DETERMINANTS OF PRODUCTION AND INNOVATION OF MAIZE PROCESSING TOOLS BY JUA KALI ARTISANS IN TRANS-NZOIA COUNTY, KENYA

BY

LORAH MARITIM

A RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF BUSINESS AND ECONOMICS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE IN ENTERPRENUERSHIP (QUANTITATIVE SKILLS AND ENTREPRENEURSHIP STUDIES)

MOI UNIVERSITY

2023

DECLARATION

Declaration by the Candidate

I, the undersigned, declare that this thesis is my original work and that it has not been presented in any other university or institution for academic credit.

Sign…….. Date…….

Lorah Maritim

SHRD/PGE/05/11

Approval by Supervisor

The thesis has been submitted for examination with our approval as University supervisor.

Sign…….. Date…….

Prof. Benard K. Nassiuma

Department of Quantitative Skills and Entrepreneurship Studies

School of Business and Economics

Moi University

Sign…….. Date…….

Prof. P.I. Omboto

Department of Economics

School of Business and Economics

Moi University

DEDICATION

I dedicate this work to my family for their support, inspiration and encouragement throughout my education.

AKNOWLEDGEMENT

I would like to thank God first for good health and strength throughout the study. I am very grateful to my family for the support they have provided me with. In particular I am grateful to family for the support they have offered me during this thesis writing period. I am grateful to my supervisors, Prof. Benard K. Nassiuma and Prof. P.I. Omboto for their tireless guidance throughout the program. I have benefitted greatly from your wealth of knowledge and meticulous guidance. I also thank management of the Voxwagen scholarship program for their financial and technical support provided when writing this thesis not forgetting colleagues who gave me moral support and motivated me throughout our studies.

ABSTRACT

About 82 percent of Sub-Saharan Africa's people still live in rural areas, earning their living primarily in farming. Relative to other world regions, the informal labor market and the number of informal enterprises is the largest and have been most prevalent. In Kenya, Jua kali industry is part of small enterprises that provide employment and serves as a pivot for economic growth and development of an industrial base in Kenya. Despite this critical role, the industry is faced with many challenges that inhibit the realization of its full potential, the key challenge being lack of access to diffusing technology to enhance their productivity. Large scale farmers of the products such as maize have suffered losses which could have been avoided. Failure to use tools of technology contributes to unavailability, affordability and lack of knowledge among farmers on their use in maize processing. The main purpose of the study was to find out the determinants of Jua kali artisans production on innovation of tools for maize processing in Trans-Nzoia County. The study was guided by the following specific objective; find out how skills and competences influence innovation of Jua Kali tools for maize processing, establish how training and outreach influence innovation of Jua Kali tools for maize processing, analyze how access to financial resources influence innovation of Jua Kali tools for maize processing and examine how policy and regulations influence innovation of Jua Kali tools for maize processing in Trans Nzoia County. The study was guided by the Resource Based View Theory. This study adopted a survey research design.The target population consisted of 400 Jua kali artisans and 457 large scale farmers. The total target population was 875 respondents. The study employed stratified sampling and simple random sampling to pick a sample of 196 artisans and 210 farmers as respondents to the study. The total sample size was 406 respondents.The study employed the use of questionnaires to collect the data for the study. Data analysis was done through descriptive and inferential statistics. The study results indicated that there was a significant relationship between skills and competences and innovation of Jua Kali tools for maize processing in Trans Nzoia County ($\beta = 0.192$, $p = 0.002$), a significant relationship between training and outreach and innovation of Jua Kali tools for maize processing in Trans Nzoia County ($\beta = 0.143$, $p = 0.000$), no significant relationship between access to financial resources and innovation of Jua Kali tools for maize processing in Trans Nzoia County ($\beta = 0.063$, $p = 0.118$) and a significant relationship between policy and regulations and innovation of Jua Kali tools for maize processing in Trans Nzoia County ($\beta = 0.321$, $p = 0.000$). The study concluded that, on objective one, how skills and competences influence innovation, development of skills and competencies requires some form of training. On training and outreach, the study concluded that farmers teach each other on how to use tools and technologies in maize farming. In terms of accessing financial resources, the study concluded that the county has a kitty for us to help Jua Kali artisans operate and then return funds issued and in relation to policy and regulations to the industry, the final objective, the study concluded that there are high taxes on their products on their products. The study made the following research recommendations; County governments and national governments should continue providing TVETs, bursaries and other forms of support to technical institutions in counties to ensure that the TVETs are able to enroll, train and graduate as many youths with special skills and with the required competency levels.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

OPERATIONAL DIFINITION OF TERMS

Jua Kali: They also refer to an informal sector in Kenya comprising of informal traders (Mutula, and Brakel, 2016).

In this study it refers to as informal sector producers of tools used in maize processing value chain in Trans-Nzoia County.

Outreach: Outreach is an activity of providing services to any populations who might not otherwise have access to those services (Diego and Mart, 2013).

In this study it refers to as a way to increase exposure beyond traditional search engine to the jua kali artisans in Trans-Nzoia County.

Skills: An ability and capacity acquired through deliberate, systematic, and sustained effort to smoothly and adaptively carryout complex activities (Achola, 2016).

In this study it refers to as the ability of Jua Kali artisans to produce tools used in maize processing value chain in Trans-Nzoia County.

Tools: Tools are items or implement used for a specific purpose (Bardeen, 2013).

In this study it refers to physical object used in maize processing value chain in Trans Nzoia County.

Training: Training is organized activity aimed at imparting information and/or instructions to improve the recipient's performance (Chorn, 2014).

In this study it refers to as the process for providing required skills to the jua kali artisans in Trans Nzoia County.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The informal sector otherwise known as Jua Kali in Kenya is critical at every level of the global economy (ILO, 1986). It encourages the development of technological ability, the diffusion of innovation, and the mobilization of capital that would not otherwise be generated, hence boosting indigenous entrepreneurship and national growth. The sector is essential to the economic growth and development of the nation. It is claimed that close to 60 percent of employment in growing and expanding regions of the world is of the informal sort; nevertheless, there are considerable regional variances (Bonnet, Vanek, & Chen, 2019). Informal employment accounts for the following percentages of the workforce in developing and emerging economies: 90% in Africa, 62.8% in Asia and the Pacific, 63.9% in Arab states, 49.6% in the Americas, and 30% in Europe and Central Asia (Bhattacharya, 2019). The broadest definition of informal economies comprises any economic activity or source of income not subject to official regulation, taxation, or oversight (Burger & Fourie, 2018). As a result, it comprises a large array of activities not included in national accounts, including subsistence agriculture, small-scale businesses, and many more. Typically, these are the most important source of work and income for the inhabitants (Glinskaya, 2018).

The tremendous relevance of informal employment in emerging economies and developing economies is confirmed by official statistics from all areas. These economies account for 82% of global employment and 93% of informal employment. As a result, informal labour and the informal sector are at the heart of economic growth strategies in a number of nations, with the objective of identifying routes out

of poverty (Bonnet et al., 2019). On the effect of ICT usage on the growth of informal companies, contradictory research has been undertaken. A compilation of well-known studies on the impact of mobile phone use on fisherman in Kerala, India demonstrated dramatic and favorable effects on trash reduction, market performance, and producer and customer welfare (Jensen, 2007; Abraham, 2007; John & Jubi, 2013). Nonetheless, certain conclusions, like those of Jensen (2007), have been contested on methodological and empirical grounds (Burrell & Oreglia, 2015; Sreekumar, 2011; Srinivasan & Burrell, 2015; Steyn, 2016; Steyn & Das, 2015). In particular, these opponents have frequently questioned the generalizability of Jensen's findings, citing the uniqueness of the social context in which the fishermen of Kerala functioned, which comprised historically built social subsystems and networks. Moreover, their findings do not entirely support Jensen's.

An investigation of the price data and marketing service Mobile-Farm in Kenya revealed that, while price information services may have assisted farmers in modifying production processes, such as cropping patterns, the service's efficacy in assisting farmers in obtaining better prices is uncertain (Baumüller, 2015). A study of the impact of ICT on microenterprise growth among women-owned businesses in urban India found that access to mobile phone, computer, and the Internet has a statistically significant but minimal impact on profits and number of employees, whereas mobile phone use alone does not necessarily promote business growth (Chew, Levy, & Ilavarasan, 2011). In Sub-Saharan Africa, the informal sector is comprised of small firms and huge corporations functioning inside well-organized networks of seemingly unrelated small businesses. These include, among others, major retailers that import goods from outside the country, shady construction organizations, and outside automobile vendors. According to the International

Monetary Fund (Medina, Jonelis, & Cangul, 2017), in sub-Saharan Africa, informal employment and the informal sector contribute 20% (South Africa, Lesotho, Namibia) to 60% (Nigeria, Tanzania, Benin) of the national GDP (SSA).

The informal sector in Kenya, also known as Jua Kali, is comprised of tiny, semi-organized firms employing inexpensive and simple technologies (Gikenye, 2014). Manufacturing, building and construction, transportation and communication, community and personal services, and retail and distribution are among the operations performed (Government of Kenya, 2010; Kiveu, Namusonge, & Muathe, 2019). The majority of MSE employees are recent high school grads who have been unable to secure employment in the official sector (Government of Kenya, 2010). Individuals who have left schools and training programs without alternative jobs, as well as those who have left the formal sector due to layoffs or reorganization, now have the option of working in the informal sector. Despite numerous obstacles, informal sector companies in Kenya have endured as survival groups due to a lack of coordination in the government's efforts to accomplish true change. According to Sessional Paper No. 2 of 1992 on "Small enterprise and jua kali development in Kenya" (Government of Kenya, 1992), after Kenya's independence in 1963, colonial rules that strictly discouraged informal sector activities were relaxed, and significant funds were spent implementing government policies and programs to build institutions to promote the informal sector. Ikiara (1991) contends that it was not until the 1980s that the Kenyan government and donor organizations took a genuine interest in the industry and began hailing it as essential for reviving economic growth and, in particular, job creation. Poor coordination among implementing agencies and the fact that the second Five-Year Development Plan, which should have built on the previous plan, made no

mention of the informal sector or jua kali indicate that the sector did not receive continuous assistance (Ikiara, 1991).

Despite the business potential associated with innovation adoption, informal sector companies, which dominate the economy of developing nations, lack access to innovations, especially computer-based ones, and the majority of informal sector participants are uninformed of their potential. They view innovation enabled by ICT as an unrealistic and distant goal. Innovations in ICT have the potential to transform business operations by enabling the rapid, reliable, and efficient exchange of large volumes of data; reducing transaction costs; enhancing information gathering and dissemination, inventory management, and quality control; and boosting organizations' and businesses' efficiency and customer service. To achieve continued expansion, firms in the informal sector must apply alterations to the global technologically innovative environment that facilitate access to international markets. The acquisition of skills and training serves important socioeconomic functions, such as the decrease of unemployment, poverty, and inequality, and the encouragement of innovation (Magidi & Mahiya, 2021). Despite the importance of formal education and training, the informal sector's talents and contributions remain generally undervalued as national training initiatives continue to prioritize formal institutions (Magidi & Mahiya, 2021). Consequently, the informal sector receives minimal or no fiscal assistance from the government and must finance its own activities. The public and private sectors have an inclination to overlook capabilities gained informally despite overwhelming evidence that they are as important and valued (Mitra, 2005).

Employers in the commercial and governmental sectors continue to compromise and overlook informally acquired competencies, despite the fact that the informal sector is a critical partner in skill development. This is due to the absence of uniformity and

proper quality assurance systems in the training process. Lange and Baier-D'Orazio (2020) report that trade association examinations and assessments have been utilized to increase skills in African countries such as Kenya, Cameroon, Ghana, and Nigeria. Nevertheless, according to (Walther, 2012), the system prioritizes formal training facilities above informal training.

1.1.1 Jua Kali Sector

Jua kali means 'fierce sun' in Kiswahili. It is the name given to the millions of workers in Kenya's informal economy who historically worked under the beating equatorial Sunday in and day out, without any shelter. Today, jua kali workers and business owners engage in a wide range of sectors and operate in various types of premises. They include retailers, *boda boda* drivers, hawkers or small-scale traders, craftspeople, metalworkers, car mechanics, and other service providers. The jua kali sector has been prevalent in Kenya's economy for more than three decades and continues to play an important role in absorbing youth who would otherwise have no income-generating options. The ease of entry and exit into the jua kali sector makes it an environment where many young people can turn to earn a livelihood. The World Bank has acknowledged that this kind of informal entrepreneurship is a lifeline for Kenya's youth (Handjiski et al., 2016). It not only creates employment opportunities for young entrepreneurs and other people they hire, but also brings marginalized youth back into the economic mainstream and addresses the delinquency that arises from joblessness (Schoof, 2006).

Although the informal sector is recognized as an important source of employment creation, most jua kali firms are one-person establishments that employ only the owner (Safavian et al., 2016; Handjiski et al., 2016). Moreover, the vast majority are not expanding or hiring additional workers (Safavian et al., 2016). These findings

concur with reports from the Global Entrepreneurship Monitor (GEM) – the world's foremost study of entrepreneurship – which suggest that many firms in sub-Saharan Africa are "low margin, 'me too' businesses that have very little differentiation and are possibly driven by necessity" (Herrington & Kelley, 2012, 7). GEM data shows a significant fraction of entrepreneurs worldwide are driven by necessity, especially in economies characterized by low-skilled labour like Kenya (Singer et al., 2014). Those pushed into self-employment out of necessity are widely believed to run smaller firms and have lower growth expectations than other entrepreneurs (Poschke, 2013; Block & Sandner, 2009). However, the empirical basis for this is rather thin.

Stimulating growth-oriented entrepreneurship, which can contribute to macroeconomic growth (Stam et al., 2011), is prominent on the agenda of policy-makers in Kenya. Growth-oriented entrepreneurship is said to have enduring value, as entrepreneurs with high growth aspirations are more likely to create employment for others. The World Bank (2012) postulates that if each entrepreneur with high potential for success were to create a single additional job, total employment in low-income countries would increase substantially. In Kenya, this would amount to an estimated 8% increase in employment (World Bank, 2012). With the Kenyan government under immense pressure to create enough jobs for the emerging labour force, understanding what propels some young entrepreneurs and not others to seek growth is therefore of critical importance. Since the jua kali sector is where the bulk of Kenyan youth are starting their businesses and where many are turning to find work, it is essential to take a closer look at the growth potential of young entrepreneurs in this context.

1.2 Statement of the Problem

Kenya's agricultural significance cannot be understated. The sector contributes significantly to the nation's gross domestic product and provides rural residents with a means of subsistence and employment, with maize production being considered a major staple crop in most communities. In recent years, Kenya has felt the severe effects of climate change, including the effects of drought in the majority of the country's regions. Because of this, there is a shortage of food in the country because the majority of the country's food crop production is dependent on rainfall, and only a small portion of the country has adopted more innovative techniques for the cultivation of maize. Due to the fact that Kenya is one of the nations that is experiencing a significant expansion in population (World Bank, 2007; Gitu, 2006; Pingali, 2001), it is essential for her and the rest of the Sub-Saharan countries to enhance production of maize crop for the purpose of ensuring food security. The output of maize, which is a significant staple crop in most communities in Kenya, has been seen to fall and, in some instances, to remain stationary, despite the fact that the demand for maize from consumers exceeds the supply that is produced domestically.

At the national, regional, and international levels, science, technology, and innovation have been recognized as facilitating the production of wealth, social welfare, and international competitiveness. Adoption of innovative technologies is expected to have good results. Positive effects include cost reduction, increased output without an increase in inputs, and enhanced product quality (Pikkarainen, Karjaluoto, & Pahnila, 2004). The adoption rate of newly developed innovative technologies has remained disappointingly low throughout the years, particularly in the realms of maize production and processing. As a direct consequence of this, average yields are far lower than their potential, and the resulting low production levels result in significant

food shortages. Notwithstanding the efforts made by the Kenyan government and in particular the Jua Kali sector in production of innovative agricultural tools, many studies still attribute the wide yield gap in maize to low adoption of productivity-enhancing technologies aimed at improving maize production and processing. There has been an inadequate amount of focus placed on the influence that innovation has had on Kenya's maize production and processing.

Extant empirical review on the informal sector role in enhancing innovative production and processing of agricultural products has produced mixed results, for instance, Ayode 2015 revealed that better access by farmers to innovative practices improved maize production in Nigeria while Mounirou (2018) study found out that despite adoption of innovation, production of Maize in Benin was still inadequate in improving yields. Given the mixed results from past empirical researches, there is a need for additional investigations to support and explain the association amongst the study variables. In addition, the focus of investigation of past empirical research has been largely limited to developing countries, and there appears to be a dearth of empirical literature furthering a developing country's perspective. This study seeks to fill this vacuum by establishing the determinants of Jua Kali artisans' production on the innovation of tools for maize processing.

1.3 Research Objectives

1.3.1 Broad Objective

The main purpose of this study was to establish the determinants of production and innovation of maize processing tools by Jua Kali artisans in Trans-Nzoia County, Kenya

1.3.2 Specific Objectives

The specific research objectives are to;

1. Determine how skills and competences influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.
2. Describe how training and outreach influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.
3. Analyze how access to financial resources influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.
4. Examine how policy and regulations influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.

1.4 Research Hypotheses

The study will be guided by the following research hypothesis;

H_{01}: There is no significant relationship between skills and competences and innovation of Jua Kali tools for maize processing in Trans Nzoia County.

H_{02}: There is no significant relationship between training and outreach and innovation of Jua Kali tools for maize processing in Trans Nzoia County.

H_{03}: There is no significant relationship between financial resources and innovation of Jua Kali tools for maize processing in Trans Nzoia County.

H_{04}: There is no significant relationship between influence of policy and regulations and innovation of Jua Kali tools for maize processing in Trans Nzoia County.

1.5 Significance of the Study

This study will provide evidence-based findings that will aid the county and national governments and other stakeholders in planning and formulating policies regarding

how to protect and nurture innovation among informal SMEs in Kenya and other regions of the world.

Knowledge generated from this study will act as impetus to other interested scholars and researchers to expand the scope of investigation in this field of study thereby help in bridging knowledge gaps that this study has pointed out. In addition, it would add to the already existing stock of knowledge and can be used as reference by future researchers.

1.6 Justification of the Study

The Jua Kali SME sector is vital to the nation's economic development. It is a source of tax money for the government and also provides individuals with employment opportunities. The Jua Kali SME sector is vital to the nation's economic development. It is a source of tax money for the government and also provides individuals with employment opportunities. The sector employs more than 80 percent of Kenya's workforce.

Kenya’s aspirations as highlighted in the Vision 2030 blueprint which envisions Science, Technology and Innovation as one of the pillars; and the big four agenda in which food security is conceptualized underscore the importance of innovation in driving industrial competitiveness. The Jua Kali Subsector therefore plays a vital role in the realization of these aspirations. As such the sector continues to get global interest, and it has been cited in existing research (Safavian et al., 2016) as a system containing ways to alleviate poverty and encourage the development of sustainable home livelihoods.

Moreover, there is a general consensus among scholars on the importance of innovation and its adoption for long term economic growth, and competitiveness

(Freeman, 1982). Innovation and its adoption enables organizations to improve the quality of their output, revitalize businesses, enter new markets, try out new technologies, and develop alternative applications for existing product categories in effect enhancing business performance. Consequently, this sector has a great deal of potential for not only increasing job creation through the building of factories and the launch of commercial enterprises, thereby generating income for those without alternative means of subsistence but also becoming seedbeds for innovation. Therefore, the sector cannot be ignored if a country is to achieve an all-inclusive development path. Nevertheless, despite apparent benefits, businesses in this sector continue to have low growth rates and limited potential (Micro and Small Enterprises Authority, 2013), which are frequently the result of a complex environment and other problems. Moreover, although the industry is widely recognized as the growth engine, it lacks originality and innovation.

