Average Number of Training Sessions per Year (No.)	Mean	Frequency	Percent (%)
1 – 4	2.5	130	70.0
5 – 8	6.5	56	30.0
Total		**186**	**100.0**

Source: Own Computation from the Study Data – July, 2013

Results from Table 24 showed that seventy (70.0) percent of agro-processors attended between 1 and 4 agro-processing training sessions per year. The remaining 30.0 percent of agro-processors attended between 5 and 8 training sessions in a year.

Cross-tabulation between the agro-manufacturing training conducted and number of agro-processing IGAs indicated that 47 (51.6%) of those who responded had received agro-manufacturing training. Fourty four (48.4%) respondents had not received training. Of those who had received training 18 (38.3%) indicated an increase in the number of agro-processing IGAs while 27(57.4%) did not realize any change, and 2 (4.3%) perceived a decline in the number of IGAs (Table 4.25). The results also showed that none (0.0%) of the untrained respondents registered positive growth in the number of agro-processing IGAs. Majority or 30 (68.2%) of the untrained did not realize change in number of IGAs while 14 (31.8%) recorded decline.

Table 4.25: Cross-tabulation between Agro-manufacturing Training Conducted and Number of IGAs Established

Agro-processing Training Conducted for Farmers	Impact on the number of Agro-processing IGAs Established (No of farmers)			
	Gone Up	*Remained Same*	*Gone Down*	*Total*
NO	0 (0.0%)	30 (33.0%)	14 (15.4%)	44
YES	18 (19.8%)	27 (29.7%)	2 (2.2%)	47
Total	**18 (19.8%)**	**57 (62.6%)**	**16 (17.6%)**	**91**

N=186 (Valid = 91; Missing = 95)

Pearson Chi-square Test was conducted to establish whether there was a relationship between agro-processing training conducted and the number of smallholder agro-processing IGAs set-up in the rural areas. The findings are shown in Table 4.26.

Table 4.26: Pearson Chi-square Test for the Relationship between Agro-manufacturing Training held and the Number of Agro-processing IGAs Established

	Value	p-value
Pearson chi-square	22.54[a]	0.003
N of valid cases	91	

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.33

The findings indicated that there was a significant relationship between agro-processing training conducted and the number of agro-processing IGAs set-up by smallholder farmers in the study area (chi-square p - value = 0.003: $p < 0.05$). The chi-square (X^2) value 22.54 was significant at 0.05 confidence level, indicating that agro-processing training of farmers caused a statistically significant influence on the number of agro-processing IGAs established by smallholder farmers in Bureti District.

4.5.2. Types of Farmers' Agro-manufacturing Technical Skills Training Conducted

Types of agro-manufacturing training modules conducted determine the scope of processing operations that can be performed and competency level of agro-processing entrepreneurs in executing the various manufacturing activities. Farmers or agro-processors trained on a wide range of manufacturing skills are expected to acquire capacity to perform or guide most of the processing operations in their businesses effectively. The types of agro-manufacturing training provided to the study respondents are summarized in Table 4.27.

Table 4.27: Cross-tabulation between Types of Agro-manufacturing Technical Skills Trained-on and Number of Agro-processing IGAs Established

Agro-manufacturing Skills Trained-on	**Access Level (%)**	**Impact on the number of Agro-processing IGAs Established (No of farmers)**			
		Gone Up	*Remained Same*	*Gone Down*	*Chi-square p-value*
Agro-processing Skills	98.8	44*(23.4%)*	110*(59.8%)*	30*(16.3%)*	**0.006**
Product Quality	44.4	31*(37.3%)*	52*(62.7%)*	0*(0.0%)*	**0.002**
Preservation Techniques	45.1	42*(50.0%)*	30*(35.7%)*	12*(14.3%)*	**0.002**
Equipment Selection	25.6	26*(54.2)*	22*(45.8%)*	0*(0.0%)*	**0.002**
Product Development	82.9	29*(18.8%)*	121*(78.6%)*	4*(2.6%)*	**0.047**
Safety Measures	30.1	16*(28.6%)*	30*(53.6%)*	11*(19.6%)*	**0.432**

Source: Own Computation from the Study Data – July, 2013

Results from the study indicated that Smallholder Agro-processing respondents were provided with agro-manufacturing training on six (6) main skill areas. These skill areas included processing techniques, product quality, product preservation, equipment selection, business plan development, marketing planning, product development and production scheduling. Investigation about the relative levels of access across the different skills revealed that some skills were availed to the agro-processing IGAs more than others. However, access to agro-processing skills was generally good with most IGAs rating their access levels at more than 70.0 percent. Below average levels of access were found in skill areas like preservation (45.1 percent), quality control (44.4 percent) and equipment selection and maintenance (25.6 percent). Inadequate access of these skills is not surprising to DAO Bureti since the district lacks experts in these subject areas. This position is confirmed by the findings from this study that showed that relevant specializations such as Agricultural Engineering which is required for guiding in equipment selection and maintenance and quality control, and Home Economics which is needed for preservation techniques are either lacking or under represented (Table 10).

Findings further indicated that different types of agro-manufacturing skills had varied positive impacts on the number of agro-processing IGAs established. The highest positive change was registered in agro-processing skills 44 (23.7%) followed by preservation techniques 42 (22.6%), product quality skills 31 (16.7%), product development 29 (15.6%), equipment selection 26 (14.0%), and safety measures 16 (8.6%).

4.5.3. Relevance of Farmers' Agro-manufacturing Technical Training Conducted

Relevance of the agro-processing training offered to farmers was examined as a measure of usability of the knowledge and skills gained in the agro-processing IGAs. Findings of the relevance of the training are given in Table 4.28:

Table 4.28: Rating of Farmers' Agro-manufacturing Technical Training Relevance

Rating of Training Relevance (%)	Frequency	Percent (%)
80-100	38	20.4
60-79	130	70.0
40-59	9	4.8
30-39	9	4.8
Total	**186**	**100.0**

Source: Own Computation from the Study Data – July, 2013

The study found that 38 (20.0 percent) agro-processing respondents indicated 80.0 to 100.0 percent relevance of the training offered. Total of 130 (70.0 percent) respondents indicated 60.0 to 79.0 percent relevance. Other agro-processors indicated 40.0 to 59.0 percent relevance and 30.0 to 39.0 percent relevance each reported by 4.8 percent of the agro-processors. From these results it can be noted that a significant 90.4 percent of the study respondents gave a relevance rating ranging from 60.0 percent to 100.0 percent. Only 4.8 percent of the respondents rated the training relevance below 40.0 percent.

Comparison of the Pearson Chi-square values generated from tests for the relationships between the various relevant agro-processing training modules conducted and the number of agro-processing IGAs established was done to confirm if the farmers' rating of training relevance was backed by a strong relationship with the number of agro-processing IGAs. The findings are presented in Table 4.29.

Table 4.29: Comparison of Pearson Chi-square Tests for the Relationship between Processing Training Modules Rated Relevant and the Number of Agro-processing IGAs Established

Relevant Agro-manufacturing Training Modules Conducted	Pearson Chi- square Values	
	Value	p-value
Agro-processing Skills	182.564	0.006
Product Quality Skills	28.083	0.002
Equipment Selection Techniques	12.938	0.002
Preservation Techniques	20.453	0.002
Safety Skills	3.677	0.432

Source: Own Computation from Study Data – July, 2013

The findings indicated that there was a significant relationship between most of the relevant agro-processing training conducted and the number of agro-processing IGAs set-up by smallholder farmers in the study area (processing skills: chi-square p - value = 0.006 : $p < 0.05$; quality skills: p - value = 0.002 : $p < 0.05$; equipment selection skills: p - value = 0.002 : $p < 0.05$; preservation techniques: p - value = 0.002 : $p < 0.05$; safety skills: p - value = 0.432 : $p > 0.05$). All the chi-square (X^2) values, except for safety skills, were significant at 0.05 confidence level, indicating that all except one agro-processing training rated relevant by farmers caused a statistically significant influence on the number of agro-processing IGAs established by smallholder farmers in Bureti District.

The content of agricultural extension messages delivered to farmers during visits by experts was investigated as a measure of relevance. Messages with high content related to agro-processing were considered more relevant than those with lower content. Table 4.30 presents findings on the content of information exchanged between experts and farmers during the agricultural extension visits.

Table 4.30: Proportion of Agricultural Extension Messages with Agro-processing Content

Extension Messages with Agro-processing Content (%)	Frequency	Percent (%)
Less than 10	37	20.0
21 - 40	112	60.0
51 – 70	37	20.0
Total	**186**	**100.0**

Source: Own Computation from the Study Data – July, 2013

The results indicate that the highest number (51-70 percent) of extension messages with agro-processing content was reported to have been passed by 20.0 percent of the agricultural experts. Notably about 80.0 percent of experts advised farmers on less than 40.0 percent issues with agro-processing content. This may be interpreted to mean that on average agro-processing content in the agricultural information passed to farmers during routine extension contacts with farmers fell between 10.0 and 40.0 percent.

4.6. Access to Automated Functions and Growth of Agro-processing Industry

The third objective of the study was to examine the impact of access to automated functions on growth of smallholder agro-processing industry in Bureti District. The impact on growth of smallholder agro-processing industry was captured using agro-processing automation parameters including diversity of mechanization within the agro-processing business processes, and access to mechanized equipments by smallholder agro-processors.

4.6.1. Diversity of Mechanization in various Agro-processing Business Processes

Mechanization of agro-processing operations is meant to help in multiplying human effort, reducing drudgery, removing imprecision and enhancing efficiency. Diversity of mechanization in agro-processing operations is regarded as an indicator of growth of the IGA towards standardizing its products through consistency and reliability of quality. Study respondents were interviewed about their agro-processing operations that already utilized some form of automation because it is considered important in

influencing the establishment of more processing units and hence growth in number of agro-processing industry.

Cross-tabulation between the manufacturing processes that used mechanization and the number of Agro-processing IGAs established by smallholder famers was done to determine if there existed any impact on growth of IGAs. The outcomes of this analysis are presented in the Table 4.31.

Table 4.31: Impact of Applying Mechanization in Agro-processing IGA Operations

Mechanized Operations	**Automation Level (%)**	**Impact on the number of Agro-processing IGAs Established (No. of farmers)**			
		Gone Up	*Remained Same*	*Gone Down*	*Total*
Pre-processing Activities	1.4	3*(100%)*	0*(0.0%)*	0*(0.0%)*	3
Agro-processing Activities	19.4	17*(47.2%)*	19*(52.8%)*	0 *(0.0%)*	36
Operational Processes	13.5	11*(44.0%)*	9*(36.0%)*	5*(20.0%)*	25
Quality Control Processes	83.6	96*(61.9%)*	31(*20.0%)*	28*(18.1%)*	155
Packaging and Labeling	0.0	0*(0.0%)*	0*(0.0%)*	0*(0.0%)*	0

Source: Own Computation from the Study Data – July, 2013

Among the agro-processing operations surveyed the existence of automation or mechanization was found to be quite low (less than 20.0 percent of the respondents) except in quality control activities where 83.6 percent of the agro-processing study respondents indicated they were using mechanized systems. The lowest level of mechanization was found by the study to have occurred in product packaging and labelling, and pre-processing activities where 0.0 percent and 1.4 percent of the IGAs respectively recorded presence of mechanized operations.

The findings showed that mechanization had the greatest positive impact on agro-processing IGAs through quality control operations as 96 (51.6%) of the respondents indicated the number of IGAs went up. Other processes influenced the number of agro-processing IGAs as follows: processing activity 17 (9.1%), routine operations 11 (5.9%), pre-processing activities 3 (1.4%) and packaging 0 (0.0%). In general 127 (68.3%) respondents indicated the number of agro-processing IGAs went up due to influence of mechanization. A total of 59 (31.7%) respondents indicated the number remained same while 33 (17.7) noted a decline.

4.6.2. Rating of Access to Mechanized Functions in Agro-processing IGAs

Rating of farmers' access to mechanized functions was used as an indicator of how mechanized equipments were made available to rural smallholder agro-processors. When accessibility of mechanized functions is easy for farmers many of them acquire the mechanized equipments to improve their processing units. Rating was determined based on a scale defined by: *Excellent, Good, Average, and Poor.* The findings are presented in Table 4.32.

Table 4.32: Agro-processors' perception on the Level of Access to Mechanized Functions

Rating of level of Access	Frequency	Percent (%)
Excellent	0	0.0
Good	19	10.0
Average	93	50.0
Poor	74	40.0
Total	**186**	**100.0**

Source: Own Computation from the Study Data – July, 2013

Ten (10.0) percent of agro-processors rated as 'good' the level of access of mechanized functions in their agro-processing IGAs. Fifty (50.0) percent felt the access to mechanized functions was 'average'. While 40.0 percent felt the access was still poor. Comparative interview with Agricultural Extension Experts of the Ministry of Agriculture indicated that 40.0 percent of the experts perceived that the level of access to

mechanization in the Agro-processing IGAs had gone up. Sixty (60.0) percent, however, felt that the level had remained the same.

4.7. Managerial Skills Training and Growth of Smallholder Processing Industry

The fourth objective of the study sought to evaluate the extent to which training on managerial skills impacts on growth of smallholder agro-processing industry in Bureti District. To attain this objective several attributes of training were evaluated namely; the frequency of farmers' managerial skill training sessions, types or diversity of managerial skill areas farmers were trained-on and the relevance of the managerial skills passed to the farmers.

4.7.1. Frequency of Managerial Skills Training and Impact on Processing IGAs

Managerial skills have become important success determinants in most businesses today. They are used in complement with technical skills to ensure that business processes are planned, organized and directed in a manner that make the entity effective and efficient. How often managerial skills are appraised depend on the complexity of operations and the changes in the business environment. Results of the frequency of managerial skills training sessions conducted are displayed in Table 4.33.

Table 4.33: Frequency and Attendance of Managerial Skills Training for Agro-processing IGAs

Annual number of Training Sessions	Frequency	Percent (%)	Annual farmer attendance	Frequency	Percent (%)
1 - 4	149	80.1	81 – 160	4	40
5 - 8	37	19.9	161 – 320	4	40
-	-	-	Over 600	2	20
Total	**186**	**100.0**	**-**	**10**	**100.0**

Source: Own Computation from the Study Data – July, 2013

The results indicate that majority 149 (80.1 percent) of agro-processors attended between 1 and 4 agro-processors' managerial skills training sessions in a year. Only 19.9

percent (37) of agro-processors attended 5 – 8 managerial skills training sessions annually.

Results of farmer attendance show that fourty (40.0) percent of agricultural experts trained between 81 and 160 farmers annually. Another 40.0 percent of the experts trained 161 to 320 farmers annually. Only 20.0 percent of the experts managed to train more than 600 farmers. This result implies that 80.0 percent of the agricultural experts achieved average of 480 farmers annually while 20.0 percent of them reached at least 600 farmers through agricultural training sessions. The total average annual number of farmers trained therefore is at least 1,080.

Cross-tabulation between the frequency of agro-managerial skills training conducted and number of agro-processing IGAs confirmed that 149 (80.1%) of the respondents had received managerial skills training. Thirty seven (19.8%) respondents had not received training. Of those who had received training 50 (26.9%) indicated an increase in the number of agro-processing IGAs while 90 (48.4%) did not realize any change, and 9 (4.8%) perceived a decline in the number of IGAs (Table 4.34). The results also showed that 2 (1.6%) of the untrained respondents registered positive growth in the number of agro-processing IGAs. Majority or 29 (15.6%) of the untrained did not realize change in number of IGAs while 6 (3.2%) recorded decline.