There is scarcity of literature touching on the areas concerning Jua Kali enterprises. The scarce availability of reliable and valid data continues to be one of the key obstacles in understanding small and micro entrepreneurs in the Jua Kali Sub-Sector. This study thus helps in both broadening the already existing data and build on the locally scarce available data

1.7 Scope of the Study

The study was carried out in Trans-Nzoia County. The study sought to establish the determinants of production and innovation of maize processing tools by Jua Kali artisans in the county. The choice of this county was based on the consideration of the fact that there was a high population of Jua Kali enterprises. Moreover, Trans-Nzoia County is considered one of the bread basket of the country because majority of the farms in this county engage in large scale plantation of maize and hence were more

likely to adopt the use of innovative tools produced by the Jua Kali artisans in producing and processing their farm produce.

Whereas there is a wide range of innovations in the informal sector for adoption in the form of products and process, the study was limited to innovative farm tools used in the production and processing of maize that are developed by the Jua Kali artisans.

1.8 Assumptions of the study

The study assumed that:

i. The farmers in Trans-Nzoia County had adopted use of innovative tools in the production and processing of their farm produce
ii. That participants will answer honestly, due to the level of anonymity and confidentiality preserved during the study.
iii. Jua Kali artisans were knowledgeable in the area of study

1.9 Limitation and Delimitation of the Study

Some respondents to this study declined to take part in the study after sampling was complete due to suspicion that it may be used against them, and result in dismissal from work. However, the researcher was able to convince them to take part in the study since it was for their own good.

The study was undertaken in Trans-Nzoia County which is one of the Forty-seven counties in Kenya. This may not be representative of all the counties in Kenya. Therefore, generalization of the findings of this study should be done with caution.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section reviews the concepts associated with the Jua Kali Sector and the Concepts associated with the availability of tools and technology for maize processing. The chapter reviews these two concepts in greater detail in the aim of shedding light on practices associated with the same.

2.1 Concepts

2.1.1 Innovation

The term "innovation" has been defined in a variety of ways throughout the available research (for a survey of various disciplines and synthesis, Baregheh et al, 2009). Despite this, there appears to be growing support for a straightforward definition of innovation that Schumpeter had already proposed: "A successful market entry (commercialization) of an idea." A more comprehensive definition (again, based on Schumpeter's definition) can be found in the Oslo Manual, which states: "The implementation (commercialization) of a new or significantly enhanced product (good or service), or process, or a new marketing approach, or a new organizational method in business operations, workplace organization, or external relations is considered an innovation." (OECD, 2005). This definition has a strong foundation in Schumpeter's definition of innovation and differentiates between four distinct types of innovation, namely product, process, marketing, and organizational innovations. When it comes to the conceptualization of the term "novelty," the definition determines the barest essential requirements for eligibility.

One of the most important characteristics of entrepreneurial activity that has been significantly connected to informal sector businesses is innovation (Oke & Myers,

2007). It is generally agreed upon that innovation is one of the most important factors in increasing both productivity and competitiveness. In todays highly competitive and international business climate, it is one of the most important procedures that can ensure a company's continued existence and ability to remain competitive (Sheu, 2007; Kiraka, Kobia & Katwalo, 2013; Lin & Chen, 2007). According to Porter (1996), in order for a company to effectively compete in its industry, it must be able to establish a distinct and long-lasting differentiating factor, and one of the most important ways in which companies can generate this factor is through innovation.

2.1.2. Skills and Competences

This concept refers to the skills, knowledge, and attitude sufficient for one to operate in a defined area of expertise. Four role clusters that identify the ASTD required competencies are interface, concept development, research, and leadership cluster. Competency is generally defined as a combination of skills, knowledge, attributes and behaviours that enables an individual to perform a task or an activity successfully within a given job. Competencies are observable behaviours that can be measured and evaluated, and thus are essential in terms of defining job requirements and recruiting, retaining and developing staff.

The general concept of skills refers to productive assets of the workforce that are acquired through learning activities. The literature, however, does not concur on a robust and accepted definition and classification of skills beyond this general characterization. The following remarks are representative of the conclusion of many analytical studies of the concept of skill: “The notion of “skill” has been one of the most elusive and hardest to-define concepts in labor economics” (Lafer, 2002).; Despite its central importance in discussions of labour market change…an appropriate and robust definition of skill has proven elusive. It seems that skill is a more complex

and abstract concept or idea than current approaches have been able to capture" (Esposto, 2008). In the now vast literature on the impact of technological change on skills a number of indirect indicators of skill level and change in skill level have been employed. Reflecting the elusive and subjective character of 'skill' these indicators are typically not the subject of detailed justification and investigation to determine their validity and reliability

Competencies enable the staff of an organization to have a clear understanding of the behaviours to be exhibited and the levels of performance expected in order to achieve organizational results. They provide the individual with an indication of the behaviours and actions that will be valued, recognized and rewarded.

Skill is typically defined as "the learned ability to bring about pre-determined results with maximum certainty; often with the minimum outlay of time or energy or both." (Knapp, 1993). This definition underlines objective and performance related criteria for skillful actions. In contrast, Dreyfus and Dreyfus (1986) argue that skill should be defined according to the manner in which the mental machinery of the agent operates.

2.1.3 Training and Outreach

Innovation is a well-accepted driver of economic growth and development, and the key determinant underlying the innovation process is assumed to be human capital. Many skills are best learned on the job, that is, after entering the labor market. Because of the rapidly changing environment of today's world in which human capital derived from formal education (schooling, vocational education) depreciates quickly, learning by doing, in the form of in-firm training, may be an additional way to continue to accumulate leading-edge knowledge. Becker's (1994) argues that firms

will invest in training only if they can appropriate its future rent, that is, the workers' higher productivity

2.1.4 Financial Resources

Innovation is paramount for firm growth and productivity. Well-functioning deep financial markets promote innovation by efficiently allocating capital to enterprises with promising projects (Levine, 2005). Financial resources dedicated to innovation can come from public institutions and fuel the organizations forming the national, regional, and local systems of innovation. They can also be directed towards companies, directly (for example public venture capital), or indirectly (for example through tax alleviations). Financial resources, of course, also come from private origins, through stock markets, banks, private venture capital activities (corporate ventures, business angels etc.), but also all the new innovative sources of funding that have developed recently. Small and innovative firms have more constraints and difficulties to access to finance, because they tend to have riskier projects and business models (Lee et al., 2015). Like access to finance is important for firms' activities, it can consequently foster economic growth (Kim et al., 2016) and influence positively innovation (Wang, 2014).

2.1.5 Policy and Regulations

Government regulations can have both positive and negative effects on the innovation process. Regulation directly affects the innovative process, while innovation and technical change have significant impacts on regulation. To be successful, regulatory reform efforts must take into account the linkages between regulation and innovation. Regulation can be said to generally refer to policies where the government acts as a referee to oversee market activity and the behaviour of private actors in the economy.

Such government intervention in the marketplace is usually justified on the basis of market failures and the need to ensure societal wellbeing.

In all domains, regulatory reform should yield benefits in terms of reducing costs, enhancing efficiency and stimulating innovation. However, this must be done without sacrificing or jeopardising the original regulatory objectives – whether this be ensuring fair market transactions, protecting the environment or maintaining government oversight of private sector activities. Regulatory reform often incurs some short-term costs of adjustment; thus, the assessment of overall effects must take a long-term view.

Regulations have numerous types of effects on innovation, both positive and negative. In the economic sphere, regulations can maintain a certain level of openness or competition in product markets which provides the necessary conditions for research and innovation. In the social sphere, regulations can place technical demands on industries and act as focusing devices for their research efforts. Regulations have also spawned the creation of new industries and products as in the case of the "environment industry" (OECD, 1996c). Administrative regulation ensures there are fair "ground rules" for all economic actors in the innovative process, as in the case of intellectual property right protection. However, regulations can also erect barriers to the development of new, improved products and production processes. They can encourage or discourage research efforts by firms. They can distort the choice of technologies that are explored and adopted. They can create barriers to innovation by increasing the uncertainty and costs of the development process.

2.2 Theoretical Framework

This section reviews the major theory that guides the study and this is the resource based view theory. The theory tenets and the relationship to the study in provided in this section of the study.

Resource-Based View (RBV)

The resource-based view (RBV) is a managerial framework used to determine the strategic resources with the potential to deliver comparative advantage to a firm. These resources can be exploited by the firm in order to achieve sustainable competitive advantage. Barney's 1991 article "Firm Resources and Sustained Competitive Advantage" is widely cited as a pivotal work in the emergence of the resource-based view. However, some scholars argue that there was evidence for a fragmentary resource-based theory from the 1930s. RBV proposes that firms are heterogeneous because they possess heterogeneous resources, meaning firms can have different strategies because they have different resource mixes. The RBV focuses managerial attention on the firm's internal resources in an effort to identify those assets, capabilities and competencies with the potential to deliver superior competitive advantages (Barney's 1991).

During the 1990s, the resource-based view (also known as the resource-advantage theory) of the firm became the dominant paradigm in strategic planning. RBV can be seen as a reaction against the positioning school and its somewhat prescriptive approach which focused managerial attention on external considerations, notably industry structure. The so-called positioning school had dominated the discipline throughout the 1980s. In contrast, the emergent resource-based view argued that the source of sustainable advantage derives from doing things in a superior manner; by developing superior capabilities and resources. Jay Barney's article, "Firm Resources

and Sustained Competitive Advantage" (1991), is seen as pivotal in the emergence of the resource-based view.

The RBV is an interdisciplinary approach that represents a substantial shift in thinking. The resource-based view is interdisciplinary in that it was developed within the disciplines of economics, ethics, law, management, marketing, supply chain management and general business. RBV focuses attention on an organization's internal resources as a means of organizing processes and obtaining a competitive advantage. Barney stated that for resources to hold potential as sources of sustainable competitive advantage, they should be valuable, rare, imperfectly imitable and not substitutable (now generally known as VRIN criteria).

The resource-based view suggests that organizations must develop unique, firm-specific core competencies that will allow them to outperform competitors by doing things differently (Barney's 1991).Although the literature presents many different ideas around the concept of the resource-advantage perspective, at its heart, the common theme is that the firm's resources are financial, legal, human, organizational, informational and relational; resources are heterogeneous and imperfectly mobile and that management's key task is to understand and organize resources for sustainable competitive advantage (Barney's 1991).Achieving a sustainable competitive advantage lies at the heart of much of the literature in both strategic management and strategic marketing.

The resource-based view offers strategists a means of evaluating potential factors that can be deployed to confer a competitive edge (Barney's 1991). A key insight arising from the resource-based view is that not all resources are of equal importance, nor possess the potential to become a source of sustainable competitive advantage. The

sustainability of any competitive advantage depends on the extent to which resources can be imitated or substituted. Barney and others point out that understanding the causal relationship between the sources of advantage and successful strategies can be very difficult in practice. Thus, a great deal of managerial effort must be invested in identifying, understanding and classifying core competencies (Barney's 1991). In addition, management must invest in organizational learning to develop, nurture and maintain key resources and competencies.

In the resource-based view, strategists select the strategy or competitive position that best exploits the internal resources and capabilities relative to external opportunities (Barney's 1991). Given that strategic resources represent a complex network of inter-related assets and capabilities, organizations can adopt many possible competitive positions. Although scholars debate the precise categories of competitive positions that are used, there is general agreement, within the literature, that the resource-based view is much more flexible than Porter's prescriptive approach to strategy formulation (Barney's 1991).Firms in possession of a resource, or mix of resources that are rare among competitors, are said to have a comparative advantage (Barney's 1991).

This comparative advantage enables firms to produce marketing offerings that are either (a) perceived as having superior value or (b) can be produced at lower costs. Therefore, a comparative advantage in resources can lead to a competitive advantage in market position. In the resource-based view, strategists select the strategy or competitive position that best exploits the internal resources and capabilities relative to external opportunities. Given that strategic resources represent a complex network of inter-related assets and capabilities, organizations can adopt many possible competitive positions. Although scholars debate the precise categories of competitive positions that are used, there is general agreement, within the literature, that the

resource-based view is much more flexible than Porter's prescriptive approach to strategy formulation (Barney's 1991).

The failure to consider factors surrounding resources; that is, an assumption that they simply exist, rather than a critical investigation of how key capabilities are acquired or developed. It is perhaps difficult (if not impossible) to find a resource which satisfies all of Barney's VRIN criteria. An assumption that a firm can be profitable in a highly competitive market as long as it can exploit advantageous resources does not always hold true. It ignores external factors concerning the industry as a whole; Porter's Industry Structure Analysis sought also be considered (Barney's 1991).

The theory is deemed relevant to the study because it explains how jua kali artisans can use the available resources such as technology to in producing tools used by small scale farmers in maize processing value chain. It also explain how small scale farmers in Trans-Nzoia county can make use of available tools and technology in maize processing value chain.

2.3 Innovative Tools for Maize Processing

Corn is the cereal with the highest production worldwide and is used for human consumption; livestock feed, and fuel (Dusenbury, Baker, James-Ortiz, Botvin, & Kerner, 2014). Various food technologies are currently used for processing industrially produced maize flours and corn meals in different parts of the world to obtain precooked refined maize flour, dehydrated flour, fermented maize flours, and other maize products. These products have different intrinsic vitamin and mineral contents, and their processing follows different pathways from raw grain to the consumer final product, which entail changes in nutrient composition. Dry maize mechanical processing creates whole or fractionated products, separated by

anatomical features such as bran, germ, and endosperm. Wet maize processing separates by chemical compound classification such as starch and protein (Tan Hamed & Che Man 2013). Various industrial processes, including whole grain, dry milling fractionation, and are described. Vitamin and mineral losses during processing are identified and the nutritional impacts outlined. Also discussed are the vitamin and mineral contents of corn.

The maize value chain can be divided into five categories: inputs; production; aggregation; processing; and marketing and distribution (Marketline, 2016). End uses depend on geographic location and food security considerations; however, animal feed and, increasingly, ethanol production are the focus in developed nations. The value chain describes the full range of activities, which are required to bring a product or service from conception, through the different phases of production delivery to final consumers, and to final disposal after use (Al-Zamily & Al-Hakim, 2015). Production per se is only one of a number of value added links. Moreover, there are ranges of activities within each link of the chain. Although often depicted as a vertical chain, intra-chain linkages are most often of a two-way nature - for example, specialized design agencies not only influence the nature of the production process and marketing, but also are in turn influenced by the constraints in the downstream links in the chain. All the value chain functions need not be performed within a single link in the chain, but may be provided by other links (Atinafu & Bedemo 2014). It is also referred to as essentially intra-link activities as the value chain. Porter complements this discussion of intra-link functions with the concept of the multi-linked value chain itself, which he refers to as the value system. The value system basically extends his idea of the value chain to inter-link linkages (Bouchon, 2016).

2.4 Determinants of Jua Kali Innovation

Innovation represents the search for novelty that enables organizations to increase their competitiveness and face competition (Zawislak, Alves, Tello-Gamarra, Barbieux, & Reichert, 2013). The ability to innovate is seen as an important element for the performance of organizations and the economic sector, since it allows the market to leave the steady state. According to this author, large organizations have access to greater business opportunities and find it easy to innovate because they have a superior management structure (Cohen et al., 2017).

Jua Kali enterprises face difficulties in accessing technological resources because they have fewer resources and limited capacities, (Laforet & Tann, 2016), which restrict their innovation capability. This capability results from several capacities developed by the firm, such as technological, operational, managerial, and commercial capabilities (Zawislak, Alves, Tello-Gamarra, Barbieux, & Reichert, 2013). If on the one hand, MSEs have constraints on those capabilities driven by technology, then on the other hand the business-driven capabilities, such as managerial and commercial, can be crucial for developing innovation and gaining a competitive advantage. Therefore, obtaining a greater understanding of the innovation stage in jua kali and how managerial and business capabilities can foster innovation are beneficial to these organizations (Ganau & Maria, 2014).

An innovation can be based on a new technology, the application of existing technologies, or the utilization of new knowledge acquired by the company. Large firms have the wherewithal (large scale of production and capacity, infrastructure in marketing, finance and R&D) to exploit new technology. On the other hand, the argument in favor of small firms is that they have flexibility in adjusting employees in innovation related projects and less complex management

structures in implementing new projects (Zawislak, Alves, Tello-Gamarra, Barbieux, & Reichert, 2013). Market structure provides the best environment to internalize the benefits of R&D (see as well, Galbraith, 2016).

2.5 Link between determinants of Jua Kali Artisan Production and Innovation of Tools for maize processing

This section reviews the studies done in relation to the research objectives of the study. This includes Skills and Competences Required for Operating Technology Influencing Maize processing, Role of Training and Outreach and Access of Financial Resources

2.5.1 Skills and Competences

In making knowledge an implicit part of manufacturing practice, for workers as well as management, advanced manufacturing technology is creating a need for a more educated work force (Bentler & Bonnett, 2014). The shift in educational attainment by manufacturing employees will become more pronounced in the coming decade. This shift is occurring at the same time that the supply of potential young workers is beginning to decline precipitously. According to Botvin, (2016) this decline is compounded by the fact that many economically disadvantaged individuals cannot meet even minimal skill requirements for the new manufacturing jobs. The development of manufacturing skills does not occur in the abstract. It is related to a set of goals, specifically to the creation and maintenance of a well-trained, flexible, and motivated manufacturing workforce, comprising prospective workers as well as current workers at all conventional levels, including technical professionals and managers, mid-level technicians, and shop floor personnel (Dusenbury, Botvin, & Diaz, 2013).

Education of prospective manufacturing workers typically occurs in elementary and secondary schools in community and technical colleges and trade schools, and in professional colleges (Heasman, & Lang, 2015). Skills and competence gap is an issue that has reached the boiling point. The same old approaches aren't enough to close the gap. Manufacturers should pursue more creative approaches to recruitment and talent management to make sure they have the skilled personnel they need to win in the future. For example, workforce planning is important (Kiaya, 2014). But, on its own it's not enough to deliver what manufacturers need. Fresh approaches in areas such as employer branding can generate big results when pursued in tandem with more traditional approaches. Similarly, many manufacturers are using many of the same approaches to talent development that were being employed a decade ago (Lee, Patriarca, & Magan, 2015). New performance tools and formal processes should be playing a larger role in any manufacturer's talent management plan.

The manufacturing industry can't solve all of its talent challenges on its own (Patel, Bosamia, Bhalani, Singh & Kumar, 2015). Government agencies and educational institutions have roles to play as well, creating a clear path for students to receive the right skills and training to prepare them for a career in manufacturing. That's easier said than done in an industry environment that is evolving faster than at any point since its beginning. It will require new levels of collaboration between each of these players (Sheahan, & Barrett, 2017). The ability to impact and influence others is a key competency frequently identified in top performers. While we assume salespeople are good at impacting and influencing, the ability to impact and influence others is often the number one competency in helping, service, managerial and leadership roles (Haidukowski et al., 2015).

Learning to increase your ability to impact and influence others can make a big difference to your career success (Gelderblom Botha & van Zyl 2013). Impact and influence as a competency is the ability to persuade or convince others to support an idea, agenda or direction. Sometimes we refer to it as strategic influence. It involves taking a variety of actions to influence others including establishing credibility or using data to directly persuade or address a person's issues or concerns. Impact and influence is often linked to organizational awareness (Dalcero, Ramos & Marín 2014). Understanding who the key decision makers are, who wields the power and who the influencers are, enables you to be more strategic in your dealings and approaches with stakeholders in order to get your desired results (Calado, Venâncio & Abrunhosa 2016).