Table 4.34: Cross-tabulation between Frequency of Managerial Skills Training Conducted and Number of IGAs Established

Managerial Skills Training Conducted for Farmers	**Impact on the number of Agro-processing IGAs Established (Number of farmers)**			
	Gone Up	*Remained Same*	*Gone Down*	***Total***
NO	2*(5.4%)*	29*(78.4%)*	6*(16.2%)*	**37**
YES	50*(33.6%)*	90*(60.4%)*	9*(6.0%)*	**149**
Total	**52*(28.0%)***	**119*(64.0%)***	**15*(8.1%)***	**186**

Pearson Chi-square Test was conducted to establish whether there was a relationship between managerial skills training conducted and the number of smallholder agro-processing IGAs set-up in the rural areas. The findings are shown in Table 4.35.

Table 4.35: Pearson Chi-square Test for the Relationship between Frequency of Managerial Skills Training and the Number of Agro-processing IGAs Established

	Value	p-value
Pearson chi-square	29.931[a]	0.003
N of valid cases	186	

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is 3.50

The findings indicated that there was a significant relationship between frequency of managerial skills training conducted and the number of agro-processing IGAs set-up by smallholder farmers in the study area (chi-square p - value = 0.003, $p < 0.05$). The chi-square (X^2) value 29.93 was significant at 0.05 confidence level, indicating that frequency of managerial skills training of farmers caused a statistically significant influence on the number of agro-processing IGAs established by smallholder farmers in Bureti District.

4.7.2. Types of Managerial Skills Training and Advisory Services and Impacts on Number of Agro-processing IGAs

In any production-related organization managerial skills are considered complementary inputs to technical skills in the realization of the organizational objectives. The types of managerial skills required by businesses vary with the type, scale of operation and complexity of the business, and the nature of challenges faced by the management. These business characteristics determine whether more rigorous principles and techniques or simplified approaches to management should be applied. The variety of managerial skills training offered to agro-processors was explored by this study and the findings are summarized in Tables 4. 36 and 4.37.

Table 4.36: Cross-tabulation between Types of Managerial Skills Trained-on and Number of Agro-processing IGAs Established

Managerial Skills Trained-on	Access Level (%)	Impact on the number of Agro-processing IGAs Established (No of farmers)			
		Gone Up	*Remained Same*	*Gone Down*	*Total*
Record Keeping Skills	100	87*(46.8%)*	78*((41.9%)*	21*(11.3%)*	**186**
Marketing Skills	54.8	34*(33.3%)*	55*(53.9%)*	13*(12.7%)*	**102**
Leadership Skills	51.6	51*(53.1%)*	45*(46.9%)*	5*(5.2%)*	**96**
Business Planning Skills	93.5	68*(39.1%)*	98*(56.3%)*	8*(4.5%)*	**174**
Material Scheduling Skills	41.9	25*(32.1%)*	40*(51.3%)*	3*(3.8%)*	**78**
Problem Solving Skills	66.7	43*(34.7%)*	67*(54.0%)*	14*(11.3%)*	**124**

Source: Own Computation from the Study Data – July, 2013

The study found that agro-processing respondents had access to at least fifteen (15) different types of project management training modules (Tables 4.36 and 4.37). Results showed that management skill access rating by the smallholder agro-processors interviewed in the study ranged from 41.9 percent for material scheduling skills to 100.0 percent for record keeping skills. On average this access level is considered adequate for improving the management of small businesses in the rural setting.

Findings further indicated that different types of managerial skills had varied positive impacts on the number of agro-processing IGAs established. The highest positive change was registered in record keeping skills 87 (46.8%) followed by business planning techniques 68 (36.6%), leadership skills 51 (27.4%), problem solving skills 43 (23.1%), marketing skills 34 (18.3%), and material scheduling 25 (13.4%). Overall, 40.8% of the respondents indicated the number of agro-processing IGAs went up due to influence of managerial skills training. Another 50.7% of respondents indicated the number remained same while 8.5% noted there was a decline.

4.7.3. Relevance of Managerial Skills Training and Number of Agro-processing IGAs

Relevance of the management training offered to farmers was also explored as an indicator of usability of the knowledge and skills gained from the training sessions. Findings of the relevance of the training are given in Table 4.37.

Table 4.37: Relevance of Managerial Skills Training to the Needs of Agro-processing IGAs

Rating of Training Relevance (%)	Frequency	Percent (%)
80-100	112	60.0
60-79	37	20.0
40-59	37	20.0
30-39	0	0.0
Total	**186**	**100.0**

Source: Own Computation from the Study Data – July, 2013

The table of results show that 112 (60.0 percent) respondent agro-processors indicated that managerial skills training offered to them was 80.0 to 100.0 percent relevant to the needs of their agro-business IGAs. Among the rest of agro-processing respondents 20.0 percent indicated 60.0 to 79.0 percent relevance, and another 20.0 percent indicated 40.0 to 59.0 percent relevance of the managerial skills training offered.

Table 4.38: Comparison of Pearson Chi-square Tests for the Relationship between Relevant Managerial Skills Training and the Number of Agro-processing IGAs Established

Relevant Managerial Skills Training Modules Conducted	Pearson Chi- square Values	
	Value	p-value
Record Keeping Skills	11.540	0.003
Marketing Skills	11.931	0.003
Leadership Skills	8.690	0.013
Business Planning Skills	6.537	0.038
Problem Solving Skills	4.431	0.049

Source: Own Computation from Study Data – July, 2013

The findings indicated that there was a significant relationship between each of the relevant managerial skills training conducted and the number of agro-processing IGAs set-up by smallholder farmers in the study area (record keeping skills: chi-square p - value = 0.003, $p < 0.05$; marketing skills: chi-square p - value = 0.003, $p < 0.05$; leadership skills: chi-square p - value = 0.013 $p < 0.05$; business planning skills: chi-square p - value = 0.038, $p < 0.05$; problem solving skills: chi-square p - value = 0.049, $p < 0.05$). All the chi-square (X^2) values 11.540, 11.931, 8.690, 6.537 and 4.431 were significant at 0.05 confidence level, indicating that all managerial skills training rated relevant by farmers caused a statistically significant influence on the number of agro-processing IGAs established by smallholder farmers in Bureti District.

CHAPTER FIVE
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

In this chapter is presented the summary of research findings, conclusions, recommendations, suggestions for further research, and the contributions of this study to the body of knowledge.

5.2. Summary of Research Findings

The study investigated the impact of access to agro-processing technologies on growth of smallholder agro-processing industry in Bureti District. The findings were that over 85.0 percent of smallholder agro-processing outfits were new with a history dating back 6 to 7 years ago. The advent of agro-processing IGAs in Bureti District is linked to Njaa Marufuku Programme and Smallholder Horticulture Marketing Programme, both implemented by the Ministry of Agriculture. The young generation falling below the age of 40 years constituted majority (59.8 percent) of the agro-processors. This category included the post-college youth (20 – 39yrs) which represented a significant 58.6 percent of all the agro-processors implying that this group of potential job seekers found small-scale agro-processing industry a suitable source of employment. The results showed low participation (18.3 percent) of middle college professionals in small-scale agro-processing industry in the rural area. People with university education (2 percent involvement) seemed not to have recognized the potential of small-scale agro-processing sector in terms of creating employment opportunities. Since the study found that 76.8 percent of respondents had not attained any form of tertiary education and had no formal training on agro-processing skills, the springing up of agro-processing IGAs after 2006 was attributed to the training and advisory services offered to farmers by the MoA from 2007 onwards. Results showed that most (76.8 percent) small-scale agro-processors preferred to operate in a group rather than as individuals. A large majority (90.3 percent) of IGAs were either in the process or had already acquired legal recognition because legal compliance is critical in forging partnerships and networks with other sector players such as buyers, raw material suppliers, and technical service providers.

Findings showed that agricultural experts comprised of 10.0 percent officers with degree level training, 70.0 percent with diploma training, and 20.0 percent with certificate level training. There was a serious weakness in the preparedness of the public agricultural

extension service in fulfilling the aspiration of Kenya Vision 2030 of commercializing agriculture through agro-processing since the most relevant specializations required for promoting agro-processing entrepreneurship were still inadequately represented in the District.

The first objective of the study investigated the extent to which manufacturing equipments impacted on growth of smallholder agro-processing industry. The impacts were determined in respect of how the cost of acquiring agro-manufacturing equipments, diversity of the accessed agro-manufacturing equipments, and distances to the sources of agro-manufacturing equipments influenced the number of agro-processing businesses or units established. The cost of agro-manufacturing equipments was considered a factor that constrained the establishment and expansion of smallholder agro-processing businesses due to un-affordability. Eighty (80.0) percent of agro-processing respondents experienced reduced rate of growth in number of agro-processing IGAs established due to the high costs of manufacturing equipments. The diversity of equipments was limited to 6 major types of agro-processing tools included those used for crushing, slicing, thermal preservation, sorting, packaging and non-thermal preservation of agricultural produce. Diversity of processing equipment impacted positively on the number of agro-processing IGAs with 60.0 percent of farmers experiencing rapid increase in number of agro-processing units set up. There was a significant relationship between distances to agro-manufacturing equipment sources and the number of agro-processing IGAs set-up by smallholder farmers (chi-square p – value = 0.002, $p < 0.05$). Shorter distances to manufacturing equipment sources had greater positive impact on the number of agro-processing IGAs set up compared to long distances. Sources within radius of 50 km had the highest impact with 70 (53.8 percent) followed by sources 50 to 100 km away with 10 (7.7 percent).

The second objective of the study was to establish the impact of manufacturing skills training on growth of smallholder agro-processing industry in Bureti District. In this endeavour training parameters including frequency of expert-farmer exchange of manufacturing information, frequency of farmers' manufacturing skills training sessions, types of manufacturing skills passed to farmers and relevance of the manufacturing skills trained-on were evaluated. The chi-square (X^2) value (p - value = 0.009, $p < 0.05$) was significant at 0.05 confidence level, indicating that the frequency of visits to farmers by agricultural experts caused a statistically significant influence on the number of agro-

processing IGAs established by smallholder farmers. About 54.3 percent (101) of respondents perceived that the number of agro-processing IGAs had gone up due to frequency of information exchange. Pearson chi-square test (chi-square p - value = 0.003; $p < 0.05$) indicated that there was a significant relationship between agro-manufacturing training conducted and the number of agro-processing IGAs set-up by smallholder farmers in the study area. Of those who received agro-manufacturing skills training 38.3% indicated an increase in the number of agro-processing IGAs while none (0.0%) of the untrained respondents registered positive growth in the number of agro-processing IGAs. The six (6) different types of agro-manufacturing skills provided to farmers had varied positive impacts on the number of agro-processing IGAs established. The highest positive change was registered in agro-processing skills 44 (23.7%) followed by preservation techniques 42 (22.6%), product quality skills 31 (16.7%), product development 29 (15.6%), equipment selection 26 (14.0%), and safety measures 16 (8.6%). Except for safety skills all the chi-square (X^2) values (processing skills: p – value = 0.006; $p < 0.05$; quality skills: p – value = 0.002; $p < 0.05$; equipment selection skills: p – value = 0.002; $p < 0.05$; preservation techniques: p – value = 0.002, $p < 0.05$; safety skills: p – value = 0.432, $p > 0.05$) were significant at 0.05 confidence level, indicating that most agro-processing skills training modules caused a statistically significant influence on the number of agro-processing IGAs established by smallholder farmers.

The third objective of the study was to examine the impact of access to automated functions on growth of smallholder agro-processing industry in Bureti District. The impact on growth of smallholder agro-processing industry was captured using agro-processing automation parameters which included diversity of mechanization within the agro-processing business processes and access to mechanized equipments by smallholder agro-processors. Use of mechanized equipments was limited mainly to crushing operations (36.0 percent), thermal preservation (36.4 percent) and quality control (83.6 percent). Most agro-processing operations in the district largely depended on manually operated tools and equipments. About 14.6 percent of the respondents used semi-mechanized systems while 8.6 percent engaged fully mechanized tools. Only 2.4 percent of the agro-processing IGAs had more than 70.0 percent of their processing operations fully mechanized while 6.2 percent of the IGAs had less than 30.0 percent of their processing activities fully mechanized.

The fourth objective of the study sought to evaluate the extent to which training on management skills impacts on growth of smallholder agro-processing industry in Bureti District. To attain this objective several attributes of training were evaluated namely; the frequency of farmers' management skill training sessions, types or diversity of management skill areas farmers were trained-on and the relevance of the management skills passed to the farmers. Frequency of managerial skills training caused a 26.9% increase in the number of agro-processing IGAs. Majority (35) or 94.6% of the untrained farmers did not realize increase in number of IGAs. There was a significant relationship between frequency of managerial skills training conducted and the number of agro-processing IGAs set-up by smallholder farmers in the study area (p – value = 0.003, $p < 0.05$). The chi-square (X^2) value was significant at 0.05 confidence level, indicating that frequency of managerial skills training caused a statistically significant influence on the number of agro-processing IGAs established by smallholder farmers. The most relevant managerial skill-inputs required by smallholder agro-processing enterprises were record keeping (80.0%), proposal writing (60.0%), leadership (60.0%), problem solving (60.0%) and communication skills (60.0%). These different types of managerial skills had varied positive impacts on the number of agro-processing IGAs established. The highest positive change was registered in record keeping skills 87 (46.8%) followed by business planning techniques 68 (36.6%), and leadership skills 51 (27.4%). Sixty (60.0) percent of respondent agro-processors indicated an 80.0 to 100.0 percent managerial skills relevance to the needs of their agro-business IGAs. There was a significant relationship between each of the relevant managerial skills training conducted and the number of agro-processing IGAs set-up by smallholder farmers in the study area (record keeping skills: p – value = 0.003, $p < 0.05$; marketing skills: p – value = 0.003, $p < 0.05$, $p < 0.05$; leadership skills: p – value = 0.013, $p < 0.05$, $p < 0.05$; business planning skills: p – value = 0.038, $p < 0.05$, $p < 0.05$; problem solving skills: p – value = 0.049, $p < 0.05$).

5.3. Conclusions

The purpose of the study was to investigate the impact of access to agro-processing technologies on the growth of smallholder agro-processing industry in Bureti District. In conclusion, it is evident from the study that there were four factors that impacted on the growth of smallholder agro-processing industry in Bureti District. Overall, these factors led to positive growth of the smallholder agro-processing industry.

In determining the extent to which manufacturing equipments impacted on growth of smallholder agro-processing industry the study concluded that diversity of, and access to, agro-manufacturing equipments in Bureti District is still limited among smallholder farmers. The combined effect of low level of access and narrow diversity of agro-manufacturing equipments impeded the rate of growth in number of agro-processing businesses. The cost of agro-manufacturing equipments was prohibitive and thus a hindrance to growth in number of smallholder agro-processing IGAs established in the district due to un-affordability. Distances to the sources of manufacturing equipments were an important factor in the agro-processing industry in Bureti District as high quality equipments are unavailable from within the local region. Long distances to the sources of equipments were a critical impediment to growth in number of agro-processing businesses particularly because the smallholder agro-entrepreneurs lacked financial capacity to incur additional acquisition costs. This resulted in slowed rate of growth in the number of agro-processing IGAs established in the District. Inspite of the constraints occasioned by high costs, narrow diversity, long distances to sources and low levels of access to agro-manufacturing equipments, the overall impact however was a positive marginal increase in the number of agro-processing businesses/IGAs that resulted from the acquired processing tools by smallholder farmers.