Precedent for improving manufacturing skills is lacking in many companies that are unaccustomed to paying for skills beyond entry level (Abbas Weaver, Ehrlich, Scharfenstein & Cotty 2015). The need to provide for continuing development is slowly being recognized, but managers untrained in modern manufacturing methods are inclined to look at manufacturing training as less productive than other training. Consequently, they remain reluctant to invest in training at the operator and technician levels (Chulze 2016). Even with more widespread interest in company-provided training, much of the work force would not be ready to take advantage of it. Problems of basic literacy, necessitating remedial instruction, are impeding the entry into the work force of increasing numbers of educationally and economically disadvantaged people who might otherwise train for the new manufacturing jobs (Barreau, Deschamps& Richard-Forget 2014).

A more fundamental barrier to the development of manufacturing skills is the largely indifferent and sometimes negative attitudes of faculty and guidance counselors, most likely derived from lack of manufacturing experience at any level (Koudande, Mensah, Sanni & Brimer 2013). In some cases, faculty interest in manufacturing is actively discouraged and offending faculty are ostracized. This negative peer pressure can be traced, in part, to a general lack of a scientific base.

In addition, an appropriate body of manufacturing knowledge in a format suitable for teaching is lacking at many levels (Hell & Mutegi 2013). Because they must compete with established programs for funding, new programs and disciplines focused on manufacturing are extremely difficult to put in place. Given funding, such programs will face the task of defining a body of manufacturing knowledge (Yin, Huang, Ruan, Zhou & Xie 2015). Manufacturing has experienced huge changes in recent years. The sector has experienced significant employment declines over the past decade, driven by a combination of erosion in competitiveness domestically and external factors such as the global financial crisis that impact on the demand for manufactured goods. Manufacturing is at the heart of making this happen. Manufacturing firms play critical roles as exporters, as employers, developers of new products and processes and as purchasers of goods and materials (Vekiru, Krska, Schatzmayr, Moll & Grabherr 2014).

2.5.2 Role of Training and Outreach

Because of the important role science plays in peoples' lives and the significant (and increasing) impact of humans on the environment, there is a great and growing need to improve links between scientists and society (Raspantini, Raspantini, Latorre & Górniak, 2014). Some funding agencies recognize this need and have shaped their

priorities accordingly. In addition to increasing a researcher's likelihood of receiving funding, building an effective public outreach component of a research project also can greatly magnify the influence of one's research and enhance teaching efforts by connecting a researcher with new audiences and partners (Kelley & Williams, 2015). Because early-career scientists are likely to be busy with teaching and research commitments, it is incumbent upon them to develop outreach programs that use their time and input efficiently. It is important for scientists to evaluate the sustainability of their commitment in the context of other responsibilities, and to account for time and financial requirements of outreach activities in any proposal they write. It is also important for them to think carefully about the extent to which they will directly implement the program versus how much they will rely on others (Ma & Zhang, 2014). Partnering and the delegation of work can lead to a more effective outreach program, save time and energy, and allow for focusing on one's strengths.

One way to make involvement with outreach programs more efficient is through the effective use of existing resources (Ghazali & Radu 2014). To this end, early-career scientists who also are professors will want to find out whether their department, school, or college has education and public outreach professionals who have community contacts and are skilled at establishing relationships with target groups that might be appropriate partners (Carlos & Etcheverry 2013). It also may be possible to leverage other, existing grants that have education and public outreach as their central purpose; it may be possible to join these programs directly or build on existing relationships between such programs and the community. One also can enlist students to help with public outreach efforts. Gaining experience communicating science to nonscientific audiences can help students develop skills and contacts that will be useful later in their careers, especially if they are planning to work at the

interface between science and society (Subrahmanyam & Piletsky 2013). If one's institution does not have an outreach professional on staff, it may be worth considering hiring one separately or partnering with other faculty to hire one. Though it can be expensive to support outreach professionals, they can greatly enhance the effectiveness of public outreach efforts and potentially grant-writing success of a research group or institution (Voss, Smith & Haschek 2017).

For an outreach program to be effective, it should address an important need. The relative importance of the needs of a community can be assessed by formal means (e.g., a survey or series of workshops) or by other, less formal input (e.g., from community leaders, teachers, or others) (Carbone, Hellmich, Munkvold, Paul, Payne & Takle 2013). Some examples of important, community-based needs include increased science literacy related to environmental issues and increased understanding of an applied problem that science can help solve. Also useful is consulting funding-agency Web sites for information on their current areas of interest regarding agency needs and target audiences (Haidukowski et al., 2015). An effective outreach program, in addition to addressing an important need, also should identify and target a particular audience. Potential target audiences include policy makers, resource managers, teachers, students, citizens, and particular professional or recreational groups. The target audience will vary depending on need, so determining the specific need will help identify the correct target audience, thereby allowing for the development of the best outreach method (Koudande, Mensah, and Sanni & Brimer 2013).

According to Barreau, Deschamps & Richard-Forget (2014) determining need will allow scientists, or the public outreach professionals with whom they are

collaborating, to identify key members of the community to consult with at the onset of a project regarding appropriate outreach methods and approach. Identifying key partners can be a particularly daunting task for an early-career scientist. Some possible approaches might include a Web search of recent public hearings related to the research topic of interest, consulting with colleagues, and contacting the alumni office of one's institution for leads.

Another possibility is to attract key partners by offering a well-publicized and generally accessible public lecture on one's research topic, to which community leaders are invited (Weaver, Ehrlich, Scharfenstein & Cotty 2015). Consultation with key members of the community also may help scientists to refine their concept of community need. It is also important to identify helpful partners who might be more familiar with the target audience. These existing groups, which often have important contacts and have established trust within a target community, may be more effective at delivering the outreach message for a research project than the researcher herself or himself (Calado, Venâncio A.& Abrunhosa,2016). Allowing partners to tailor the message to their needs also increases their sense of ownership of the message and the likelihood that partners and the target community will adopt real change in the long term.

In addition to determining the need and audience for an outreach program, identifying some specific measurable outcomes and products also is important. Being specific and explicit about one's goals early on will focus efforts and will also allow for evaluating success and impact (Gelderblom, Botha & van Zyl 2013). A few examples of specific and concrete goals to consider include increased test scores for students, a change in attitudes and behavior of community members, the creation of a Web site that is

regularly consulted by a target audience, and an observable change in the use or quality of a shared resource. The identification of need, target audience, and desired outcomes will help with the design of an effective outreach method (Weaver, Ehrlich, Scharfenstein & Cotty 2015).

Soliciting advice from a mentor who has attempted something similar to one's outreach effort may save a lot of time and prevent false starts (Klich, & Leslie, 2014). Also, there may be other faculty with whom to collaborate, potentially sharing the workload and magnifying one's impact. Community organizations also may be effective partners, particularly if they have worked with one's institution in the past. In seeking to partner with individuals or organizations outside the academic research environment, it is useful to listen to their needs and expectations from the beginning and to approach them as collaborators who bring a valuable and complementary skill set (Groote, Narrod, Kimenju, Bett, Scott, Tiongco, &Gitonga, 2016). In this vein, each partner should approach the collaboration with specific goals for participation. For example, scientists might expect to amplify the impact of their research or enhance their sampling capacity whereas outreach professionals might expect to gain access to state-of-the-art information and expertise that can be incorporated into their public outreach efforts. Clarifying these goals at the outset will help define the nature of the partnership and avoid potential misunderstandings as the project develops (Lee, Patriarca & Magan, 2015).

The effective evaluation of outreach activity relies on clearly stated and quantifiable goals (Baines, Manning & Soon, 2016). The evaluation of a project should not happen only at the end of the project; rather, it also should occur during the project so that midcourse corrections are possible. Evaluation methods might include before, during,

and after surveys of the outreach target audience or indices of understanding and metrics of behavior change (Mutungi, Sanginga & Borgemeister, 2015). The use of an interactive Web site is one way to evaluate the participation of the target community in an outreach activity. Simply counting the number of Web site visits is somewhat less useful, but it also can provide information about whether a Web site is effective. It also may be possible to interview or form focus groups with participants to obtain feedback on program effectiveness (Groote, Narrod, Kimenju, Bett, Scott, Tiongco, &Gitonga, 2016). Effective evaluation is critical for improving outreach programs and for reporting back to granting agencies in annual and final reports, especially if the education and public outreach activity was proposed as part of the work plan.

Most research grants last only a few years, so it is important to think about a plan for sustainability or an exit strategy at the outset of the outreach program (Hack, Bordi & Hessert, 2016). If the program is meant to address a discrete problem, project goals should be clearly defined at the project's outset so that success can be effectively evaluated (Choudhary, Rajgopal, Ray & Mudhambi 2013). If the program is meant to last beyond the period of one's grant, it is essential to develop a sense of ownership within the target audience, leading them to support and possibly fund the program. Establishing a self-sustaining outreach program requires that members of the target audience value the outreach effort and that at least a subset of the target audience feels capable of continuing to promulgate the outreach message in the absence of continued participation by the primary researcher (Citizen, 2014).

One way to engender this ability and attendant confidence might be to train teachers and volunteers to train others. Education and training are important tools for informing workers and managers about workplace hazards and controls so they can

work more safely and be more productive (Clarke, & Rottger, 2016). Another role of education and training, however, is to provide workers and managers with a greater understanding of the safety and health program itself, so that they can contribute to its development and implementation (Mutungi, Sanginga &Borgemeister, 2015). Education and training provides employers, managers, supervisors, and workers with: Knowledge and skills needed to do their work safely and avoid creating hazards that could place themselves or others at risk (Kimenju, & De Groote, 2013).

Training may be needed depending on the roles assigned to employers or individual managers, supervisors, and workers ((Baines, Manning, & Soon, 2016). For example, employers, managers, and supervisors may need specific training to ensure that they can fulfill their roles in providing leadership, direction, and resources for the safety and health program. Workers assigned specific roles in the program (e.g., incident investigation team members) may need training to ensure their full participation in those functions (Klich, & Leslie, 2014). Effective training and education can be provided outside a formal classroom setting. Peer-to-peer training, on-the-job training, and worksite demonstrations can be effective in conveying safety concepts, ensuring understanding of hazards and their controls, and promoting good work practices (Lee, Patriarca & Magan, 2015).

2.5.3 Access of Financial Resources

Worldwide, agriculture is the main source of income among the rural poor. Relative to other sectors, agricultural growth can reduce rural poverty rates faster and more effectively (Christiaensen and others 2013). Farmers' decisions to invest and to produce are closely influenced by access to financial instruments. If appropriate risk mitigation products are lacking, or if available financial instruments do not match

farmers' needs, farmers may be discouraged to adopt better technologies, to purchase agricultural inputs, or to make other decisions that can improve the efficiency of their businesses. Improving access to finance can increase farmers' investment choices and provide them with more effective tools to manage risks (Cai and others 2015).

Historically, financial institutions have been reluctant to serve the sector for many reasons. One major reason is geographical (Karlan and others 2013). Low population density and large geographical dispersion of clients in rural areas make it difficult for banks to operate at a profitable scale. The lack of financial institutions branches has translated in a limited provision of saving, insurance and credit products to farmers and agribusinesses. A second factor inhibiting financial institutions from serving the sector has to do with the systemic risk characterizing agricultural activities. When natural hazards or adverse weather conditions take place, they typically affect a large number of farmers and firms simultaneously, making it more challenging for financial providers to diversify their portfolio of clients, since when one client fails to pay, many others will be in the same situation. This problem is aggravated by the paternalistic behavior or political motives that governments may have.

Policies ranging from bailouts to relieve households from their debt obligations to political loans to the sector may distort firms and farmers incentives and discourage financial providers to enter the market. Kanz (2013) finds that India's largest bailout program did not alleviate problems of debt overhang of its beneficiaries. Instead, program recipients increased their reliance on informal credit and reduced their productive investment. His findings suggest that beneficiaries were concerned of the stigma of being identified as defaulters due to the program, and the effects this may have in their future access to formal credit.

Another challenge that banks face when serving the agriculture sector is that financial infrastructure in rural areas is in general very poor (Klich, & Leslie, 2014). Tracking identity of clients or monitoring production outcomes becomes extremely difficult in rural areas. If financial provides cannot track their clients back, then the punishment of default or underperform for a farmer is low, especially if contract enforcement is low (Maloba, 2017). Hence, potential lenders or insurers may well decide not to engage with the sector in the first place, or to respond by excessive credit rationing or over-reliance on traditional forms of collateral, which many farmers lack (Patel, Bosamia, Bhalani, Singh & Kumar, 2015).

In the last two decades, new approaches attempting to reduce these challenges have been developing in agricultural finance. One with great potential in agricultural settings is the use of technology to facilitate financial transactions. Credit and movable collateral registries, mobile banking and correspondent banking are examples of ways in which technology can help ease market failures in the agriculture setting (Giné and others 2015). While rigorous impact evaluations on many of these new developments are pending, there are some studies that provide some insights. In Malawi, Giné and others (2014) found that the use of fingerprints to identify clients made the threat of future credit denial credible. As a result, the incentives for clients to pay back the loan increased, while simultaneously incentivizing lenders to engage in more transactions. Even though projects of this type are in piloting stages, these initiatives show great potential in reducing information costs of lenders or insurers.

Proper risk management strategies are of extreme relevance to the sector. Instruments such as index insurance succeed in minimizing moral hazard and adverse selection, and under some circumstances can incentivize farmers to take riskier but more

profitable investments (Karlan and others 2012, Mobarak and Rosenzweig 2012). However, index insurance remains a small fraction of the broad range of insurance products, and there are some challenges that index insurance still faces- having a low take-up rate, being too complicated for farmers to understand and value (World Bank 2007), or failing to dissipate an important part of the risk faced by farmers (Carter 2008).

As agricultural production transforms into integrated and more complex market chains, value chain finance has gained importance, helping link small farmers with the rest of the chain. As defined by FAO, value chain finance refers to the financial services that flow through the value chain to address the needs of those participating in the chain. Financial needs could range from securing sales, to procuring products, or obtaining finance. Several financial products have been developed to finance value chains, such as trade finance instruments, warehouse receipts, leasing, factoring, etc. An innovative business model in value chain financing is Agrofinanzas in Mexico. Agrofinanzas specializes in lending to small farmers with little experience with banks and formal financing. Its business model is based on relationships with larger firms that are connected to smaller farmers. Agrofinanzas identifies its borrowers with information obtained by large firms on their small suppliers.

Summing up, evidence suggests that productivity in the agricultural sector can benefit from better access to financial instruments tailored to the needs of farmers and agribusinesses (Maloba, 2017). Policy makers can take a series of steps to make this happen. First, investing in rural financial infrastructure can overcome the information asymmetries that discourage financial providers from serving agricultural firms. The availability of public databases on agricultural and weather statistics would allow

lenders and insurers to distinguish good clients from bad ones more precisely and monitor their actions (Heasman, & Lang, 2015). Governments have a comparative advantage in providing information to help lenders or insurers identify their risks and price them accordingly (World Bank 2007). Second, strengthening property rights and contract enforcement can open up access to important financial products to farmers and agribusinesses.

According to Sheahan, & Barrett, (2017), governments should abstain from paternalistic policies that discourage financial providers from entering the market and that distort the incentives for farmers and firms. Public subsidies directed at jua kali industry should be carefully considered because they provide inappropriate incentives for artisans to invest in unprofitable jua kali activities (Lee, Patriarca, & Magan, (2015). While certain subsidized insurance products could be justified on the basis of achieving the higher take-up of these products and allowing users to understand their value, subsidies that do not involve proper assessments of the quality or feasibility of projects should be avoided (Heasman, & Lang, 2015).

2.5.4 Influence of policy and regulations

Farming is in the midst of a major transformation not only in technology and production practices, but also in size of business, resource (land) control and operation, business model and linkages with buyers and suppliers (Boehlje, Hoffing, and Schroeder 2014). The forces driving this transformation are many and widespread including increased quality, safety and traceability demands of processors and consumers of food products; implementation of information and process control technologies that facilitate biological manufacturing of crop and livestock products; adoption of technologies and business practices that exploit economies of size;

increased use of leasing and other outsourcing strategies to foster growth and expand options for resource control; and wider adoption of contracting, strategic alliance and cooperative business models to facilitate more effective and efficient vertical coordination in the production/distribution value chain (Boehlje, et. al. (2016).

Grain sectors are changing from an industry dominated by family-based, small and modest size, relatively independent firms to one of generally larger businesses following an industrial business model that are more tightly aligned across the value chain (Boehlje, Hoffing, and Schroeder 2014). This manuscript first describes the fundamental drivers of structural change in agriculture. Illustrations of the impact of these drivers are then provided by describing innovative farming operations agriculture; not the typical farms but those that appear to be leading and shaping the industry. Finally, the farm policy implications of the transformation of farming to an industrial manufacturing model will be discussed.

Technology drives structural change through the form or type of technology that will be used in agricultural production as well as the rate and characteristics of the adopters of the technology. The types of technology that have the potential to be part of the future of the production industry include jua kali industry (Boehlje and Erickson 2015). The end result is the prospect of an industry characterized by biological manufacturing of differentiated products for various food and nonfood uses. New technology has dramatically changed the timeliness constraint that has been a significant limit on the growth potential for many grain operations (Boehlje, Doehring, and Sonka, 2016). The ability to plant and harvest crops during the limited number of suitable field days in the spring and fall without encountering yield penalties is critical to overall efficiency and profitability (Boehlje, Hoffing, and Schroeder 2014). The development of guidance and auto-steer technology combined

with larger planting and harvesting equipment has dramatically altered the timeliness constraint.

More sophisticated monitoring and measuring technology that is part of precision farming also enables growth of crop operations (Boehlje and Erickson, 2017). If crop production processes can only be monitored by people with unique skills and those resources are costly or expensive to train, the monitoring process limits the span of control to what one individual or at least a few can oversee personally. But, if electronic systems can monitor the processes of plant growth (whether it be machinery operations, or the growth process of the crop, or the level of infestation of insects or weeds), fewer human resources are needed for this task and generally larger scale is possible (Boehlje and Erickson 2015). Crop production can and will move more and more towards improved electronic monitoring and control systems which expand the span of control of a farmer/manager.

The general economic policies however, limited the growth of agricultural production and hampered efforts to reduce rural poverty. In many cases, sector-specific pricing and tax policies have also resulted in substantial discrimination against agriculture (Boehlje and Erickson, 2015). In addition, government interventions at all stages of production, consumption, and marketing of agricultural products and inputs, though undertaken to improve the efficiency of markets, have frequently resulted in greater inefficiencies and lower output and incomes. As a consequence, farm incomes in many developing countries are stagnating, and little progress is being made in overcoming the problems of poverty.

Informal sector plays an important role at all levels of a global economy (Ilo, 2015). It's a seedbed for indigenous entrepreneurship and national development since

it energizes technological capacity building, innovation diffusion, and capital mobilization, which would not otherwise be generated.

The key role of informal sector through various national development plans, sessional and strategy papers has been emphasized (Boehlje and Erickson 2015). Penetrating the global market has been the main challenge of entrepreneurs from the developing world, a fact attributed to limited design process and technological capability (Kerre, 2016). Design is a process of converting an idea into instructions from which a new product can be made (Roy & Wield, 2014). It's the activity in which ideas or market requirements are given specific physical form, starting from the initial sketches or conceptual designs, through prototype development, to the detailed drawings and specifications needed to make the product (Boehlje and Erickson 2015).

2.6 Chapter Summary and Research Gap

2.6.1 Summary

Tools and technology for processing as well as management, advanced manufacturing technology is creating a need for a more educated work force. The shift in educational attainment by manufacturing employees will become more pronounced in the coming decade. The development of manufacturing skills does not occur in the abstract. Because of the important role science plays in peoples' lives and the significant (and increasing) impact of humans on the environment, there is a great and growing need to improve links between scientists and society. Some funding agencies recognize this need and have shaped their priorities accordingly. In addition to increasing a researcher's likelihood of receiving funding, building an effective public outreach component of a research project also can greatly magnify the influence of one's research and enhance teaching efforts by connecting a researcher with new audiences

and partners. It is also important for them to think carefully about the extent to which they will directly implement the program versus how much they will rely on others. Farmers' decisions to invest and to produce are closely influenced by access to financial instruments. If appropriate risk mitigation products are lacking, or if available financial instruments do not match farmers' needs, farmers may be discouraged to adopt better technologies, to purchase agricultural inputs, or to make other decisions that can improve the efficiency of their businesses. Improving access to finance can increase farmers' investment choices and provide them with more effective tools to manage risks.