Establishing the impact of manufacturing skills training on growth of smallholder agro-processing industry concluded that the frequency of expert-farmer exchanges of agricultural information was generally adequate although agro-processing content in the agricultural extension packages were low at less than 40.0 percent. Similarly, the frequency of farmers' agro-manufacturing training sessions conducted by agricultural experts was adequate. The diversity of agro-manufacturing skills trained-on was broad enough. Access to these skills was generally good but not uniform in all agro-processing IGAs because the district lacked relevant experts in some subject areas. Agro-manufacturing skills trainings provided by the Agricultural experts were found to be relevant to the needs of the smallholder agro-processors. The level of agro-manufacturing skills in agro-processing IGAs was sufficient for some processing activities but remained a challenge to most smallholder agro-processors in other areas. Agro-manufacturing training skills offered to farmers had positive net impact on the number of agro-processing IGAs as some adopted and implemented some aspects of the skills acquired from the training sessions and this led to establishment of new units.

Examination of the impact of access to mechanized/automated functions on growth of smallholder agro-processing industry concluded that diversity of mechanization/automation in small-scale agro-processing IGAs was limited and evident mainly in crushing, thermal preservation and quality control operations. Most agro-processing operations in Bureti District largely depended on manually operated tools and equipments. Levels of mechanization/automation in smallholder agro-processing IGAs therefore were quite low. However, the level of mechanization had gone up in 40.0 percent of the IGAs while remaining same for the rest. This created positive impact in 40.0 percent of the agro-processing IGAs, which was manifested in form of increase in number of agro-processing units.

Exploration of how training on management skills impacted on growth of smallholder agro-processing industry concluded that the frequency of managerial skills training sessions yielded an impact in form of rapid increase in the number of agro-processing IGAs among 26.9 percent of the processors. Diversity or types of managerial skills farmers were trained-on was significantly broad in scope and number with at least fifteen (15) different types of managerial skills training modules provided. The most relevant managerial skill-inputs required by smallholder agro-processing enterprises in Bureti District were record keeping, proposal writing, leadership, problem-solving and communication skills. Diversity of management training skills had positive impact on 20.0 percent of IGAs that experienced rapid increase in the number of agro-processing units. Managerial skills training stimulated an overall increase in number of agro-processing IGAs to some 40.8 percent of the respondents.

5.4. Recommendations

In view of the findings of this study, the following recommendations are made for consideration in the future intervention strategies which are aimed at enhancing growth and development of smallholder agro-processing industry among the rural farmers in the study area of Bureti District:

1. The government and other development partners should develop and facilitate mechanisms that will realistically increase access of friendly investment capital to the young generation (18 – 40 years) to purchase equipments for starting small-scale agro-processing businesses. This will

make agriculture attractive to the youth and help create self-employment for the jobless majority.

2. Deliberate efforts should be made to target graduates of tertiary institutions (middle colleges and universities) with agro-manufacturing knowledge and skills as a way of attracting intellectual insights into agricultural development, which is otherwise unfairly identified with the less educated.
3. Education policy makers should introduce basic functional agro-manufacturing education at lower rungs of educational hierarchy as a strategy to create life-skills preparedness to potential primary and secondary graduates who may not transit to tertiary institutions.
4. Agricultural service providers and other stake-holding organizations should develop agro-processing farmer groups' mentorship plan which would gradually graduate groups into full fledged legal business entities or companies rather than socio-commercial groups. This would strengthen their networking and partnership capability with other actors in the product value chain.
5. The government and other agricultural service providers should embrace personnel deployment policy that is based on matching staff specializations with the critical needs of the farmers or clients so as to ensure value in service provision and thus attainment of broader national objectives such as Kenya Vision 2030.
6. Strategies aimed at improving access to investment capital for smallholder farmers should be anchored on the philosophy of internal capacity development. That means government and other development agencies in agriculture sector should put more emphasis on helping farmers to identify and build their own capacity to mobilize financial resources for investing in agricultural projects rather than encouraging dependency through provision of hand-outs.
8. Agricultural extension service providers should intensify awareness training of farmers on the importance of credit financing while at the same time facilitating the development of farmer-friendly credit packages by micro-financing institutions.

7. Government should encourage and create conducive environment for local manufacture of agro-processing equipments as a strategy of lowering costs of equipments for small-scale agro-processing IGAs. Each county should establish an agro-technology development centre to address peculiar agro-manufacturing needs of the local farmers as a way of decentralizing industrialization.
8. The level of agro-processing skills content in the agricultural extension packages passed to farmers should be increased to reflect the current national policy focus on value addition/agro-processing as a way of commercializing agriculture.
9. The Ministry of Agriculture should increase the number of agricultural extension experts in-order to improve expert-to-farmer ratio for better access of agro-processing technologies by farmers.
10. The Ministry of Agriculture should embrace synergy with other agro-processing service providers such as KIRDI, KEBS, Ministry of Industrialization, JKUAT, GìZ etc in-order to comprehensively mentor and grow the small-scale agro-processing IGAs to a level where they can exploit all agro-manufacturing skill opportunities (e.g. packaging and labeling, quality enhancement etc) they get from training for better market penetration of their products.
11. More emphasis should be put in training agro-processing entrepreneurs on mechanizing their business operations so as to increase efficiency and standardization of their products for better market performance.

5.5. Suggestions for Further Research

The study suggests further investigations in the following areas;

1. Exploring the relationship between access to agro-processing technologies and economic performance of smallholder agro-processing industry
2. Investigating the influence access to agro-processing technologies have on diversity of processed agro-products by smallholder agro-processing Businesses

3. Whether agro-processing skills have impact on the value-added index of agricultural produce among small-scale rural farmers

5.6. Contribution to the Body of Knowledge

The study makes the following contributions to the body of knowledge:

Objectives	Contribution to the Body of Knowledge
1. To Determine the Extent to which Manufacturing Equipments Impact on Growth of Smallholder Agro-processing Industry in Bureti District.	The average expenditure of KES 70 - 170 thousand required for agro-manufacturing equipment is unaffordable for most rural farmers. The cost factor constrained the establishment and expansion of smallholder agro-processing businesses among 80.0 percent of agro-processing farmers. Access to agro-manufacturing equipment is critical for growth of small-scale agro-processing industry in Bureti district. Ownership of such equipment can lead to rapid increase in number of agro-processing businesses/units by up-to 60.0 percent. Shorter distances travelled to source for agro-manufacturing equipments have greater positive impact on the number of agro-processing IGAs set up compared to long distances. Sources within radius of 50 km had the highest impact with 53.8 percent.
2.To Establish the Impact of Manufacturing Skills Training on Growth of Smallholder Agro-processing Industry in Bureti District	Higher frequency of Expert-and-Farmer exchange of agro-processing information is important in growing the number of agro-processing businesses. Frequency of 1 – 2 times in 3 months involving 48.9 percent of farmers registered an increase in the number

	of agro-processing IGAs established by 27.9 percent. Different agro-manufacturing skills have varied effects on growth of processing industry. The highest positive impact on number of IGAs established was registered from agro-processing skills 44 (23.7%) followed by preservation techniques 42 (22.6%), product quality skills 31 (16.7%) and equipment selection 26 (14.0%), Agro-manufacturing skills training are a critical factor in growth of smallholder agro-processing industry. Training of 70.0 % of farmers led to 38.3% increase, while none (0.0%) of the untrained respondents registered positive growth, in the number of agro-processing IGAs in Bureti District.
3.To Examine the Impact of Access to Automated/mechanized Functions on Growth of Smallholder Agro-processing Industry in Bureti District	Limited diversity and low levels of mechanization in small-scale agro-processing IGAs in Bureti District is an impediment to growth in number of agro-processing businesses. Levels of mechanization/automation in agro-processing IGAs was found to be 14.6 percent semi-mechanized systems while fully mechanized tools accounted for 8.6 percent.
4.To Evaluate the Extent to which Training on Management Skills Impacts on Growth of Smallholder Agro-processing Industry in Bureti	Managerial skills have become important determinants for growth of agro-processing industry. Management skills training frequency of 1 – 4 times per year involving

District	80.1 percent of farmers registered an increase in the number of agro-processing IGAs established by 26.9 percent. Different types of managerial skills exert varied positive impacts on the number of agro-processing IGAs established. The highest positive change was registered in record keeping skills 46.8% followed by business planning techniques 36.6%, leadership skills 27.4% and problem solving skills 23.1%. Sixty (60.0) percent of smallholder farmers have found 80.0 to 100.0 percent of managerial skills relevant to the needs of their agro-business IGAs.