2.6.2 Research Gap

Researcher concentrated on importance skills and competences in advancing tools and technology and the importance of education in improving tools and technology in manufacturing. There are no studies on importance of skills and competences to jua kali artisans that produce tools used in small scale maize processing value chain. There are studies on the educating farmers and outreach programs there are no studies on how to improve outreach programs to ensure that farmers are educated on the use of certain tools and technology in maize producing value chain. There are studies on effects of finance on production of tools and technology in maize processing value chain and the challenges faced by farmers in accessing financial supports. There are no studies on how the government and NGOs can help farmers to access finance.

Table 2.2 Research Gap

Author	Article Title	Contribution	Gap
Thorpe, J., & Maestre, M. (2015).	Brokering development: enabling factors for public-private-producer partnerships in agricultural value chains.	The study discussed the factors that facilitate agricultural value chain including skills and competences.	The study failed to address the skills and competences required for operating technology affecting maize value chain to be specific.
Prokopy, L. S., Morton, L. W., Arbuckle Jr, J. G., Mase, A. S., & Wilke, A. K. (2015).	Agricultural stakeholder views on climate change: implications for conducting research and outreach.	The study shade light on implications for conducting research and outreach programs to increase post-harvest of agricultural products for food security due to change in climate	The study failed to address the roles of training and outreach for tools that are necessary in maize processing value chain.
Isakson, S. R. (2014).	Food and finance: The financial transformation of agro-food supply chains.	The study explained on how finance transform agro-food supply chains	The study failed to address how financial challenges affect jua kali production of tools used in maize processing value chain and other agro-food products.
Makini, F. W., Kamau, G. M., Mose, L. O., Ongala, J., Salasya, B., Mulinge, W. W., & Makelo, M. (2017).	Status, Challenges, and Prospects of Agricultural Mechanisation in Kenya: The case of Rice and Banana value chains.	The study addressed challenges of agricultural mechanization including regulations for rice and bananas value chain.	There are no studies on the effects of policy and regulation on mechanization of maize processing value chain and the role of jua kali in maize value chain.

2.7 Conceptual Framework

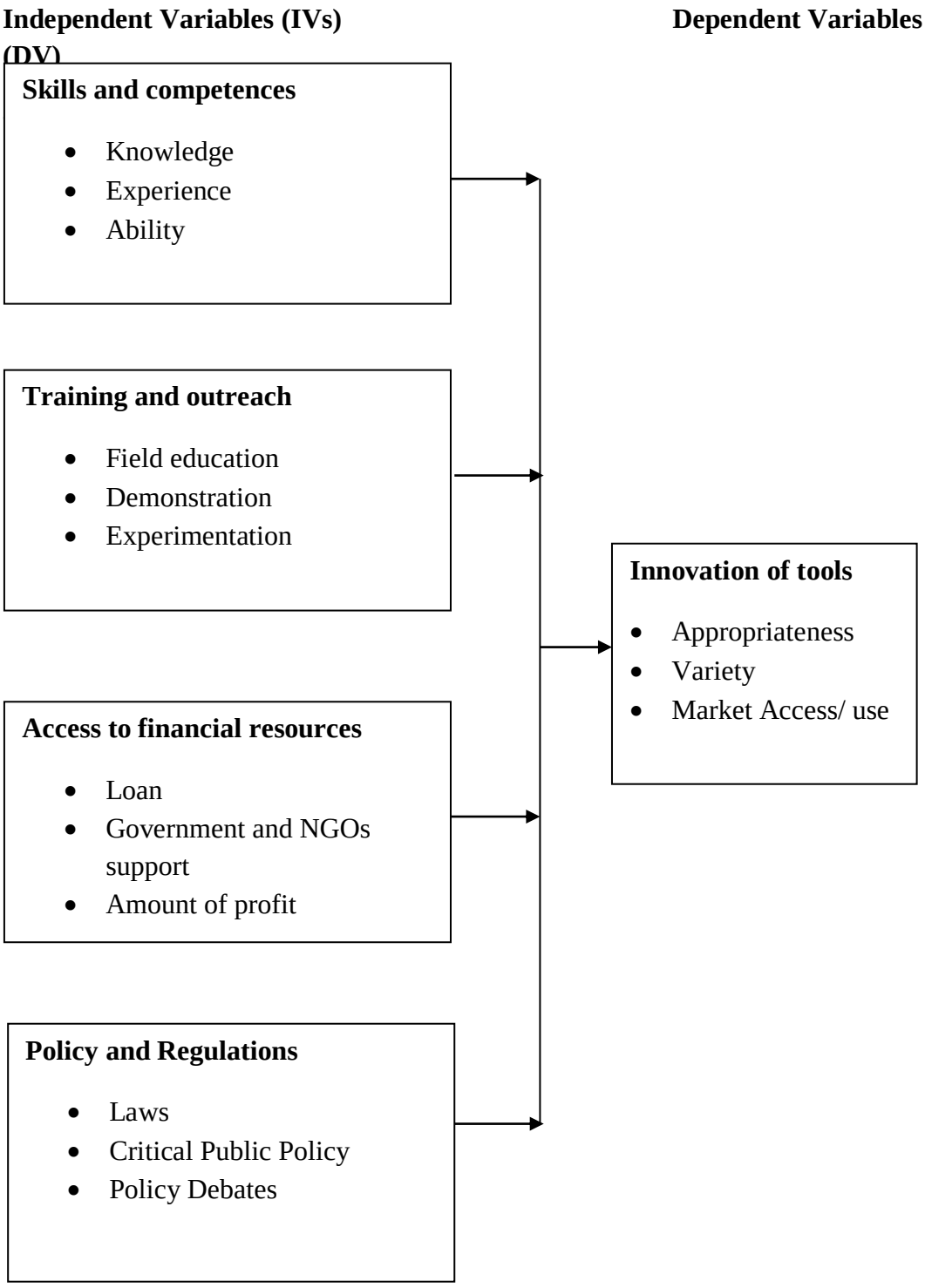


Figure 2.1: Conceptual Framework

Source: Researcher Data (2021)

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter describes the research methods and procedures that were used in the study. In particular, the chapter describes the research design, locale of the study, target population, sample population, sample size and sampling procedures, research instruments, validity and reliability of the research instruments, data collection procedures, data analysis, pilot study and ethical considerations of the study.

3.1 Research Philosophy

Cooper and Schindler (2014) define Research Philosophy as the method by which data about a certain phenomenon can be collected and analyzed, whereas Kothari (2014) defines it as a belief on the method by which data about a phenomenon should be acquired, analyzed, and utilized. This study adhered to positivist research philosophy. According to this paradigm, the researcher was interested in collecting general information and data from a large social sample instead of focusing details of research. According to this position, researcher's own beliefs have no value to influence the research study. The positivism philosophical approach is mainly related with the observations and experiments to collect numeric data (Cooper & Schindler, 2014).

3.2 Research Approach

This research adopted the Mixed Methods approach. This involves deliberate collection, and analysis of quantitative and qualitative data, and combining the findings to answer a research problem. Mixed methods and positivist paradigm were chosen as they facilitate researchers to select the most suitable methods to fulfil the aim and achieve the objectives of a research.

In research, none of the methods is considered superior to others as each has its limitations. Their application depends on the research problem (Creswell, 2014). Mixed methods embrace the best of both quantitative and qualitative approaches, through an integration which provides breadth and depth in knowledge and understanding of social behaviour (Creswell and Clark, 2011).

3.3 Research Design

A research design is the set of methods and procedures used in collecting and analyzing measures of the variables specified in the research problem, (Muaz, 2013).This study adopteddescriptive survey research design. Descriptive research design was found appropriate since it provides an accurate account of characteristics of a particular event or scope of real-life situation (Kothari, 2014).Since the study sought to collect information that will investigate the determinants of production and innovation of maize processing tools, this study adopted descriptive research design.

Additionally, this design was found to be appropriate by the researcher because the researcher was studying a sample in order to make generalizations about the population. There was therefore the advantage of identifying the attributes of the population from a small group of individuals. Secondly, the design was found suitable because of enabling the researcher make quantitative descriptions of the opinions of the population. Descriptive design was used to allow the researcher to gather information, summarize, present and interpret it for purpose of clarification.

3.4 Study Area

The study was undertaken in Trans-Nzoia County that has an area of 2,469.90 km2. Trans-Nzoia County is made up of five sub-counties which also double up as constituencies. These are: Kwanza, Saboti, Kiminini, Cherangany and Endebess. It

borders Republic of Uganda to the North-West; Bungoma County to the West; Kakamega and Uasin Gishu Counties to the South; West-Pokot County to the North; and Elgeyo-Marakwet County to the East. This study was undertaken in Trans-Nzoia County. Trans-Nzoia County was chosen based on the consideration that it has a high concentration of informal sector businesses due to ready market of their products owing to the fact that the county is considered an agricultural zone with a majority of farmers engaged in large scale maize farming. Further, the study area was considered appropriate since no similar to the current study has been undertaken in the area particularly in the wake of devolution.

3.5 Target Population

Tabachnick and Fidell (2013) observe that target population refers to that reference population for which the researcher wishes to draw generalizations and from which the study population is drawn. Mugenda (2012) defined a population is as a complete set of individuals, cases or objects with some common observable characteristics whilst target population also referred to as the unit of observation is defined as a group of individuals, objects or items from which samples are taken for measurement (Field, 2013).The study targetedJua Kali artisans and farmers in Trans-Nzoia County. A population is any group of individuals who have one or more characteristics in common that are of interest to the researcher. The population may be all the individuals of a particular type or a more restricted part of that group and its merit is that the results obtained are representative, accurate and reliable and hence question of error becomes almost insignificant (Salaria, 2012).

Table 3.1 Target Population

Sub-Counties	Jua Kali Artisans	Large Scale Maize Farmers (> 10	Total Target population

		Hectares)	
Cherangany Sub-County	77	105	182
Kwanza Sub-County	92	84	176
Saboti Sub-County	81	65	146
Endebess Sub-County	76	80	156
Kiminini Sub-County	74	123	197
Total	**400**	**457**	**875**

Source: Field Data

The target population consisted of 400 Jua Kali artisans and 457 large scale farmers. Farmers in the county have adopted innovative processes for the production and processing of their produce. Jua Kali artisans on the other hand play an important role of engaging in the production of innovative tools to be used by farmers. The total target population therefore consisted of 875 respondents.

3.6 Sample Size and Sampling Technique

The study employed stratified sampling where Trans-Nzoia County was grouped in sub-counties then simple random sampling was used to select jua kali artisans and artisans in each Sub-County in Trans-Nzoia County. Kothari (2009), define a sample as part of the target population that has been procedural selected to represent it. Sampling is the process of systematically selecting representative elements of a population.

3.6.1 Sampling frame

A sampling frame consists of a list of all the items where a representative sample will be drawn for the purpose of a given study The sample frame from which the population and sample for the artisans in the study was obtained from the Trans-Nzoia County licensing records while the list of the large-scale farmers was obtained from the department of agriculture and livestock development in the county. The unit of analysis for the study was the registered artisans and large-scale farmers in Trans-

Nzoia County as of December 2021.It was crucial to comprehend the attributes of the unit of analysis as it provides a foundation for further analysis.

3.6.2 Sample Size

According to Kothari (2017), sampling allows researchers to estimate unknown population features and establish accurate generalizations. The sample size for this study was established using the methods proposed by Krejcie and Morgan (1970) after determining the target population of 875. The sampling formulae is as illustrated in figure 3.1

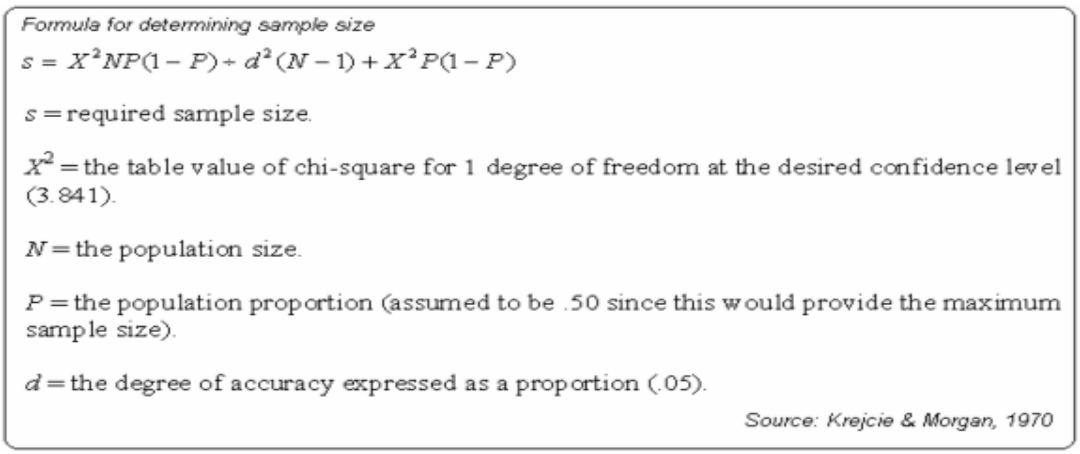


Figure 3.1: Krejcie and Morgan 1970

Sampling of Artisans

Table 3.2: Sampling of Jua Kali Artisans

Sub-Counties	Jua Kali Artisans (Target)	Procedure	Total Sample
Cherangany Sub-County	77	77/400 * 196	38
Kwanza Sub-County	92	92/400 * 196	45
Saboti Sub-County	81	81/400 * 196	40
Endebess Sub-County	76	76/400 * 196	37
Kiminini Sub-County	74	74/400 * 196	36
Total	**400**		**196**

A total of 196 artisans were sampled

Table 3.3: Sampling of Farmers

Sub-Counties	Farmers (Target)	Procedure	Total Sample
Cherangany Sub-County	105	105/457 * 210	48
Kwanza Sub-County	84	84/457 * 210	39
Saboti Sub-County	65	65/457 * 210	30
Endebess Sub-County	80	80/457 * 210	37
Kiminini Sub-County	123	123/457 * 210	56
Total	**457**		**210**

A total of 210 farmers and 196 jua kali artisans and 210 farmers were sampled. The total sample size was therefore 406 respondents.

3.7 Data Collection Instruments and data collection Procedure

3.7.1 Data Collection Instruments

Creswell (2013) defines data collection as a means by which information is obtained from the selected subjects of an investigation. Mugenda and Mugenda (2003) observe that the choice of a tool and instrument depends mainly on the attributes of the subject, research topic, data and expected results.The study employed the use of questionnaires to collect the data for the study. Kothari (2013) points out that a questionnaire is made up of a number of questions printed or typed in a formal order on a form or forms. A questionnaire is a useful instrument for gathering extensive amounts of information for large groups of individuals in short time spans. Questionnaires usually collect data that shows how widespread certain opinions are within a large group. It is a research instrument that gathers data over a large sample. In this study questionnaires was administered to all the sampled respondents. They included both open ended and closed ended questions. Close-ended questions were especially used to elicit most important and precise responses on particular aspects on graduate studies interaction needs. These enabled the study to be more focused in its findings. The open-ended questions was used to collect qualitative data while the

closed ended questions was used to collect quantitative data. They were preferred because they can be used to gather data quickly from geographically dispersed sample population. They were also deemed appropriate as many respondents could be reached (Mugenda, 2013).

3.7.2 Data Collection Procedure

Primary data was collected directly from respondents. Kothari (2012) describe primary data as those which are collected afresh and for the first time, and thus happen to be original in character. The primary data collection procedure started with identifying the respondents and their accessibility. The availability of adequate questionnaires was ascertained. A letter of introduction as student was requested from the university to be used alongside the research permit obtained from the National Council of Science and Technology and Innovation.

The questionnaires were administered by the researcher with the assistance of research assistants (2). The purpose of hiring research assistants was to speed up the data collection process. The research assistants were given orientation training in order to become familiar with the study's aims. The researcher gave an overview of the study, how to recruit participants, how to utilize the questionnaire, ethical concerns to follow during the study, and how to assure quality data collection during the training. The researcher distributed a questionnaire and a cover letter to the chosen sample size. A letter was given to each responder seeking their aid in completing the survey. Respondents were urged to fill out the survey as thoroughly and honestly as possible.

3.8 Validity and Reliability of the Research Instrument

3.8.1 Validity of research instrument

Validity refers to the accuracy and meaningfulness of inferences based on the research results (Kothari, 2004). Validity exists if the data measure what they are supposed to measure. The study enlisted both face validity, content validity, construct validity and criterion validity. In order to ascertain face validity, the instruments were constructed and passed over to university supervisors for constructive criticism. Thereafter it was revised according to their insights. The study instrument was also content-validated.

Donald and Pamela (2001) posit that content validity is determined by expert judgment. In this study, content validity was achieved through expert judgements of the research supervisors. The research supervisors were required to indicate whether the item were relevant or not. The results of their responses were analyzed to establish the percentage representation using the content validity index. The content validity formula by Amin (2005) was used in line with other previous studies (Waithaka, 2013).

To test for construct validity the study adopted confirmatory factor analysis. Factor analysis acts as a gauge of the substantive importance of a given variable to the factor and it is used to identify and remove hidden constructs or variable items that do not meet the objectives of the study and which may not be apparent from direct analysis (Finchman, 2012). Communalities were used to indicate the substantive importance of variable factors where a loading value of 0.4 as a rule of thumb was used to be satisfactory. Smith (2015) argued that a factor loading of 40% and above is satisfactory and in such a case the variable is not dropped.

3.8.2 Reliability of Research Instrument

Reliability refers to extent to which a measurement instrument is able to yield consistent results each time it is applied under similar conditions. It is the constituent of a measurement device that causes it to yield similar outcome or results for similar inputs. Statistically, reliability is defined as the percentage of the inconsistency in the responses to the survey that is the result of differences in the respondents. This implies that responses to a reliable survey varied because respondents have different opinions, not because the questionnaire items are confusing or ambiguous. Reliability could be estimated mathematically or through pre-testing of the instruments. The questionnaire items were pilot tested in Eldoret town, Uasin Gishu County to remove confusing words and to improve upon the clarity of the questions items to strengthen its reliability. Again, statistically, the Cronbach's alpha was also used to assess the reliability of an instrument. A reliability values of 6.0 to 0.70 and above are considered by many researchers as acceptable (Cooper & Schindler, 2006; Malhotra & Birks, 2016)

3.9 Data Collection Procedures

In order to carry out the study, the researcher sought to adhere to all the ethical issues that pertain to data collection. Permits were sought from The National Council for Science, Technology and innovation (NACOSTI). The researcher visited the identified jua kali artisans through snowballing with an assistance of a person whom the researcher had briefed him and collect the necessary maize samples and information for the interview schedules. Research assistants were recruited who helped in administering the questionnaires after briefing them on ethical issues and how to conduct the research. While filling the questionnaires; participants were not required to write their names. This was expected to enable them give sincere and

reliable responses. The information was gathered through on-the-spot questionnaire filling for the respondents who consent to take part in the study. This ensured high return rate of the questionnaires and rule out the problems likely to be encountered by collecting them later.

3.10 Data Analysis

Data analysis is the process of reviewing the information gathered in a survey and drawing conclusions and judgments (Kothari, 2004). After all of the data has been gathered, all instruments were cross-checked to identify erroneous, incomplete, or inappropriate data, and then the quality was improved by correcting discovered mistakes and omissions. Data was coded according to the study's goals and then fed into a computer for analysis. Quantitative analysis was part of the data analysis technique. According to Kothari (2017), descriptive surveys are often portrayed using frequency tables, graphs, pie-charts, percentage calculations, and proper tabulating. The statistical package for social sciences (SPSS) software version 25 was used for all statistical analyses.

Both descriptive and inferential data analysis approaches were employed in this study. Descriptive statistics in the form of standard deviations, means, and frequencies tables were presented while inferential statistics in the form of Pearson Moment Correlation analysis was used to explore the relationship between the study variables. In addition, simple linear regression analyses were used to assess regression model.

The first phase in data analysis, according to Mugenda and Mugenda (2006), is to characterize or summarize the data using descriptive statistics. The information was edited, coded, classed, and categorized. The data was coded as follows in order to make it statistically analyzable using the Statistical Package for Social Sciences

(SPSS) version 26: For nominal data, such as the demographics of respondents and other attributes such as male = 1 and female = 2, male = 1 and female = 2. When dealing with categorical data, a Likert scale of 1 to 5 was employed, with 1 indicating the least and 5 indicating the most. During the data collecting phase, descriptive data analysis begins.

According to Orodho (2009), inferential statistics are used anytime a researcher wants to infer information about the population from a small sample drawn from the population. A sample is examined in order to draw conclusions about the wider population from which it was drawn. As a result, inferential statistics is concerned with making broad generalizations about larger circumstances or the entire population that has not been researched (Sekaran & Bougie, 2016). The cause-effect connection between the dependent variable and the independent variables were tested using correlation analysis. Multiple regression analysis was used to determine the impact of one independent variable on the dependent variable, whereas multiple regression analysis was used to determine the strength, direction, and significance of the relationship between the two variables.

3.11 Model Specification

For regression, the multiple regression was employed and its equation was as follows;

$$Y=\beta_0 + \beta_1X_1+ \beta_2X_2 +\beta_3X_3+ \beta_4X_4+\varepsilon_i$$

Where:

x= The independent variables - X_1 = Skills and Competencies

X_2= Training and Outreach

X_3= Access to Financial Resources

X_3= Policy and Regulations

Y = The dependent variable (Innovation of Tools)

β = βeta

ε_i = Error Term

3.12 Assumptions of the Multiple Linear Regression Model

The following are the assumptions that the data must meet in order to conduct a linear regression analysis.

Normality: It is assumed that the residuals of variables are normally distributed. That is, the errors in the prediction of value Y (the dependent variable) are distributed in a way that approaches the normal curve. The assumption of normality is especially critical when constructing reference intervals for variables and when this assumption does not hold, it is impossible to draw accurate and reliable conclusions about reality (Ghasemi & Zahediasl, 2012). The study therefore, used the Shapiro-Wilk test for testing the normality of data in line with the recommendation of Thode (2002). The Shapiro-Wilk test is based on the correlation between the data and the corresponding normal scores and provides better power than the K-S test even after the Lilliefors correction (Steinskog, 2007; Mendes & Pala, 2003).

Linearity: When the variables X and Y are linearly correlated, it is meaningless to fit a linear regression model between them. Therefore, *t*-Test is being used to examine whether there is some significant linear relationship between the independent and dependent variables or not (Kothari & Garg, 2014). The decision about the null hypothesis in a two-tailed test was taken by comparing the computed value and critical value of *t* distribution. The null hypothesis is rejected at α x 100% level of

significance when the computed value and critical value T_r is lower than $-t_{\alpha/2}$ or larger than $t_{\alpha/2}$. Rejecting a null hypothesis means there is a significant linear relationship between the variables (Kothari & Garg, 2014). It is assumed that the relationship between the independent and dependent variables is linear. Scatter plots of the variables can help make this determination.

Homoscedasticity: In this study heteroscedasticity shall be minimized or eliminated where possible by ensuring that the data used in hypothesis testing is approximately normal and is accurately transformed and that the right functional forms of regression model are selected and variables presented by scatter plot diagrams of the dependent variable (DV) widened or narrowed as the value of the independent variable (IV) increases. The inverse of heteroscedasticity is homoscedasticity, which indicates that a DV's variability is equal across values of an IV. At each level of the predictor variables(s), the variance of the residual terms should be constant. This was tested using qq plots

Multicollinearity: Multicollinearity was tested using variance inflation factor and tolerance (VIF). Multicollinearity exists when two or more of the predictors in a regression model are moderately or highly correlated. Unfortunately, when it exists, it can wreak havoc on analysis and thereby limit research conclusions in this study it were detected when the *t*-tests for each of individual slopes are non-significant ($P>$ 0.05), but the overall *F*-test for testing all of the slopes are simultaneously 0 is significant ($P<$ 0.05); hence relying on variance inflation factor (*VIF*) quantifies how much the variance is inflated; the variances of the estimated coefficients are inflated when multicollinearity exists.

3.13 Ethical Consideration

The researcher sought permit from the National Commission for Science, Technology and Innovation (NACOSTI) before commencing the data collection exercise. Further the researcher obtained a letter from the University authorizing data collection. In this research three key ethical principles were used namely; beneficence, respect and justice. The study considered the respondents' feelings. Secondly, the informants were notified that the information they gave would only be adopted for academic purposes. Contact time was also observed to avoid inconveniencing the respondents' work schedules. This was achieved by contacting the respondents during lunch breaks. Utmost level of honesty was observed and level of integrity was maintained, for example, the researcher communicated to the respondents the purpose for the study verbally and through a cover letter. The researcher assured the respondents of anonymity and confidentiality; this was achieved by not taking the names of the respondents. The exercise was voluntary, there was no coercion whatsoever.

Table 3.3: Measurement of Variables

Objectives	Nature	Measurement	Target
1. How skills and competences influence availability of Jua Kali tools and technology for maize processing value chain in Trans Nzoia County.	Independent	Scale	Descriptive (Frequency and percentage)
2. How training and outreach influence the availability of Jua Kali tools and technology for maize processing value chain in Trans Nzoia County.	Independent	Scale	Descriptive (Frequency and percentage)
3. How access to financial resources influence availability of Jua Kali tools and technology for maize processing value chain in Trans Nzoia County.	Independent	Scale	Descriptive (Frequency and percentage)
4. How policy and regulations influence on Jua Kali production to tools and technologies for maize processing value chain.	Independent	Scale	Descriptive (Frequency and percentage)
5. The determinants of Jua Kali innovation production on the creation of tools and technology for maize processing value chain in Trans-Nzoia County.	Dependent	Scale	Inferential statistics (regression analysis)

CHAPTER FOUR

DATA ANALYSIS, INTERPRATATION AND DISCUSSIONS

4.1 Introduction

This chapter sought to analyse the data collected in relation to the research objectives. Descriptive and inferential statistics were used in the data analysis process. Descriptive statistics included frequencies percentages, means and standard deviations while the inferential statistics included the correlations and the multiple linear regression analysis.

4.1.1 Piloting and Response Rate

The study sought to collect data from 196 respondents and 100% response rate was achieved from the respondents. The questionnaires however were piloted to test for reliability at Uasin Gishu using 20 questionnaires and the reliability results were as presented in table 4.1

4.1.2 Data Preparation and Cleaning

Preparation of data included coding the responses, cleaning, screening the data and selecting the appropriate data analysis strategy for testing the hypothesis. Coding involved assigning a numeric symbol to enable quick data entry and to minimize errors during the analysis. Each item in the questionnaire was assigned a code that upon completion was entered into a statistical analysis software package IBM SPSS. Cleaning and screening the data involved checking for inconsistencies, missing responses, and other errors to ensure accuracy and completeness.

4.2 Reliability of Instruments

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. The researcher used Cronbach alpha coefficient which is widely used by researchers for assessing reliability of multiple items. Reliability test was also done using SPSS to check if the instruments met the expected standards. A rule of thumb for interpreting alpha for dichotomous questions (i.e. questions with two possible answers) or Likert scale questions is: $\alpha \geq 0.9$, excellent, $0.9 \geq \alpha \geq 0.8$, good, $0.8 \geq \alpha \geq 0.7$, acceptable, $0.7 \geq \alpha \geq 0.6$, questionable, $0.6 \geq \alpha \geq 0.5$, poor, $0.5 > \alpha$, unacceptable. The instruments were considered reliable if their reliability coefficients were above the recommended 0.7 threshold (Fraenkel & Wallen, 2000). The generally acceptable level of Cronbach's alpha is above 0.70.

According Bryman & Bell (2007) reliability is whether the concept and the result are reliable and if the study can be replicated with the same result. The findings indicated that all constructs had Cronbach's Alpha values within the suggested value of between 0.746 and 0.985 thus the data collection tool was reliable. On the basis of this reliability test it was confirmed that the scales used in the study were reliable to capture the constructs. The findings of the reliability test are shown in table 4.1.

Table 4.1: Reliability Results after Piloting

Reliability Statistics for Skills and Competencies	
Cronbach's Alpha	N of Items
0.785	6
Reliability Statistics for Training and Outreach	
Cronbach's Alpha	N of Items
0.985	6
Reliability Statistics for Access to Financial Resources	
Cronbach's Alpha	N of Items
0.845	6
Reliability Statistics for Policy and Regulations	
Cronbach's Alpha	N of Items
0.746	6
Reliability Statistics for Innovation by Jua Kali Artisans	
Cronbach's Alpha	N of Items
0.810	6

The study results indicated that the skills and competencies item had a Cronbach's Alpha of 0.785, training and outreach had a Cronbach's Alpha of 0.985, access to financial resources had a c Cronbach's Alpha of 0.845, policy and regulation had a Cronbach's Alpha of 0746 and the dependent variable that is Innovation by Jua Kali artisans had a Cronbach's Alpha of 0.810. All the items had Cronbach of over 0.7 which was the recommended Cronbach's Alpha value hence they were all considered reliable.

4.3 Demographic Analysis

The study sought to analyze the demographics of the respondents. This were presented in table 4.2

Table 4.2: Demographics of the Respondents

	Frequency	Percent
Gender		
Male	189	96.4
Female	7	3.6
Total	196	100
Education		
primary	10	5.1
secondary	12	6.1
certificate	113	57.7
Diploma	53	27
others	8	4.1
Total	196	100
Period of Work		
Below 3 years	62	31.6
3-5 years	73	37.2
5-8 years	28	14.3
over 9 years	33	16.8
Total	196	100

The study findings indicated that 189(96.4%) of the respondents were male while 7(3.6%) were female. This meant that the sector is dominated by the male youths.

The study results also indicated that 10(5.1%) of the respondents had primary education, 12(6.1%) had secondary education, 113(57.7%) had certificate education, 53(27%) had diploma education and 8(4.1%) had other forms of qualifications.

In relation to how long the respondents had worked in the artisan business, the study findings noted that 62(31.6%) had worked for below 3 years, 73(37.2%) had worked for between 3 – 5 years, 28(14.3%) had worked for between 5 – 8 years and 33(16.8%) had worked for over 9 years.

4.4 Analysis of Specific Objectives

4.4.1 Skills and Competences Influence on Innovation of Jua Kali Tools for Maize Processing

The study findings indicated that 155(79.1%) of the respondents strongly agreed that they have knowledge in producing tool for maize processing, 8(4.1%) agreed, 6(3.1%) were undecided 17(8.7%) disagreed, 10(5.1%) strongly disagreed. Results also indicated that 55(28.1%) strongly agreed that they are experienced in producing tools for maize processing, 51(26.0%) agreed, 32(16.3%) were undecided 28(19.4%) disagreed, 20(10.2%) strongly disagreed. Another 59(30.1%) strongly agreed that they have the ability to produce quality tools for maize processing. 68(34.7%) agreed, 65(33.2%) were undecided, 3(1.5%) disagreed, 1(0.5%) strongly disagreed.

Findings also noted that 46(23.5%) strongly agreed that they attended a school to be taught on artisanship's to prepare products, 91(46.4%) agreed, 49(25.0%) were undecided, 7(30.785, 6%) disagreed, 3(1.5%) strongly disagreed. Results also noted that 44(22.4%) strongly agreed that they have worked as an apprentice in a Jua Kali shop before producing various artifacts, 33(16.8%) agreed, 21(53%) were undecided, 53(27.0%) disagreed, 45(23.0%) strongly disagreed. Finally, 50(25.5%) strongly agreed that their customers have praised my work heavily for products sold 36(18.4%) agreed, 22(11.2%) were undecided, 47(24.8%) disagreed, 41(23.0%) strongly agreed.

Table 4.3: Skills and Competences Influence on Innovation of Jua Kali Tools for Maize Processing

		SA	A	UD	D	SD	Mean	Std
We have knowledge in producing tool for maize processing	Fre	155	8	6	17	10	4.43	1.202
	%	79.1	4.1	3.1	8.7	5.1		
We are experienced in producing tools for maize processing	Fre	55	51	32	38	20	3.42	1.347
	%	28.1	26	16.3	19.4	10.2		
We have the ability to produce quality tools for maize processing	Fre	59	68	65	3	1	4.12	2.919
	%	30.1	34.7	33.2	1.5	0.5		
I attended a school to be taught on artisanship's to prepare products	Fre	46	91	49	7	3	3.87	0.867
	%	23.5	46.4	25	3.6	1.5		
I have worked as an apprentice in a Jua Kali shop before producing various artifacts	Fre	44	33	21	53	45	2.89	1.501
	%	22.4	16.8	10.7	27	23		
My customers have praised my work heavily for products sold	Fre	50	36	22	47	41	3.036	1.514
	%	25.5	18.4	11.2	24	20.9		

Key: SA – Strongly Agree, A – Agree, UD – Undecided, D – Disagree, SD – Strongly Disagree
Fre – Frequency, % - Percentage

The study findings indicated that a majority of the respondents mean = 4.43, Std = 1.202 were of the opinion that they have knowledge in producing tool for maize processing. A further mean = 4.12, Std = 2.919 of the respondents were of the opinion that they have the ability to produce quality tools for maize processing, Mean = 3.870, Std = 0.867 were of the opinion that they attended a school to be taught on artisanship's to prepare products, Mean = 3.42, Std = 1.347 were of the opinion that they are experienced in producing tools for maize processing, Mean = 3.036, Std = 1.514 were of the opinion that customers have praised their work heavily for products sold and finally Mean= 2.89, Std = 1.501 were of the opinion that they have worked as an apprentice in a Jua Kali shop before producing various artifacts.

The study findings can be interpreted to mean that the development of skills and competencies does not occur in the abstract. It is related to a set of goals, specifically

to the creation and maintenance of a well-trained, flexible, and motivated manufacturing workforce, comprising prospective workers as well as current workers at all conventional levels, including technical professionals and managers, mid-level technicians, and shop floor personnel. For the workers to have this required level of skill and competence as indicated in the study means that they must have gone through some form of training. As a result a majority of the Jua Kali artisans find themselves with the required level of skill and competence to perform tasks required of them for example producing jua kali products for maize processing.

The study findings are contrary to the findings of Abor & Quartey, (2014) who notes that in Africa, Small engineering firms which represent the Jua Kali actions in African nations have been recognized for playing important role in nation's economic development especially in job creation but competencies is one of the factors a part from lack of managerial skills, finances, regulatory issues,and access to international markets that hamper their developments Although small engineering firms are considered to be the engine of growth of economy in any country, most of these firms in Africa discontinue or remain inefficient.

Sarosa and Zowghi, (2013) also contradicts this findings by noting that creativity and innovation of the Jua Kali sector to support the jua Kali sector in Kenya is also wanting with product recycling being the norm A few inventions have been developed to support the farmer and especially the large scale farmer. This include the maize and the wheat farmers. Farming tools and storage tools have been developed but much more still needs to be done to support the small scale farmers. Overall therefore the study notes that there is a need to enhance skills and competencies among the Jua Kali workers.

4.4.2 Training and Outreach Influence on Innovation of Jua Kali Tools for Maize Processing

The study findings indicated that 54(27.6%) of the respondents strongly agreed that farmers get field education from government and NGOs outreach programs on how to use our products, 68(34.7%) agreed, 44(22.4%) were undecided, 19(9.7%) disagreed, 11(5.6%) strongly disagreed. Also 63(32.1%) of the respondents strongly agreed that farmers are taught how to use various tools and technology in maize processing value chain by demonstration, 89(45.4%) agreed, 33(16.8%) were undecided, 5(2.6%) disagreed, 6(3.1%) strongly disagreed. Results also indicate that 95(48.5%) strongly agreed that farmers carry out experimentation on the use of tools and technology in maize processing value chain, 71(36.2%) agreed, 5(2.6%) were undecided, 15(7.7%) disagreed, 10(5.1%) strongly disagreed.

The findings show that 103(52.6%) strongly agreed that farmers teach each other on how to use tools and technologies in maize farming, 74(37.8%) agreed, 2(1.0%) were undecided, 7(3.6%) disagreed, 10(5.1%) strongly disagreed. In addition, 44(22.4%) strongly agreed that they make time to go teach farmers on how to use our products, 35(17.9%) agreed, 24(12.2%) were undecided, 55(28.1%) disagreed and 38(19.4%) strongly disagreed. Finally, 47(24.0%) strongly agreed that our products have a use manual which the farmers use, 41(20.9%) agreed, 25(12.8%) were undecided, 45(23.0%) disagreed, 38(19.4%) strongly disagreed.

Table 4.4: Training and Outreach Influence on Innovation of Jua Kali Tools for Maize Processing

		SA	A	UD	D	SD	Mean	Std
Farmers get field education from government and NGOs outreach programs on how to use our products	Fre	54	68	44	19	11	3.69	1.141
	%	27.6	34.7	22.4	9.7	5.6		
Farmers are taught how to use various tools and technology in maize processing value chain by demonstration	Fre	63	89	33	5	3	4.01	0.934
	%	32.1	45.4	16.8	2.6	3.1		
Farmers carry out experimentation on the use of tools and technology in maize processing value chain	Fre	95	71	5	15	10	4.15	1.122
	%	48.5	36.2	2.6	7.7	5.1		
Farmers teach each other on how to use tools and technologies in maize farming	Fre	103	74	2	7	10	4.29	1.029
	%	52.6	37.8	1	3.6	5.1		
We make time to go teach farmers on how to use our products	Fre	44	35	24	55	38	2.96	7.464
	%	22.4	17.9	12.2	28.1	19.4		
Our products have a use manual which the farmers use	Fre	47	41	25	45	38	3.07	1.477
	%	24	20.9	12.8	23	19.4		

Key: SA – Strongly Agree, A – Agree, UD – Undecided, D – Disagree, SD – Strongly Disagree
Fre – Frequency, % - Percentage

The study findings indicated that a majority of the respondents Mean = 4.29, Std =1.029 were of the opinion that farmers teach each other on how to use tools and technologies in maize farming, Mean = 4.15, Std = 1.122 of the respondents were of the opinion that farmers carry out experimentation on the use of tools and technology in maize processing value chain, Mean = 4.01, Std = 0.934 of the respondents were of the opinion that farmers are taught how to use various tools and technology in maize processing value chain by demonstration, Mean = 3.69, Std = 1.141 of the respondents were of the opinion that farmers get field education from government and NGOs outreach programs on how to use our products, Mean = 3.07, Std =1.477 of the respondents were of the opinion that their products have a use manual which the

farmers use and finally, Mean = 2.96, Std = 7.464 were of the opinion that Jua Kali artisans make time to go teach farmers on how to use our products.

The findings that farmers teach each other on how to use tools and technologies in maize farming were interpreted to mean that there is little training or no outreach happening to farmers to equip them with the right knowledge to know how to use the Jua kali equipment's that they are in possession of. This means that some could be using the tools in a wrong manner or in a less productive manner. This situation could be a major contributor to their inability to see the full benefits of the Jua Kali products.

This finding are supported by Abbas Weaver, Ehrlich, Scharfenstein & Cotty (2015) who notes that precedent for improving manufacturing skills is lacking in many countries. The need to provide for continuing development is slowly being recognized. Even with more widespread interest in need for training in this era, many people are not ready to take up this challenge. Problems of basic literacy, necessitating remedial instruction, are impeding the entry into the work force of increasing numbers of educationally and economically disadvantaged people who might otherwise train for the new jobs. Koudande, Mensah, Sanni & Brimer (2013) also note that a more fundamental barrier to the development of skills is the largely indifferent and sometimes negative attitudes of faculty and guidance counselors, most likely derived from lack of experience at any.