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APPENDICES

Appendix 1: Letter of Transmittal

Odoyo J. Bittar
University of Nairobi
P. O. Box 30197
00100 Nairobi, Kenya.

June 2013

Dear Sir/Madam,

RE: **IMPACT OF ACCESS TO AGRO-PROCESSING TECHNOLOGIES ON GROWTH OF SMALLHOLDER AGRO-PROCESSING INDUSTRY IN BURETI DISTRICT**

I am a student at the University of Nairobi undertaking a Masters Degree in Project Planning and Management. I am conducting a research study in your District as part of the requirement for the fulfillment of the above stated degree.

As an important stakeholder in the agricultural sector in Bureti District your views are considered crucial in meeting the objectives of this study. The purpose of this letter therefore is to humbly request you to participate in the study by providing accurate information on the following issues contained in the Interview Schedule and Questionnaire to the best of your ability.

Assurance is hereby given that all information you provide shall strictly be treated as private and confidential, and shall not be used for any other purpose whatsoever except for this study.

Your assistance and cooperation will be appreciated.

Thanking you in advance,

Odoyo J. Bittar
Student Researcher
The University of Nairobi
Kenya.

Appendix 2: Structured Interview Schedule for the Agro-Processing Group Members and

Individual Processors

Section A:

General Information

A1: Please indicate/tick your age bracket:

(i) Less than 20 yrs ☐ (ii) 20 to 29 yrs ☐ (iii) 30 to 39 yrs ☐ (iv) 40 – 50yrs ☐ (v)Over 50yr

A2: Please indicate your level of education:

(i)Primary ☐ (ii) Secondary ☐ (iii) Certificate ☐ (iv)Diploma ☐ (v) Degree

A3: Indicate how long you have been in Agro-processing business or operating agro-processing activity:

(i)Less than 2 years ☐ (ii) 2 to 3yrs ☐ (iii) 4 to 6 yrs ☐ (iv) 7 to 10yrs

A4: Indicate legal status of your operation: Registered with;

(i)Register of businesses ☐ (ii)Social Services ☐ (iii) Not registered ☐ (iv)Other specify

A5: Please indicate your impression about the current status of the number of agro-processing units or businesses owned by smallholder farmers/business people in your area compared to 3 years ago:

(i) Increased ☐ (ii) Same ☐ (iii) Decreased ☐

Section B:
Manufacturing Equipments and Growth of Smallholder Agro-processing Industry

B1: Indicate the functional types of manufacturing equipments used in your agro-processing business or unit: *(tick the applicable ones – more than one may apply)*

Equipment	Tick	Equipment	Tick
i).Crushing tool		v).Sorting Equipment	
ii).Grinding tool		vi).Packaging equipment	
iii).Slicing tool		vii).Non thermal preservation equipment	
iv).Thermal preservation equipment		viii).Others (specify)	

B1.1: In your view do you think the diversity of manufacturing equipments stated in B1 have had any impacts on the number of agro-processing units or businesses established in your area? (i) Yes ☐ (ii) No ☐

If Yes,

B1.2: State the nature of the impacts:

i) No. of units decreased ☐ (ii) No. of units remained same ☐

(iii) No. of units increased ☐

B2: Which expenditure range best approximates the total equipment cost investment in your business over the last 3years? (Tick as applicable)

(i) Less than 10,000Ksh		(ii) 10,000 – 50,000Ksh	
(iii) 50,001 - 100,000Ksh		(iv) 100,001 - 300,000Ksh	
(v) 300,001 – 500000 Ksh		(vi) Over 500,000Ksh	

B2.1: What impact has the cost of manufacturing equipments had on the number of agro-processing units or businesses in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐

(iii) Rapid increase in number ☐

B3: How far are your major sources of most of the equipments used in the business or agro-processing unit? (Tick as applicable) – *Note: May be more than one source.*

(i) South Rift {radius of less than 50 Km}		(ii) Nakuru/ Eldoret Region {101 – 150 km}	
(iii) Kisumu/Kisii Region {50 – 100Km)		(iv)Nairobi/Central Region {151 – 400 Km}	
(iv) Others(specify) {Over 400 Km}			

B3.1: What effect has the distance of equipment sources had on the number of agro-processing units or businesses established in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐

(iii) Rapid increase in number ☐

B4: How would you generally rate the level of access to agro-manufacturing equipments among Small-Scale agro-processing businesses in your area? (Tick as appropriate)

(i)Excellent ☐ (ii) Good ☐ (iii) Average ☐ (iv) poor ☐

B5: In your view, what is the impact of the access to agro-manufacturing equipments stated in B4 on the number of agro-processing businesses or units in your area?

(i) Gone Up ☐ (ii) Remained Same ☐ (iii) Decreased ☐

Section C:
Manufacturing Skills Training and Growth of Smallholder Agro-processing Industry

C1: Indicate how often you get advised by agro-processing specialists(through either your visit to specialists or them visiting you):

Regularity visits	Own visits	Specialist's
None at all	☐	☐
1-2 times /3months	☐	☐
3-4 times/3months	☐	☐
1– 2 times/month	☐	☐
3– 4 times/month	☐	☐
5-8times/month	☐	☐

C2: On average indicate the <u>number</u> of smallholder farmers' <u>agro-processing</u> training sessions (both on-farm and institutional) you attend every year:

(i) 1 – 4 ☐ (ii) 5 – 8 ☐ (iii) 9 – 16 ☐ (iv) 17 – 30 ☐ (v) >30 ☐

C3: In your view do you think the <u>number of times farmers get advised or trained</u> on agro-processing has had any impact on the number of agro-processing units or businesses established in your area?

(i) Yes ☐ (ii) No ☐

C3.1: If Yes, what impact has the agro-processing training and advice had on the number of agro-processing units or businesses in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐

(iii) Rapid increase in number ☐

C4: With respect to the agro-processing advice and training selected in C1 and C2 please indicate the skill areas covered and their relative importance:

Technical skills	importance Low High 1 2 3 4 5	
i). Pre-processing raw Produce sorting & grading skills	☐☐☐☐☐	
ii) Product processing skills	☐☐☐☐☐	
iii) Material handling skills	☐☐☐☐☐	
iv) Process control skills		
v) Food safety & hygiene skills		☐☐☐☐☐
vi) Thermal preservation & shelf life enhancement techniques		☐☐☐☐☐
vii) Non-thermal preservation skills(e.g. deep chilling, chemical etc)		☐☐☐☐☐
viii) Quality control skills		☐☐☐☐☐
ix) Packaging & labelling skills		☐☐☐☐☐
x) Others (specify)----------		☐☐☐☐☐

C5: Generally, how would you rate the relevance of the agro-manufacturing training and advice you have been given to the needs of your business?

(i)80 – 100% relevant (ii) 60 – 79% relevant (iii) 40 – 59% relevant (iv) 30 – 39 % relevant (v) less than 30%

C6: What impact has the diversity in types of agro-processing training and advice had on the number of agro-processing units or businesses in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐ (iii) Rapid increase in number

C7: How would you rate the status of manufacturing skills in your business: (tick against the scale)

Skill Area	Very good 1 2 3 4 5 Very poor
i)Pre-processing skills	☐☐☐☐☐
ii)Materials handling	☐☐☐☐☐
iii) Processing skills	☐☐☐☐☐

Skill Area	Very good 1 2 3 4 5 Very poo
iv)Production planning	☐☐☐☐☐
v) Packaging skills	☐☐☐☐☐
vi)Quality control skills	☐☐☐☐☐

C8: In your view, what is the impact of agro-manufacturing skills training stated in C1 and C2 on tl number of agro-processing units or businesses?

(i) Gone Up ☐ (ii) Remained Same ☐ (iii) Decreased ☐

Section D:
Automated/Mechanized Functions and Growth of Agro-processing Industry

D1: Please estimate the overall degree of automation/mechanization of your business processes:

	Percent distribution				
	< 10	10 – 30	31-50	51- 70	>70
i) Manual	☐	☐	☐	☐	☐
ii) Semi-automated	☐	☐	☐	☐	☐
iii) Full automated	☐	☐	☐	☐	☐

D2: Please indicate presence of any level of automation/mechanization in the following functional processes in your business:

Activity	Available	None at all
i) Pre-processing activity	☐	☐
ii) Processing activity	☐	☐
iii) Operational process control	☐	☐
iv) Quality control/preservation	☐	☐
v) Packaging & labeling	☐	☐

D3: How would you generally rate the level of access to Automated/mechanized functions among small-scale agro-processing businesses in your area? (Tick as appropriate)

(i)Excellent ☐ (ii) Good ☐ (iii) Average ☐ (iv) poor ☐

D4: In your view, what is the impact of the access to automated/mechanized functions stated in D1 and D2 on the number of agro-processing units or businesses in your area?

(i) Gone Up ☐ (ii) Remained Sam ☐ (iii) Decreased ☐

Section E:

Agro-processing Management Skills and Growth of Smallholder Agro-processing Industry

E1: Have your workers been provided with Agro-processing Management Skills training (from outside the business) in the following areas?

		Yes	No
i)	Leadership skills	☐	☐
ii)	Business planning Skills	☐	☐
iii)	Interpersonal skills	☐	☐
iv)	Problem Solving skills	☐	☐
v)	Record keeping skills	☐	☐
vi)	Basic financial mgt skills	☐	☐
vii)	Team building skills	☐	☐
viii)	Safety skills	☐	☐
ix)	Other (specify)	☐	☐

E2: What impact has the types of agro-processing management training had on the number of agro-processing units or businesses in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐

(iii) Rapid increase in number ☐

E3: On average indicate the number of smallholder agro-processing management training sessions (both on-farm and institutional) you attend every year:

(i) 1 – 4 ☐ (ii) 5 – 8 ☐ (iii) 9 – 16 ☐ (iv) 17 – 30 ☐ (v) >30 ☐

E4: In your view do you think the number of times farmers get advised or trained on agro-processing management skills has had any impact on the number of agro-processing units or businesses established in your area?

(i) Yes ☐ (ii) No ☐

E4.1: If Yes, what impact has the agro-processing management training and advice had on the number of agro-processing units or businesses in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐

(iii) Rapid increase in number ☐

E5: Generally, how would you rate the relevance of the agro-processing management training and advice you have been given to the needs of your business?

(i)80 – 100% relevant (ii) 60 – 79% relevant (iii) 40 – 59% relevant (iv) 30 – 39 % relevant (v) less than 30%

E6: Do you have anything or issues you may wish to add?.....……
……...……
…….....
.....
.....
.....
.....
.....

Thank you very much for your cooperation
END

Appendix 3: Questionnaire for Agro-processing Experts of the Ministry of Agriculture

Section A:

General Information

A1: State your level of professional training:

(i) Certificate ☐ (ii) Diploma ☐ (iii) Graduate ☐ (iv) Post Graduate ☐

(v) Other (specify)…….....

A2: Based on your level of training specified in part A1 indicate which area best describes your professional specialization:

(i) General Agriculture ☐ (ii) Agribusiness & Entrepreneurship

(iii) Agriculture & Home Economics ☐ (iv) Agricultural Engineering

(v) Horticulture ☐ (vi) Agricultural Economics

A3: What is the estimated Smallholder farmers' population in your working area:

(i) < 5,000 ☐ (ii) 5,000 – 8,000 ☐ (iii) 8,001-12,000 ☐

(iv) 12,001 – 20,000 ☐ (v) 20,001 – 50,000 ☐ (vi) > 50,000 ☐

A4: Estimate the number of smallholder farmer groups in your area of work:

(i) 1-10 ☐ (ii) 11 – 30 ☐ (iii)31 – 50 ☐ (iv)51 – 70 ☐ (v)71 – 100 ☐ (vi) over 100

A5: Indicate the estimated number of farmers in your area who are represented in the groups in part A4:

(i)20 – 200 ☐ (ii) 201 – 600 ☐ (iii)601 – 1000 ☐ (iv)1001-1400 ☐ (v)1401-2000 ☐
(vi) over 2000

A6: Please indicate your impression about the current status of the number of agro-processing units or businesses owned by smallholder farmers/business people in your area compared to 3 years ago:

(i)Increased ☐ (ii) Same ☐ (iii) Decreased ☐

Section B:

Manufacturing Equipments and Growth of Smallholder Agro-processing Industry:

B1: Indicate the functional types of manufacturing equipments used in smallholder agro-processing businesses or units in your area: *(tick the applicable ones – more than one may apply)*

Equipment	Tick	Equipment	Tick
i).Crushing tool		v).Sorting Equipment	
ii).Grinding tool		vi).Packaging equipment	
iii).Slicing tool		vii).Non thermal preservation equipment	
iv).Thermal preservation equipment		viii).Others (specify)	

B1.1: In your view do you think the diversity of manufacturing equipments stated in B1 have had any impacts on the number of agro-processing units or businesses established in your area? (i) Yes ☐ (ii) No ☐

If Yes,

B1.2: State the nature of the impacts:

(i) Slowed increase in number ☐ (ii) No change in number of units ☐

(iii) Rapid increase in number ☐

B2: Which expenditure range best approximates the total equipment cost investment by individual businesses in your area over the last 3years? (Tick as applicable)

(i) Less than 10,000Ksh		(ii) 10,000 – 50,000Ksh	
(iii) 50,001 - 100,000Ksh		(iv) 100,001 - 300,000Ksh	
(v) 300,001 – 500000 Ksh		(vi) Over 500,000Ksh	

B2.1: What impact has the cost of manufacturing equipments had on the number of agro-processing units or businesses in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐

(iii) Rapid increase in number ☐

B3: How far are your farmers' major sources of most of the equipments used in the businesses or agro-processing units in your area? (Tick as applicable) – *Note: May be more than one source.*

(i) South Rift {radius of less than 50 Km}		(ii) Nakuru/ Eldoret Region {101 – 150 km}	
(v) Kisumu/Kisii Region {50 – 100Km)		(iv)Nairobi/Central Region {151 – 400 Km}	
(vi) Others(specify) {Over 400 Km}			

B3.1: What effect has the distance of equipment sources had on the number of agro-processing units or businesses established in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐

(iii) Rapid increase in number

B4: How would you generally rate the level of access to agro-manufacturing equipments among Small-Scale agro-processing businesses in your area? (Tick as appropriate)

(i)Excellent (ii) Good ☐ (iii) Average ☐ (iv) poor ☐

B5: In your view, what is the impact of the access to agro-manufacturing equipments stated in B4 on the number of agro-processing businesses or units in your area?