4.4.3 Access to Financial Resources Influence on Innovation of Jua Kali Tools for Maize Processing

The study findings indicated that 85(43.4%) of the respondents strongly agreed that they can access loans from financial institution hence they have no financial

challenges, 50(25.5%) agreed, 30(15.3%) were undecided, 15(7.7%) disagreed, 16(8.2%) strongly disagreed. Another 90(45.9%) strongly agreed that government and NGOs provide financial support to us to make our products, 62(31.6%) agreed, 19(9.7%) were undecided, 12(6.1%) disagreed, 13(6.6%) strongly disagreed. The results also showed that 52(26.5%) strongly agreed that they earn a lot of profit therefore they do not have financial challenges, 31(15.8%) agreed, 25(12.8%) were undecided, 53(27.0%) disagreed, 35(17.9%) strongly disagreed. The study findings also noted that 48(24.5%) strongly agreed that our products are made once a customer pays a specified amount so that we get operational funds, 41(20.9%) agreed, 20(10.32%) were undecided, 50(25.5%) disagreed, 31(18.9%) strongly disagreed. Finally the results indicated that 29(14.8%) strongly agreed, 66(33.7%) agreed, 59(30.1%) were undecided, 28(14.3%) disagreed, 14(7.1%) strongly disagreed.

Table 4.5: Access to Financial Resources Influence on Innovation of Jua Kali Tools for Maize Processing

		SA	A	UD	D	SD	Mean	Std
We can access loans from financial institution hence they have no financial challenges	fre	85	50	30	15	16	3.88	1.274
	%	43.4	25.5	15.3	7.7	8.2		
Government and NGOs provide financial support to us to make our products	fre	90	62	19	12	13	4.04	1.185
	%	45.9	31.6	9.7	6.1	6.6		
We earn a lot of profit therefore they do not have financial challenges.	fre	52	31	25	53	35	3.06	1.487
	%	26.5	15.8	12.8	27	17.9		
Our products are made once a customer pays a specified amount so that we get operational funds	fre	48	41	20	50	37	3.05	1.485
	%	24.5	20.9	10.2	25.5	18.9		
The county has a kitty for us to help us operate and then return funds issued	fre	105	79	2	4	6	4.39	0.867
	%	53.6	40.3	1	2	3.1		
The region has well-wishers who sponsor the development of this products	fre	29	66	59	28	14	3.35	1.115
	%	14.8	33.7	30.1	14.3	7.1		

Key: SA – Strongly Agree, A – Agree, UD – Undecided, D – Disagree, SD – Strongly Disagree
Fre – Frequency, % - Percentage

The study findings indicated that a majority of the respondents Mean = 4.39, Std = 0.867 were of the opinion that the county has a kitty for us to help us operate and then return funds issued, Mean = 4.04, Std = 1.185 of the respondents were of the opinion that Government and NGOs provide financial support to us to make our products, Mean = 3.88, Std = 1.274 of the respondents were of the opinion that they can access loans from financial institution hence they have no financial challenges, Mean = 3.35, Std = 1.115 of the respondents were of the opinion that The region has well-wishers who sponsor the development of this products, Mean = 3.06, Std = 1.487 of the respondents were of the opinion that they earn a lot of profit therefore they do not have financial challenges and finally, Mean = 3.05, Std = 1.485 of the respondents were of the opinion that their products are made once a customer pays a specified amount so that we get operational funds.

The findings that the county has a kitty for us to help us operate and then return funds issued was interpreted to mean that financial institutions have been reluctant to serve the sector despite the importance of the sector hence the county has had to take over this role. Low population density and large geographical dispersion of clients in rural areas make it difficult for banks to operate at a profitable scale. The lack of financial institutions branches has translated in a limited provision of saving, insurance and credit products to farmers and agribusinesses. A second factor inhibiting financial institutions from serving the sector has to do with the systemic risk characterizing agricultural activities. When natural hazards or adverse weather conditions take place, they typically affect a large number of farmers and firms simultaneously, making it more challenging for financial providers to diversify their portfolio of clients, since when one client fails to pay, many others were in the same situation. This problem is

aggravated by the paternalistic behavior or political motives that governments may have.

The findings are supported by Maloba, (2017) who notes that productivity in the agricultural sector can benefit from better access to financial instruments tailored to the needs of farmers and agribusinesses. However caution is given by Sheahan, & Barrett, (2017) who notes that governments should abstain from paternalistic policies that discourage financial providers from entering the market and that distort the incentives for farmers and firms. Public subsidies directed at Jua Kali industry should be carefully considered because they provide inappropriate incentives for artisans to invest in unprofitable Jua kali activities. While certain subsidized products could be justified on the basis of achieving the higher take-up of these products and allowing users to understand their value, subsidies that do not involve proper assessments of the quality or feasibility of projects should be avoided.

4.4.4 Policy and Regulations Influence Innovation of Jua Kali Tools for Maize Processing

The study findings indicated that 131(66.8%) of the respondents agree that they price our products expensively due to high tax from government, 32(16.3%) agreed, 13(6.6%) were undecided, 9(4.6%) disagreed and 11(5.6%) strongly disagreed. Elsewhere, 110(56.1%) of the respondents strongly agreed that there are many manufactured imports substitutes for their products, 49(25%) agreed, 17(8.7%) were undecided, 10(5.1%) disagreed and another 10(5.1%) strongly disagreed. The results also revealed that 83(42.3%) of the respondents strongly agreed that business licensing is at its highest making cost of business high, 26(13.3) agreed, 19(9.7%) were undecided, 41(20.9%) disagreed and 27(13.8%) strongly disagreed.

Study results revealed that 60(30.6%) of the respondents strongly agreed that the county and national government assists them market their products, 39(19.9%) agreed, 17(8.7%) were undecided, 46(23.5%) disagreed and 34(17.3%) strongly disagreed. In addition, the results showed that 89(45.4%) of the respondents strongly agreed that the county and national government have invested a lot in training artisans, 95(48.5%) agreed, 2(1.6%) were undecided, 4(2%) disagreed and 6(3.1%) strongly disagreed. Finally, 29(14.8%) of the respondents strongly agreed that there are policies to assist us access credit at any MFI, 55(28.1%) of the respondents agreed, 72(36.7%) were undecided, 26(13.3%) disagreed and 14(7.1%) strongly disagreed.

Table 4.6: Policy and Regulations Influence Innovation of Jua Kali Tools for Maize Processing

		SA	A	UD	D	SD	Mean	Std
We price our products expensively due to high tax from government	fre	131	32	13	9	11	4.34	1.146
	%	66.8	16.3	6.6	4.6	5.6		
There are many manufactured imports substitutes for our products	fre	110	49	17	10	10	4.22	1.127
	%	56.1	25	8.7	5.1	5.1		
Business licensing is at its highest making cost of business high	fre	83	26	19	41	27	3.49	1.534
	%	42.3	13.3	9.7	20.9	13.8		
The county and national government assists us market our products	fre	60	39	17	46	34	3.23	1.52
	%	30.6	19.9	8.7	23.5	17.3		
The county and national government have invested a lot in training artisans	fre	89	95	2	4	6	4.31	0.853
	%	45.4	48.5	1.6	2	3.1		
There are policies to assist us access credit at any MFI	fre	29	55	72	26	14	3.3	1.098
	%	14.8	28.1	36.7	13.3	7.1		

Key: SA – Strongly Agree, A – Agree, UD – Undecided, D – Disagree, SD – Strongly Disagree
Fre – Frequency, % - Percentage

The study findings indicated that a majority of the respondents of the respondents, Mean = 4.34, Std = 1.146 were of the opinion that they price their products expensively due to high tax from government, Mean = 4.31, Std = 0.853 of the

respondents were of the opinion that the county and national government have invested a lot in training artisans, Mean = 4.22, Std =1.127 of the respondents were of the opinion that there are many manufactured imports substitutes for our products, Mean = 3.49, Std = 1.534 of the respondents were of the opinion that business licensing is at its highest making cost of business high, Mean = 3.3, Std = 1.098 of the respondents were of the opinion that there are policies to assist us access credit at any MFI and finally, Mean = 3.23, Std= 1.52 of the respondents were of the opinion that the county and national government assists us market our products

The study findings that there are high taxes on their products on their products were interpreted to mean that lack of efficient tax policies was one of the main reasons why the Jua Kali artisans were not able to make affordable Jua Kali products which could be bought by maize farmers to assist them in maize processing. The study findings therefore point to a need by both the county and the national government to make policies that regulate the amount of taxes paid by the Jua Kali workers for their products.

The findings are supported by Boehlje and Erickson, (2015) who noted that in many cases, sector-specific pricing and tax policies have also resulted in substantial discrimination against agriculture As a consequence, farm incomes in many developing countries are stagnating, and little progress is being made in overcoming the problems of poverty. The tax policies have added to the pricing of agricultural products making them out of reach financially to farmers especially in the developing countries where farmers capacity to acquire resources for farming are limited. A review of taxation policies in the agricultural sector is therefore recommended in most African countries to help combat the food security challenge.

4.4.5 Innovation of Maize Processing Tools

The study findings indicated that 114(58.2%) of the respondents strongly agreed that Tools developed are very useful in maize processing value chain, 34(17.3%) agreed, 14(7.1%) were undecided, another 14(7.1%) disagreed and 20(10.2%) strongly disagreed. Also, 119(60.7%) of the respondents strongly agreed that Jua Kali tools are designed in a variety of shapes, qualities and functionalities for all farmers, 44(22.4%) of the respondents agreed, 16(8.2%) of the respondents were undecided, 9(4.6%) disagreed and 8(4.1%) strongly disagreed. Results further showed that 72(36.7%) strongly agreed that Jua Kali products utility is higher compared to manufactured tools, 26(13.3%) agreed, 19(9.7%) were undecided, 43(21.9%) disagreed and 36(18.4%) strongly disagreed.

The study findings indicated that 66(33.7%) of the respondents strongly agreed that Jua Kali tools are more common among rural farmers markets compared to other imported tools, 37(18.9%) agree, 16(8.2%) were undecided, 45(23%) disagreed and 32(16.3%) strongly disagreed. The study findings also showed that 86(43.9%) of the respondents strongly agreed that tools developed by Jua Kali are long lasting and safe, 92(46.9%) agreed, 5(2.6%) were undecided, 6(3.1%) disagreed and 7(3.6%) strongly disagreed. Finally the study findings indicated that 29(14.8%) of the respondents strongly agreed that tools developed by Jua Kali are easier to handle, 54(27.6%) of the respondents agreed, 73(37.2%) were undecided, 26(13.3%) disagreed and 14(7.1%) strongly disagreed

Table 4.7: Innovation of Tools by Jua Kali Artisans

		SA	A	UD	D	SD	Mean	Std
Tools developed are very useful in maize processing value chain	fre	114	34	14	14	20	4.061	1.363
	%	58.2	17.3	7.1	7.1	10.2		
Jua Kali tools are designed in a variety of shapes, qualities and functionalities for all farmers	fre	119	44	16	9	8	4.311	1.071
	%	60.7	22.4	8.2	4.6	4.1		
Jua Kali products utility is higher compared to manufactured tools	fre	72	26	19	43	36	3.28	1.578
	%	36.7	13.3	9.7	21.9	18.4		
Jua Kali tools are more common among rural farmers markets compared to other imported tools	fre	66	37	16	45	32	3.31	1.529
	%	33.7	18.9	8.2	23	16.3		
Tools developed by Jua Kali are long lasting and safe	fre	86	92	5	6	7	4.25	0.923
	%	43.9	46.9	2.6	3.1	3.6		
Tools developed by Jua Kali are easier to handle	fre	29	54	73	26	14	3.30	1.097
	%	14.8	27.6	37.2	13.3	7.1		

The study findings indicated that a majority of the respondents, Mean = 4.31, Std = 1.071 were of the opinion that Jua Kali tools are designed in a variety of shapes, qualities and functionalities for all farmers, Mean = 4.25, Std = 0.923 were of the opinion that tools developed by Jua Kali are long lasting and safe, Mean = 4.06, Std = 1.365 were of the opinion that tools developed are very useful in maize processing value chain, Mean = 3.31, Std = 1.529 of the respondents were of the opinion that Jua Kali tools are more common among rural farmers markets compared to other imported tools, Mean = 3.28, Std = 1.578 of the respondents were of the opinion that Jua Kali products utility is higher compared to manufactured tools and finally Mean = 3.30, Std = 1.097 of the respondents were of the opinion tools developed by Jua Kali are easier to handle

This study findings are interpreted to mean that there are numerous Jua Kali ventures in the county employing many unemployed youth and as a result creativity and innovation is growing leading to many agricultural tools that can support agriculture

for example maize processing. This variety is an indication of the level of creativity associated with the industry and also an indication of the number of employment rate created by the industry as more and more youthful persons engage in the sector.

The availability of product variety of Jua Kali products is supported by Handjiski et al., (2016) who notes that the jua kali sector has been prevalent in Kenya's economy for more than three decades and continues to play an important role in absorbing youth who would otherwise have no income-generating options. The ease of entry and exit into the jua kali sector makes it an environment where many young people can turn to earn a livelihood. The World Bank has acknowledged that this kind of informal entrepreneurship is a lifeline for Kenya's youth. It not only creates employment opportunities for young entrepreneurs and other people they hire, but also brings marginalized youth back into the economic mainstream and addresses the delinquency that arises from joblessness.

4.5 Factor Analysis

Factor analysis is a process of reducing data using a specific technique (Pallant, 2007); this is achieved by taking a large variable set and summarizing them using a smaller set of factors (Pallant, 2007). Variables can be described as an item or factor that can be regulated or adjusted. The set of variables used in these analyses are the items or factors stated in each section of the questionnaire**.** To show the validity of the factors or if it is appropriate for factor analysis, those items less than 0.3 are regarded as weak items and they must be left out. In order to enhance the factorability of the data, Bartlett Test of Sphericity and the Kaiser- Meyer – Olkin (KMO) Measure of Sampling Adequacy were used (Pallant 2007). In this regard, the Bartlett Test of Sphericity is considered significant if less than 0.05 and Kaiser-MeyerOlkin (KMO),

an index, should be from 0 to 1 with 0.6 considered as suitable minimum value of good factor analysis (Pallant, 2007).

Before testing the hypotheses, factorability of the items of the study were examined to identify a small number of items which were used to test relationship among interrelated variables, and also to investigate the validity of each construct through measurement purification process, items with factor loadings less than .5 were omitted from the analyses to increase construct validity. According to Souza et al., (2017), construct validity measures the degree to which a scale measures what it intends to measure and it is assessed by factor analysis in this research study.

The Kaiser-Meyer-Olkin measure of sampling adequacy was .718, above the commonly recommended value of .6 (Fisher, 2005), and Bartlett's test of sphericity was significant with Chi-square of 3165.782, at df= 465 and a significant level of p =.000. Finally, the communalities were all above .3, further confirming that each item shared some common variance with other items. Communalities relate to the percentage of variation in the original variable which is accounted for by the high loading factors. Given these overall indicators, factor analysis was deemed to be suitable with items of the study

4.5.1. Factor Analysis with All the Items

Table 4.1: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.718
Bartlett's Test of Sphericity	Approx. Chi-Square	3165.782
	df	465
	Sig.	.000

Source: Research Data (2022)

Principal components analysis was used with an objective of identifying and computing the composite scores for the factors underlying the study. The eigen

value for each factor is greater than 1.0 (5.79, 3.27, 2.85, 2.47, 2.30, 1.33, 1.28, 1.06 and 1.02) which implies that each factor can explain more variance than a single variable. The cumulative percentage of variance explained by the six factors is 69.08 per cent. In other words, more than 69% per cent of the common variance shared by the 31 items can be accounted or explained by these nine factors. Based on these results, the construct validity is established.

Table 4.2: Total Variance Explained

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.795	18.694	18.694	5.795	18.694	18.694	3.633	11.719	11.719
2	3.275	10.563	29.258	3.275	10.563	29.258	2.937	9.476	21.195
3	2.851	9.196	38.454	2.851	9.196	38.454	2.786	8.986	30.181
4	2.470	7.969	46.423	2.470	7.969	46.423	2.611	8.422	38.604
5	2.308	7.445	53.868	2.308	7.445	53.868	2.368	7.638	46.242
6	1.335	4.306	58.173	1.335	4.306	58.173	2.319	7.481	53.723
7	1.285	4.146	62.319	1.285	4.146	62.319	2.031	6.553	60.276
8	1.067	3.441	65.760	1.067	3.441	65.760	1.373	4.429	64.705
9	1.029	3.321	69.081	1.029	3.321	69.081	1.356	4.376	69.081

Extraction Method: Principal Component Analysis.

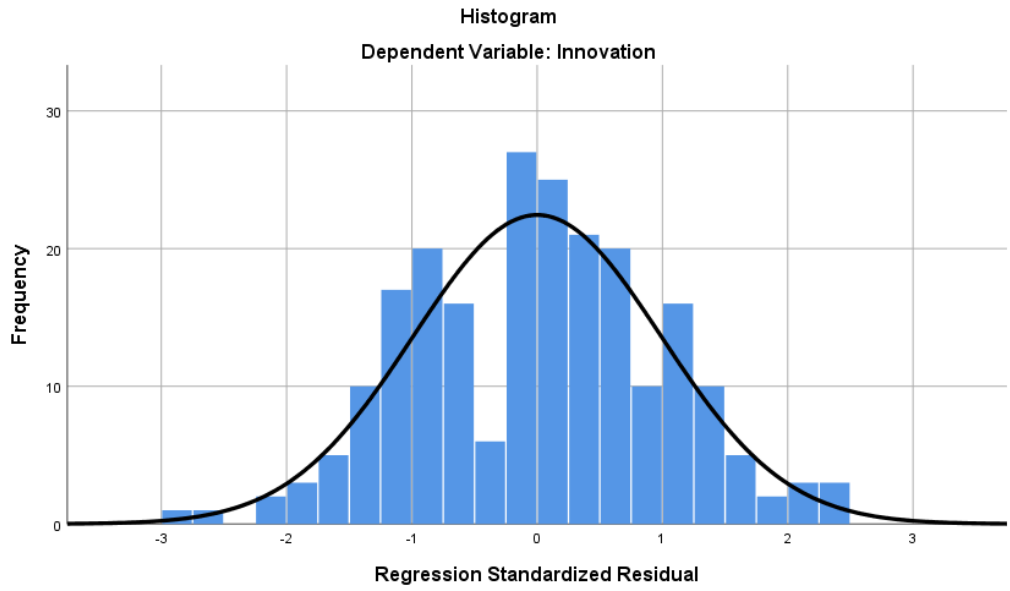
Source: Research Data (2022)

4.6 Testing Assumptions of Regression Analysis

Before carrying out correlation and regression analysis, the researcher tested several assumptions of the regression model. This is because if the assumptions are not met the results may not be trustworthy, resulting in a Type I or Type II error, or over- or under-estimation of significance or effect size(s). The key assumptions tested included normality, linearity, multi-collinearity, homoscedasticity and independence of errors (Hair et al., 1998). The study used the existing sample data to test for the hypotheses after it met the key assumptions.

4.6.1 Normality Test

Normal distribution assumes the symmetrical bell-shaped curve which is defined by mean μ = 0 and varianceσ = 1. Graphically, a histogram is used to show the normal distribution of a variable as shown in Figure 4.1. The rule of the thumb is that any skewness statistics that is outside this range should be examined



To test for Normality an inspection was done on the regression standardized residual histogram (Figure 4.2) which indicated that the data is normally distributed. In addition, the regression standardized residual (Figure 4.1) was also found to be normally distributed whereby the observed and expected values were found along the line, without any significant departures from it.