(ii) Gone Up ☐ (ii) Remained Same ☐ (iii) Decreased ☐

Section C:

Manufacturing Skills and Growth of Smallholder Agro-processing Industry

C1: Indicate how often you advise farmers on agro-processing skills(through either your visit t visiting you):

Regularity	Own visits	Specialist's visits
None at all	☐	☐
1-2 times /3months	☐	☐
3-4 times/3months	☐	☐
1– 2 times/month	☐	☐
3– 4 times/month	☐	☐
5-8times/month	☐	☐

C2: On average indicate the number of smallholder farmers' agro-processing training sessions institutional) you conduct for farmers every year:

(i) 1 – 4 ☐ (ii) 5 – 8 ☐ (iii) 9 – 16 ☐ (iv) 17 – 30 ☐ (v) >30 ☐

C3: In your view do you think the number of times farmers get advised or trained on agro-pro impact on the number of agro-processing units or businesses established in your area?

(i) Yes ☐ (ii) No ☐

C3.1: If Yes, what impact has the agro-processing training and advice had on the number of a or businesses in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐ (iii) Rapid increase in number

C4: With respect to the agro-processing advice and training selected in C1 and C2 please indicate the skill areas covered and their relative importance:

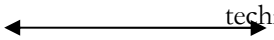
Technical skills importance

Low

High

1 2 3

4 5



i). Pre-processing raw Produce sorting & grading skills

ii) Product processing skills

iii) Material handling skills

iv) Process control skills

v) Food safety & hygiene skills

vi) Thermal preservation & shelf life enhancement techniques

vii) Non-thermal preservation skills(e.g. deep chilling, chemical etc)

viii) Quality control skills

ix) Packaging & labelling skills

x) Others (specify)----------

C5: Generally, how would you rate the relevance of the agro-manufacturing training and advice you have given to the needs of your farmers' businesses?

(i)80 – 100% relevant (ii) 60 – 79% relevant (iii) 40 – 59% relevant (iv) 30 – 39 % relevant (v) less than 30%

C6: What impact has the diversity in types of agro-processing training and advice had on the number of agro-processing units or businesses in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐ (iii) Rapid increase in number

C7: How would you rate the status of manufacturing skills in your farmers' businesses: (tick against the scale)

Skill Area	Very good 1	2	3	4	Very poor 5
i)Pre-processing skills	☐	☐	☐	☐	☐
ii)Materials handling	☐	☐	☐	☐	☐
iii) Processing skills	☐	☐	☐	☐	☐

Skill Area	Very good 1	2	3	4	Very poor 5
iv)Production planning	☐	☐	☐	☐	☐
v) Packaging skills	☐	☐	☐	☐	☐
vi)Quality control skills	☐	☐	☐	☐	☐

C8: In your view, what is the impact of agro-manufacturing skills training stated in C1 and C2 on the number of agro-processing units or businesses in your area?

(i) Gone Up ☐ (ii) Remained Same ☐ (iii) Decreased ☐

Section D:

Automated/Mechanized Functions and Growth of Agro-processing Industry

D1: Please estimate the overall degree of automation/mechanization of your farmers' business processes:

	Percent distribution				
	< 10	10 – 30	31-50	51- 70	>70
i) Manual	☐	☐	☐	☐	☐
ii) Semi-automated	☐	☐	☐	☐	☐
iii) Full automated	☐	☐	☐	☐	☐

D2: Please indicate presence of any level of automation/mechanization in the following functional processes in your farmers' businesses:

Activity	Available	None at all
i) Pre-processing activity	☐	☐
ii) Processing activity	☐	☐
iii) Operational process control	☐	☐
iv) Quality control/preservation	☐	☐
v) Packaging & labeling	☐	☐

D3: How would you generally rate the level of access to Automated/mechanized functions among small-scale agro-processing businesses in your area? (Tick as appropriate)

(i)Excellent ☐ (ii) Good ☐ (iii) Average ☐ (iv) poor ☐

D4: In your view, what is the impact of the access to automated/mechanized functions stated in D1 and D2 on the number of agro-processing units or businesses in your area?

(ii) Gone Up ☐ (ii) Remained Same ☐ (iii) Decreased ☐

Section E:

Agro-processing Management Skills and Growth of Smallholder Agro-processing Industry

E1: Have the workers in your farmers' businesses been provided with Agro-processing Management Skills training (from outside the business) in the following areas?

		Yes	No
i)	Leadership skills	☐	☐
ii)	Business planning Skills	☐	☐
iii)	Interpersonal skills	☐	☐
iv)	Problem Solving skills	☐	☐
v)	Record keeping skills	☐	☐
vi)	Basic financial mgt skills	☐	☐
vii)	Team building skills	☐	☐
viii)	Safety skills	☐	☐
ix)	Other (specify)	☐	☐

D2: What impact has the types of agro-processing management training had on the number of agro-processing units or businesses in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐

(iii) Rapid increase in number ☐

D3: On average indicate the number of smallholder agro-processing management training sessions (both on-farm and institutional) you conduct for farmers every year:

(i) 1 – 4 ☐ (ii) 5 – 8 ☐ (iii) 9 – 16 ☐ (iv) 17 – 30 ☐ (v) >30 ☐

D4: In your view do you think the number of times farmers get advised or trained on agro-processing management skills has had any impact on the number of agro-processing units or businesses established in your area?

(i) Yes ☐ (ii) No ☐

D4.1: If Yes, what impact has the agro-processing management training and advice had on the number of agro-processing units or businesses in your area?

(i) Slowed increase in number ☐ (ii) No change in number of units ☐

(iii) Rapid increase in number ☐

D5: Generally, how would you rate the relevance of the agro-processing management training and advice you have been given to the needs of your business?

(i) 80 – 100% relevant (ii) 60 – 79% relevant (iii) 40 – 59% relevant (iv) 30 – 39 % relevant (v) less than 30%

D6: Do you have anything or issues you may wish to

add?.....

.....

.....

.....

Thank you very much for your cooperation

END

Appendix 4: Determination of Sample Size for Research Activities

Table for determining needed sizes of randomly chosen sample from a given finite population of '***n***' cases such that the sample proportion '***p***' will be within **0.05** of the population proportion **p** with a **95%** level of confidence**.**

Population	Sample Size	Population	Sample Size	Population	Sample Size
10	10	220	140	1,200	291
15	14	230	144	1,300	297
20	19	240	148	1,400	302
25	24	250	152	1,500	306
30	28	260	155	1,600	310
35	32	270	159	1,700	313
40	36	280	162	1,800	317
45	40	290	165	1,900	320
50	44	300	169	2,000	322
55	48	320	175	2,200	327
60	52	340	181	2,400	331
65	56	360	186	2,600	335
70	59	380	191	2,800	338
75	63	400	196	3,000	341
80	66	420	201	3,500	346
85	70	440	205	4,000	351
90	73	460	210	4,500	354
95	76	480	214	5,000	357
100	80	500	217	6,000	361
110	86	550	226	7,000	364
120	92	600	234	8,000	367
130	97	650	242	9,000	368
140	103	700	248	10,000	370
150	108	750	254	15,000	375
160	113	800	260	20,000	377
170	118	850	265	30,000	379
180	123	900	269	40,000	380
190	127	950	274	50,000	381
200	132	1,000	278	75,000	382
210	136	1,100	285	100,000	384

Source: Adapted from R.V. Krejcie and D.W. Morgan: "Determining Sample Size for Research Activities", Educational and Psychological Measurement, 30(3), p608, copyright 1970 Sage Publications, Inc. Reprinted by permission of Sage Publications Inc**.**