4.6.2 Linearity

Linearity means the correlation between variables, which is represented by a straight line. Knowing the level of the relationship among variables is considered an important element in data analysis. Hair et al. (2010) argue that linearity is an assumption of all multivariate techniques based on co-relational measures of association, including regression, multiple regression and factor analysis. In this study, linearity assumption

was examined through the use of simple inspection of P-P plot of the scores represented by a straight line (Pallant, 2013) and also proved through coefficient of determination (R^2) as indicated in Figure 4.1. This regression equation is very useful for making predictions since the value of R^2 is close to 1(Garson, 2012).

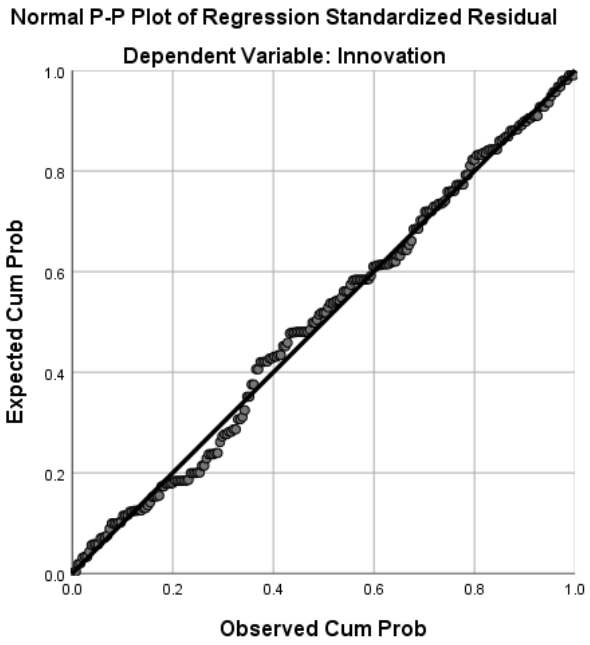


Figure 4.1: Coefficient of determination (R^2)

4.6.3 Test for Multicollinearity

This study used Variance inflation Factor (VIF) and tolerance to test for multicollinearity in the data. The rule of thumb is that VIF > 4.0 and tolerance and tolerance <0.20indicates multicollinearity problem in the analysis. Since the tolerance value of all the variables is greater than .20 and the VIF is less than 4.0, it implies that there is no multicollinearity problem (Hair et al., 2010).

Table 4.3: Test for Multicollinearity

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	4.215	.320		13.179	.000		
	Skills and Competence	-.125	.068	-.134	-1.844	.067	.837	1.194
	Training and Outreach	-.033	.060	-.039	-.552	.581	.905	1.105
	Financial Resources	.062	.069	.063	.898	.370	.901	1.109
	Policy and Regulations	-.122	.064	-.132	-1.906	.058	.920	1.087

a. Dependent Variable: Innovation

4.6.4 Testing for Homoscedasticity

As indicated on residual scatter plot (Figure 4.3) the variance of residuals is considered to be same for all predicted value of dependent variable which provided support of homoscedasticity. The residuals are randomly scattered around 0 (the horizontal line) providing a relatively even distribution. Heteroscedasticity is indicated when the residuals are not evenly scattered around the line. According to Osborne and Waters (2002), residuals should lie between -2 and/or +2 points. Therefore, the assumption of homoscedasticity in the analyses has been fulfilled in this study where all the residuals are within the recommended threshold.

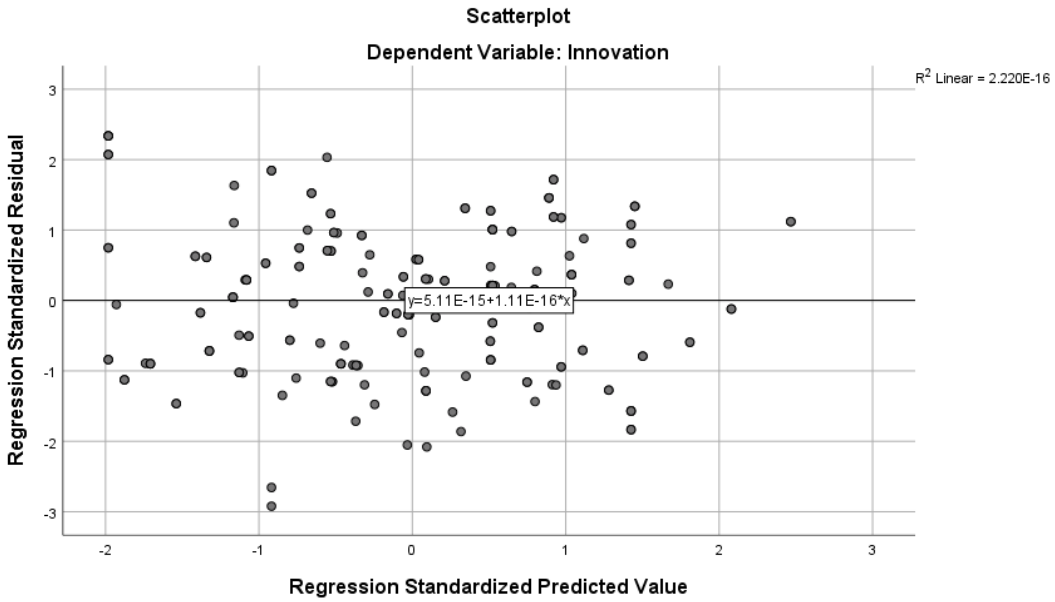


Figure 4.2: Scatterplot

4.7 Inferential Analysis

The study sought to establish the relationship between the variables under study and computed the following correlational and regression results.

4.8 Correlational Results

The study sought to establish the relationship between the independent variables. The study findings were as presented in table 4.8

The study findings indicated that policy and regulations had a relationship to all the other independent variables. There was a strong positive significant relationship between policy and regulation versus skills and competencies (p=0.000, β= 0.821), training and outreach (p = 0.001, β = 0.912) and access to financial resources (p = 0.000, β = 0888).

The results were implied that policy and regulation was a major precursor of the other three determinant of jua Kali artisan production on innovation of tools for maize

production. With the right policies and regulations in place it can be possible to positively and significantly influence access to financial resources by Jua Kali artisans, influence their training and outreach and their skills and competencies.

This results are supported by Karde (2018) who noted that the agricultural and industrial sector in Kenya is ailing from many policies which are not specific to the sector. He notes that there is a need to streamline the policies and regulations governing the sector to ensure that the needs of farmers and providers are well covered. This is will aid in ensuring providers such as the Jua Kali workers needs are addressed and provided for as would be described in the policy and regulation documents.

The study findings also indicated a relationship between training and outreach and the acquisition of skills and competencies by the Jua Kali artisans ($p = 0.002$, $\beta = 713$). This results are interpreted to mean that more teaching and outreach would lead to acquisition of the right skills and competencies by farmers on how to use the Jua Kali products. This is important as institutions such as the county governments have heavily invested in TVETs and other institutions to train the Jua Kali artisans in various locations/counties in Kenya.

Table 4.8: Correlation Results on Relationships between Independent Variables

Correlations

		Skills and Competencies	Training and Outreach	Access to Financial Resource	Policy and Regulation
Skills and Competencies	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	406			
Training and Outreach	Pearson Correlation	0.713**	1		
	Sig. (2-tailed)	0.002			
	N	406	406		
Access to Financial Resource	Pearson Correlation	0.006	0.032	1	
	Sig. (2-tailed)	0.931	0.660		
	N	406	406	406	
Policy and Regulation	Pearson Correlation	0.821**	0.912**	.888**	1
	Sig. (2-tailed)	0.000	0.001	0.000	
	N	406	406	406	406

**. Correlation is significant at the 0.01 level (2-tailed).

4.9 Multiple Linear Regression

The hierarchical multiple regression analysis was used in this study to test the hypotheses H01, H02, H03, and H04 (direct effects). According to Kothari (2004), regression is the process of determining a statistical relationship between two or more variables. This can involve a single variable or multiple variables. In the method of simple regression, there are two variables. One of these variables (which is defined as independent) is the factor that determines the behavior of the other variable (defined as dependent variable). The results of the multivariate regression analysis served as the basis for the testing of hypotheses.

4.9.1 Testing for Direct Effects

The coefficient between independent variables (skills and competences, training and outreach, financial resources, policy and regulation) and dependent variable (innovation) were calculated using a multiple linear regression analysis

4.9.1.1. Model Summary

Table 4.9 shows the results of the study's model. In the model, R^2 =.74 indicates that the total prediction of all factors explained approximately 7.4% of the total variance innovation. The ANOVA model demonstrated that the prediction of the independent variable, as indicated in Table, was statistically significant (F = 136.1, p=.000). This clearly demonstrates the existence of a strong association between the predictor variables and the dependent variable. The significance value is 0.000, which is less than 0.05, so the model is statistically significant in its ability to predict innovation. It also means that the independent variables influence the innovation of Jua Kali enterprises.

Table 4.9: Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.860[a]	0.74	0.735	0.2817

a. Predictors: (Constant), Policy and Regulations, Skills and Competencies, Training and Outreach, Access to Financial Resources

4.9.1.2 ANOVA Results for Multivariate Regression Analysis

The findings on Table of ANOVA revealed F-statistics of 136.1 with a p-value of 0.000 which was less than significance level of 0.05. The study hence concluded that the model used to link the independent variables to dependent variable had a good fitness. In this case the alternative hypothesis that the model had good fitness was accepted and concluded that determinants of production and process significantly predicated innovation tools by Jua Kali artisans

Table 4.9: Anova

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	43.205	4	10.801	136.116	.000[a]
	Residual	15.156	191	0.079		
	Total	58.361	195			

a. Predictors: (Constant), Policy and Regulations, Skills and Competencies, Training and Outreach, Access to Financial Resources

b. Dependent Variable: Innovation of Tools

Coefficients[a]

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	0.119	0.252		0.473	0.637
	Skills and Competencies	0.202	0.039	0.192	0.503	0.002
	Training and Outreach	0.154	0.041	0.143	1.302	0.000
	Access to Financial Resources	0.075	0.079	0.063	1.572	0.118
	Policy and Regulations	0.462	0.082	0.321	9.262	0.000

a. Dependent Variable: Innovation of Tools

4.9.1.3 Beta Coefficient Results

The findings indicated existence of a positive and significant relationship between skills and competences and innovation (β= 0.202 and p-value=0.002). The implication is that a unit increase in skills and competences led to an increase in innovation by 20.2%. Since the p-value was less than 0.05, the null hypothesis; which stated that there is no significant relationship between skills and competences and innovation of Jua Kali tools for maize processing in Trans Nzoia County was rejected and conclusion made that skills and competences had a significant effect on innovation.

The study findings further indicates that a positive and significant effect exists between training and outreach (β= 0.154 and p-value=0.000)and innovation implying that a unit increase in training and outreach led to an increase in innovation among Jua Kali artisans by 15.4%. Since the p-value was less than 0.05, the null hypothesis which stated that there is no significant relationship between training and outreach and innovation of Jua Kali tools for maize processing in Trans Nzoia County was rejected and conclusion made that training and outreach had a significant positive effect on innovation by Jua Kali artisans.

The study depicted an insignificant relationship between financial resources and innovation among Jua Kali artisans (β=0.075and p-value=0.118). It can then be concluded that a unit increase in financial resources led to a decrease in innovation by 7.5%. Since the p-value was more than 0.05, the null hypothesis which stated that there is no significant relationship between financial resources and innovation of Jua Kali tools for maize processing in Trans Nzoia County was upheld and conclusion made that financial resources had no effect on innovation by Jua Kali artisans.

The study findings further indicates that a positive and significant effect exists between policy and regulations and innovation (β=0.462and p-value=0.000) implying that a unit increase in tax knowledge awareness led to an increase in innovation among Jua Kali artisans by 46.2%.Since the p-value was less than 0.05, the null hypothesis which stated that there is no significant relationship between policy and regulations and innovation of Jua Kali tools for maize processing in Trans Nzoia County was rejected and conclusion made that policy and regulations had a significant positive effect on innovation by Jua Kali artisans.

The in the regression equation was equated as follows;

$Y=\beta_0 + \beta_1X_1+ \beta_2X_2 +\beta_3X_3+ \beta_4X_4+\varepsilon_i$

$Y=0.119+ 0.202X_1+ 0.154X_2 +0.075X_3+ 0.462X_4+\varepsilon_i$

Where:

x= The independent variables - X_1 = Skills and Competencies
X_2= Training and Outreach
X_3= Access to Financial Resources
X_3= Policy and Regulations

Y = The dependent variable (Innovation of Tools)

β = βeta

ε_i = Error Term

4.10 Hypothesis Testing

H_{01} of the study postulated that there is no significant relationship between skills and competences and innovation of Jua Kali tools for maize processing in Trans Nzoia County was rejected and conclusion made that skills and competences had a significant effect on innovation as depicted by bea and p- values (β= 0.202 and p-value=0.002)

H_{02} stated that there is no statistically significant effect between training and outreach and innovation of Jua Kali tools for maize processing in Trans Nzoia County was rejected and conclusion made that training and outreach had a significant positive effect on innovation by Jua Kali artisans(β= 0.154 and p-value=0.000).

H_{03} hypothesized that there is no statistically significant relationship between financial resources and innovation of Jua Kali tools for maize processing in Trans Nzoia County was upheld and conclusion made that financial resources had no effect on innovation by Jua Kali artisans(β=0.075and p-value=0.118).

H_{04} hypothesized that there is no statistically significant relationship between policy and regulations and innovation of Jua Kali tools for maize processing in Trans Nzoia County was rejected and conclusion made that policy and regulations had a significant positive effect on innovation by Jua Kali artisans(β=0.462and p-value=0.000)

CHAPTER FIVE

SUMMARY OF THE FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter sought to highlight the summary of findings, the conclusions of the study based on the research objectives and provide recommendations for the study.

5.2 Summary of Findings

On the skills and competencies of Jua Kali artisans, the study findings indicated that a majority of the respondents mean = 4.43, Std = 1.202 were of the opinion that they have knowledge in producing tool for maize processing. A further mean = 4.12, Std = 2.919 of the respondents were of the opinion that they have the ability to produce quality tools for maize processing, Mean = 3.870, Std = 0.867 were of the opinion that they attended a school to be taught on artisanship's to prepare products, Mean = 3.42, Std = 1.347 were of the opinion that they are experienced in producing tools for maize processing, Mean = 3.036, Std = 1.514 were of the opinion that customers have praised their work heavily for products sold and finally Mean= 2.89, Std = 1.501 were of the opinion that they have worked as an apprentice in a Jua Kali shop before producing various artifacts. The study results indicated that there was a significant relationship between skills and competences and innovation of Jua Kali tools for maize processing in Trans Nzoia County ($\beta = 0.192$, $p = 0.002$) and hence the null hypothesis was rejected. The alternative hypothesis was accepted ($p<0.05$).

In terms of training and outreach offered to Jua Kali artisans and from artisans to farmers, the study findings indicated that a majority of the respondents Mean = 4.29, Std =1.029 were of the opinion that farmers teach each other on how to use tools and technologies in maize farming, Mean = 4.15, Std = 1.122 of the respondents were of

the opinion that farmers carry out experimentation on the use of tools and technology in maize processing value chain, Mean = 4.01, Std = 0.934 of the respondents were of the opinion that farmers are taught how to use various tools and technology in maize processing value chain by demonstration, Mean = 3.69, Std = 1.141 of the respondents were of the opinion that farmers get field education from government and NGOs outreach programs on how to use our products, Mean = 3.07, Std =1.477 of the respondents were of the opinion that their products have a use manual which the farmers use and finally, Mean = 2.96, Std = 7.464 were of the opinion that Jua Kali artisans make time to go teach farmers on how to use our products. The study results indicated that there was a significant relationship between training and outreach and innovation of Jua Kali tools for maize processing in Trans Nzoia County ($\beta = 0.143$, $p = 0.000$) and hence the null hypothesis was rejected. The alternative hypothesis was accepted ($p<0.05$).

On the question of access to financial resources, the study findings indicated that a majority of the respondents Mean = 4.39, Std = 0.867 were of the opinion that the county has a kitty for us to help us operate and then return funds issued, Mean = 4.04, Std = 1.185 of the respondents were of the opinion that Government and NGOs provide financial support to us to make our products, Mean = 3.88, Std = 1.274 of the respondents were of the opinion that they can access loans from financial institution hence they have no financial challenges, Mean = 3.35, Std = 1.115 of the respondents were of the opinion that The region has well-wishers who sponsor the development of this products, Mean = 3.06, Std = 1.487 of the respondents were of the opinion that they earn a lot of profit therefore they do not have financial challenges and finally, Mean = 3.05, Std = 1.485 of the respondents were of the opinion that their products are made once a customer pays a specified amount so that we get operational funds.

The study results indicated that there was no significant relationship between access to financial resources and innovation of Jua Kali tools for maize processing in Trans Nzoia County ($\beta = 0.063$, $p = 0.118$) and hence the null hypothesis was accepted. ($p>0.05$)

On the objective of policy and regulations for Jua Kali Sector, the study findings indicated that a majority of the respondents of the respondents, Mean = 4.34, Std = 1.146 were of the opinion that they price their products expensively due to high tax from government, Mean = 4.31, Std = 0.853 of the respondents were of the opinion that the county and national government have invested a lot in training artisans, Mean = 4.22, Std =1.127 of the respondents were of the opinion that there are many manufactured imports substitutes for our products, Mean = 3.49, Std = 1.534 of the respondents were of the opinion that business licensing is at its highest making cost of business high, Mean = 3.3, Std = 1.098 of the respondents were of the opinion that there are policies to assist us access credit at any MFI and finally, Mean = 3.23, Std= 1.52 of the respondents were of the opinion that the county and national government assists us market our products. The study results indicated that there was a significant relationship between policy and regulations and innovation of Jua Kali tools for maize processing in Trans Nzoia County ($\beta = 0.321$, $p = 0.000$) and hence the null hypothesis was rejected. The alternative hypothesis was accepted ($p<0.05$).

AS pertains the innovation of tools by Jua Kali Artisans, the study findings indicated that a majority of the respondents, Mean = 4.31, Std = 1.071 were of the opinion that Jua Kali tools are designed in a variety of shapes, qualities and functionalities for all farmers, Mean = 4.25, Std = 0.923 were of the opinion that tools developed by Jua Kali are long lasting and safe, Mean = 4.06, Std = 1.365 were of the opinion that tools developed are very useful in maize processing value chain, Mean = 3.31, Std = 1.529

of the respondents were of the opinion that Jua Kali tools are more common among rural farmers markets compared to other imported tools, Mean = 3.28, Std = 1.578 of the respondents were of the opinion that Jua Kali products utility is higher compared to manufactured tools and finally Mean = 3.30, Std = 1.097 of the respondents were of the opinion tools developed by Jua Kali are easier to handle. The study findings indicated that policy and regulations had a relationship to all the other independent variables. There was a strong positive significant relationship between policy and regulation versus skills and competencies ($p=0.000$, $\beta= 0.821$), training and outreach ($p = 0.001$, $\beta = 0.912$) and access to financial resources ($p = 0.000$, $\beta = 0888$). The study findings also indicated a relationship between training and outreach and the acquisition of skills and competencies by the Jua Kali artisans ($p = 0.002$, $\beta= 713$). The study results indicated that there was a significant relationship between policy and regulations and innovation of Jua Kali tools for maize processing in Trans Nzoia County ($p = 0.000$) and hence the null hypothesis was rejected. The alternative hypothesis was accepted ($p<0.05$).

The study findings noted that policy and regulation had the greatest cumulative effect of innovativeness of the Jua Kali artisans at 46.2% followed by skills and competencies at 20.2%, training and outreach at 15.4% and finally access to financial resources at 7.5%.

5.3 Conclusion

The study concluded that the development of skills and competencies occur in a conducive environment. It is related to a set of goals, specifically to the creation and maintenance of a well-trained, flexible, and motivated manufacturing workforce, comprising prospective workers as well as current workers at all conventional levels, including technical professionals and managers, mid-level technicians, and shop floor

personnel. For the workers to have this required level of skill and competence as indicated in the study means that they must have gone through some form of training. As a result a majority of the Jua Kali artisans find themselves with the required level of skill and competence to perform tasks required of them for example producing jua kali products for maize processing.

On training and outreach, the study concluded that farmers teach each other on how to use tools and technologies in maize farming were interpreted to mean that there is little training or no outreach happening to farmers to equip them with the right knowledge to know how to use the Jua kali equipment's that they are in possession of. This meant that some could be using the tools in a wrong manner or in a less productive manner. This situation could be a major contributor to their inability to see the full benefits of the Jua Kali products.

In terms of accessing financial resources, the study concluded that the county has a kitty for us to help Jua Kali artisans operate and then return funds issued was interpreted to mean that financial institutions have been reluctant to serve the sector despite the importance of the sector hence the county has had to take over this role. Low population density and large geographical dispersion of clients in rural areas make it difficult for banks to operate at a profitable scale. The lack of financial institutions branches has translated in a limited provision of saving, insurance and credit products to farmers and agribusinesses. A second factor inhibiting financial institutions from serving the sector has to do with the systemic risk characterizing agricultural activities. When natural hazards or adverse weather conditions take place, they typically affect a large number of farmers and firms simultaneously, making it more challenging for financial providers to diversify their portfolio of clients, since when one client fails to pay, many others will be in the same situation. This problem

is aggravated by the paternalistic behavior or political motives that governments may have.

The study also in relation to policy and regulations relating to the industry concluded that there are high taxes on their products on their products were interpreted to mean that lack of efficient tax policies was one of the main reasons why the Jua Kali artisans were not able to make affordable Jua Kali products which could be bought by maize farmers to assist them in maize processing. The study findings therefore point to a need by both the county and the national government to make policies that regulate the amount of taxes paid by the Jua Kali workers for their products.

On innovativeness of the Jua Kali Industry the study concluded that there are numerous Jua Kali ventures in the county employing many unemployed youth and as a result creativity and innovation is growing leading to many agricultural tools that can support agriculture for example maize processing. This variety is an indication of the level of creativity associated with the industry and also an indication of the number of employment rate created by the industry as more and more youthful persons engage in the sector.

The results overall concluded that policy and regulation was a major precursor of the other three determinant of jua Kali artisan production on innovation of tools for maize production. With the right policies and regulations in place it can be possible to positively and significantly influence access to financial resources by Jua Kali artisans, influence their training and outreach and their skills and competencies. Training was also shown to impact the skills and competencies. Policy and regulation however had the greatest effect on innovativeness of Jua Kali artisans.

5.4 Recommendations for the Study

The study made the following research recommendations

i. County governments and national governments should continue providing TVETs, bursaries and other forms of support to technical institutions in counties to ensure that the TVETs are able to enroll, train and graduate as many youths with special skills and with the required competency levels to address community problems to help them be self-employed.

ii. The County governments in collaboration with Jua Kali Unions should work to train farmers by creating awareness on the kinds of products they produce to help them in maize processing and also train them on the usage of these resources so as to increase the visibility of these Jua Kali products

iii. The government through the ministry of agriculture at both the county and National Government level should work to ensure that Jua Kali artisans are registered in unions and can access loans from MFI operating in their local locations. This can also be done by inviting more financial institutions to partner with the local and national governments to provide loans to these groups of artisans

iv. There is a need for legislators at the county and National Government level to rework on industrial and agricultural policies to prioritize marketing of Jua Kali products, training of Jua Kali artisans, taxation and licensing Jua Kali artisans businesses and the access of credit by the Jua Kali artisans

5.5 Suggestions for Further Studies

The study made the following recommendations as suggestions for further studies;

A study be conducted to evaluate the moderating role of policy and regulations on the relationship between Jua Kali artisan venture challenges and productivity

An evaluation of the role of county governments in supporting the Jua Kali sector in Kenya be conducted with an aim of recommending measures for intervention

REFERENCES

Abor, J., & Quartey, P. (2014). Issues in SME development in Ghana and South Africa. *International Research Journal of Finance and Economics*, *39*(6), 215-228

Achola K. (2016). Challenges to Industrialization and manufacturing in Kenya. *International Research Journal of Finance and Economics 41*(5), 201-244.

Al-Zamily R & Al-Hakim S (2015). Research on deep frying of foods II Organoleptic and storage properties of deep fried potato chips in local commercial fats and oil. *Iraqui J Agri Sci Zanco* 6(2):157-169

Atinafu DG& Bedemo B (2014) *Estimation of total free fatty acid and cholesterol content in some commercial edible oils in Ethiopia*, Bahir DAR. J Cereals Oilseeds2: 71-76

Baines, R. N., Manning, L., & Soon, J. M. (2016). Mycotoxin incidents associated with cereals: lessons learnt and risk reduction strategies. *Quality Assurance and Safety of Crops & Foods*, *10*(1), 1-16.

Barreau C., Deschamps A. & Richard-Forget F. (2014). Impact of Pediococcus pentosaceus strain L006 and its metabolites on fumonisin biosynthesis by Fusarium verticillioides. *Food Control* 23:405–411.

Belewu MA, Belewu KY (2017).Comparative Physico-Chemical evaluation of tiger-nut, soybean and coconut milk sources. *Int J Agri Biol* 5: 785-787

Bentler, P. M., & Bonnett, D. G. (2014). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, *88*(3), 588-605.

Boehlje, M. and B. Erickson (2015). "Farm Consolidation and Market Integration: Will Crop Production Follow Livestock's Lead?" Top Crop Farmer Workshop Newsletter, Purdue University.

Boehlje, M., S. Hoffing, and R. Schroeder (2014). "Farming in the 21st Century." Dept. of AgriEcon., Purdue University Staff paper #99-9.

Boehlje, M., T. Doehring, and S. Sonka (2016). "Farmers of the Future: Market Segmentation and Buying Behavior." International Food and Agribusiness Management Review. 8(2005)3: 52-68.

Boskou G, Salta FN, Chiou A, Troullidou E, Andrikopoulos NK (2016) Content of trans, trans-2,4-decadienal indeep-fried and pan-fried potatoes. European J Lipid

Botvin, G. J. (2016). *Preventing adolescent drug abuse through Life Skills Training: Theory, methods and effectiveness*. In J. Crane (Ed.), *Social programs that really work* (pp. 225-257).

Bouchon P (2016). *Understanding oil absorption during deep - fat frying*. Advanced in Food Nutri Res 57: 209 - 34

Calado T., Venâncio A., & Abrunhosa L., (2016). *Irradiation for mold and mycotoxin control: a review. Compr* Rev Food Sci Food 13:1049–1061.

Carbone I., Hellmich R., Munkvold G., Paul P., Payne G. & Takle E. (2013). *Climate change impacts on mycotoxin risks in US maize*. World Mycotoxin J 4:79–93.

Carlos C. & Etcheverry M. (2013). Field studies on the relationship between Fusarium verticillioides and Maize (*Zea mays L.*): effect of biocontrol agents on fungal infection and toxin content of grains at harvest. *Int J Agron* 2011:486914.

Choudhary NM, Rajgopal MV, Ray SP & Mudhambi SP (2013). *Effect of incorporating papad khar (crude sodium carbonate) in papad doughs on the physico-chemical properties of the frying medium.* J Food Sci Technol

Chulze S.N. (2016). *Strategies to reduce mycotoxin levels in maize during storage: a review.Food Addit Contam Part A Chem Anal Control Expo Risk Assess* 27(5):651–657.

Citizen, (2014). (www.thecitizen.co.tz). *Maize production in Kilolo District, Iringa Region*. Website Visited 20 August 2012.

Clarke, B. & Rottger, A.(2016). *Small Mills in Africathe mamian r. Agricultural and Food Engineering Working Document* No. 5. Food and Agriculture Organization of the United Nations, Rome. Crop Life.

Dalcero A., Ramos A.J.& Marín S. (2014). *Modelling the effect of temperature and water activity of Aspergillus flavus isolates from corn*. Int J Food Microbiol 156:60–67.

Dusenbury, L., Baker, E., James-Ortiz, S., Botvin, E. M., & Kerner, J. (2014). Smoking prevention among urban minority youth: Assessing effects on outcome and mediating variables. *Health Psychology*, *11*, 290-299.

Dusenbury, L., Botvin, E. M., & Diaz, T. (2013). *Long-term follow-up results of a randomized drug abuse prevention trial in a white middle-class population. JAMA*, *273*, 1106-1112.

Gelderblom W.C., Botha A. & van Zyl W.H. (2013). *Degradation of aflatoxin B (1) by fungal laccase enzymes.* Int J Food Microbiol 135:47–52.

Ghazali H.M. & Radu S. (2014). Modelling the effect of water activity and temperature on growth rate and aflatoxin production by two isolates of Aspergillus flavus on paddy. *J Appl Microbiol* 111:1262–1274.

Groote, H., Narrod, C., Kimenju, S. C., Bett, C., Scott, R. P., Tiongco, M. M., &Gitonga, Z. M. (2016). Measuring rural consumers' willingness to pay for quality labels using experimental auctions: the case of aflatoxin-free maize in Kenya. *Agricultural economics Journal*, *47*(1), 33-45.

Hack DM, Bordi PL Jr & Hessert SW Jr (2016). Nutrition, sensory evaluation, and performance analysis of hydrogenated frying oils. *International Journal Food Sci Nutr* 60: 647-651.

Haidukowski et al., (2015). Effect of fungicides on the development of Fusarium head blight, yield and deoxynivalenol accumulation in wheat inoculated under field conditions with Fusarium graminearum and Fusarium culmorum. *Journal of the Science of Food and Agriculture*, 85, 191–198.

Haidukowski et al., (2015). Effect of fungicides on the development of Fusarium head blight, yield and deoxynivalenol accumulation in wheat inoculated under field conditions with Fusarium graminearum and Fusarium culmorum. *Journal of the Science of Food and Agriculture*, 85, 191–198.

Heasman, M., & Lang, T. (2015). *Food wars: the global battle for mouths, minds and markets*. Routledge.

Hell K. & Mutegi C. (2013). *Aflatoxin control and prevention strategies in key crops of Sub-Saharan Africa.* Afr J Microbiol Res 4:459–466.

Isakson, S. R. (2014). Food and finance: The financial transformation of agro-food supply chains. *Journal of Peasant Studies*, *41*(5), 749-775.

Kelley R.Y.& Williams W.P., (2015). Identification of maize genes associated with host plant resistance or susceptibility to *Aspergillus flavus* infection and aflatoxin accumulation. PLoS One 7(5), e36892.

Kiaya, V. (2014). Post-harvest losses and strategies to reduce them. *Technical Paper on Postharvest Losses, Action Contre la Faim (ACF)*.

Kimenju, S. & De Groote, H.(2013). *Economic Analysis of Alternative Maize Storage Technologies in Kenya*, 3rdInternational Conference of the African Association of Agricultural Economists, 19 —23 September 2010, Cape Town, South Africa. International Maize and Wheat improvement Centre (CIMMYT),

Klich, M., & Leslie, J. F. (2014). Identification of Toxigenic Aspergillus and Fusarium Species in the Maize Grain Chain. *Mycotoxin Reduction in Grain Chains*, 11.

Koudande D.O., Mensah G.A., Sanni A. & Brimer L. (2013). *A review on aflatoxin contamination and its implications in the developing world: a sub-Saharan African perspective.* Crit Rev Food Sci Nutr 53(40):349–365.

Lee, H. B., Patriarca, A., & Magan, N. (2015). Alternaria in food: ecophysiology, mycotoxin production and toxicology. *Mycobiology*, *43*(2), 93-106.

Ma J.J., Shao B., Lin X.H., Yu H.X.& Li F.Q. (2015). *Study on the natural occurrence of multi-mycotoxin in cereal and cereal-based product samples collected*

Ma Q.G., & Zhang H.Y. (2014). *Occurrence of mycotoxins in feed ingredients and complete feeds obtained from the Beijing region of China.* J Anim Sci Biotechnol 5:37.

Machara K (2015). Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. Info. Syst. Res. 2(3): 173-191.

Makini, F. W., Kamau, G. M., Mose, L. O., Ongala, J., Salasya, B., Mulinge, W. W., & Makelo, M. (2017). Status, Challenges, and Prospects of Agricultural Mechanisation in Kenya: The case of Rice and Banana value chains. *FARA Research Results*, *1*(2), 24.

Maloba, W. O. (2017). Defending Kenya: Looking from Within. In *The Anatomy of Neo-Colonialism in Kenya* (pp. 149-213). Palgrave Macmillan, Cham.

Miller, J. D. (2016). Mycotoxins in Food and Feed: A Challenge for the Twenty-First Century. In *Biology of Microfungi* (pp. 469-493). Springer, Cham.

Mutula, S.M., & Brakel, P.V. (2016). E-readiness of SMEs in the ICT sector in Botswana with respect to information access. *The Electronic Library*, 24(3), 402-417.

Mutungi, C., Sanginga, P., &Borgemeister, C. (2015). Unpacking postharvest losses in sub-Saharan Africa: a meta-analysis. *World Development*, *66*, 49-68.

Osano, L., Kinyua, A., Maji, E. & Messerman, K. (2014).*Kibuye Market; Indigenous Economy and Social Space in Western Kenya's Largest Open-Air Market.*

Patel, S. V., Bosamia, T. C., Bhalani, H. N., Singh, P., & Kumar, A. (2015). Aflatoxins: Causes & Effects. *Journal of Agricultural and Biological Sciences*, *13*(9), 140-141.

Prokopy, L. S., Morton, L. W., Arbuckle Jr, J. G., Mase, A. S., & Wilke, A. K. (2015). Agricultural stakeholder views on climate change: implications for conducting research and outreach. *Bulletin of the American Meteorological Society*, *96*(2), 181-190.

Raspantini P.F., Raspantini L.R., Latorre A.O. & Górniak S.L. (2014). *Zearalenone, an estrogenic mycotoxin, is an immunotoxic compound.* Toxins 6(3):1080–1095.

Sarosa, S., and Zowghi, D. (2013). *Strategy for adopting information technology for SMEs: Experience in adopting email within an Indonesian furniture company. Electronic Journal of Information Systems Evaluation, 6(2), 165-176.*

Sheahan, M., & Barrett, C. B. (2017). Food loss and waste in Sub-Saharan Africa: A critical review. *Food Policy*, *70*, 1-12.

Subrahmanyam S. & Piletsky S.A. (2013). *Analytical methods for determination of mycotoxins: a review.* Anal Chim Acta 632(2):168–180.

Tan CP, Hamed M, Che Man YB (2013) *Effect of frying process on fatty acid composition and iodine value of selected vegetable oils and their blends*. Int

Thorpe, J., & Maestre, M. (2015). Brokering development: enabling factors for public-private-producer partnerships in agricultural value chains.

Vekiru E., Krska R., Schatzmayr G., Moll W.D.& Grabherr R. (2014). *Degradation of fumonisin B1 by the consecutive action of two bacterial enzymes. J Biotechnol* 145:120–129.

Voss K.A., Smith G.W. & Haschek W.M. (2017). *Fumonisins: toxicokinetics, mechanism of action and toxicity.* Anim Feed Sci Technol 137:299–325.

Wang W., Shao B., Zhu J.H., Yu H.X. & Li F.Q. (2014). *Dietary exposure assessment of some important Fusarium toxins in cereal-based products in China.* J Hyg Res 39(6):709–714.

Weaver M.A., Ehrlich K.C., Scharfenstein L.L.& Cotty P.J. (2015).*Identification of genetic defects in the atoxigenic biocontrol strain Aspergillus flavus K49 reveals the presence of a competitive recombinant group in field populations.* Int J Food Microbiol 154:192–196.

Yin Y.L., Huang R.L., Ruan Z., Zhou T., & Xie M.Y. (2015). *Occurrence of mycotoxins in feeds and feed ingredients in China*. *J Food Agric Environ* 9(2):163–167.

APPENDICES

Appendix I: Questionnaire for Jua Kali Artisans

I am conducting research on **THE DETERMINANTS OF JUA KALI ARTISANS PRODUCTION ON THE INNOVATION OF TOOLS FOR MAIZE PROCESSING IN TRANS-NZOIA COUNTY, KENYA.** I kindly request you to participate in my study and your responses to the items in the questionnaire will be treated with utmost confidentiality, and will not be used for any other purposes except this study. The questionnaire is made up of two sections A and B.

SECTION A: BACKGROUND INFORMATION

1. What is your Gender?

   Male [ ] Female [ ]

2. Your age in years (Please tick as appropriate)

   20-24 years [ ]

   25-29 years [ ]

   30-34 years [ ]

   40-44 years [ ]

   45-49 years [ ]

   Above 50 years [ ]

3. What is your level of education?

   Primary level [ ]

   Secondary level [ ]

   Certificate level [ ]

   Diploma level [ ]

4. How long have you worked in Jua kali Industry?

   Below 3 years [ ]

   3-5 years [ ]

   5-8 years [ ]

   Over 9 years [ ]

SECTION B

5. How skills and competences influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.

Key: 5 – Strongly Agree, 4 – Agree, 3 – Undecided, 2 – Disagree, 1 – Strongly Disagree

Statements	**1**	**2**	**3**	**4**	**5**
We have knowledge in producing tool for maize processing					
We are experienced in producing tools for maize processing					
We have the ability to produce quality tools for maize processing					
I attended a school to be taught on artisanship's to prepare products					
I have worked as an apprentice in a Jua Kali shop before producing various artifacts					
My customers have praised my work heavily for products sold					

Any other Specify

……
……
……..

6. How training and outreach influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.

Key: 5 – Strongly Agree, 4 – Agree, 3 – Undecided, 2 – Disagree, 1 – Strongly Disagree

Statements	**1**	**2**	**3**	**4**	**5**
Farmers get field education from government and NGOs outreach programs on how to use our products					
Farmers are taught how to use various tools and technology in maize processing value chain by demonstration.					
Farmers carry out experimentation on the use of tools and technology in maize processing value chain.					
Farmers teach each other on how to use tools and technologies in maize farming					
We make time to go teach farmers on how to use our products					
Our products have a use manual which the farmers use					

Any other Specify

……
……
……..

7. How access to financial resources influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.

Key: 5 – Strongly Agree, 4 – Agree, 3 – Undecided, 2 – Disagree, 1 – Strongly Disagree

Statements	**1**	**2**	**3**	**4**	**5**
We can access loans from financial institution hence they have no financial challenges					
Government and NGOs provide financial support to us to make our products					
We earn a lot of profit therefore they do not have financial challenges.					
Our products are made once a customer pays a specified amount so that we get operational funds					
The county has a kitty for us to help us operate and then return funds issued					
The region has well-wishers who sponsor the development of this products					

Any other Specify

……

……

……..

8. How policies and regulations influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.

Key: 5 – Strongly Agree, 4 – Agree, 3 – Undecided, 2 – Disagree, 1 – Strongly Disagree

Statements	**1**	**2**	**3**	**4**	**5**
We price our products expensively due to high tax from government					
There are many manufactured imports substitutes for our products					
Business licensing is at its highest making cost of business high					
The county and national government assists us market our products					
The county and national government have invested a lot in training artisans					
There are policies to assist us access credit at any MFI					

Any other Specify

……

……

Section C: Dependent Variable

9. Kindly rate the extent to which you agree with the following statements on innovation of Jua Kali tools for maize processing in Trans Nzoia County.

Key: 5 – Strongly Agree, 4 – Agree, 3 – Undecided, 2 – Disagree, 1 – Strongly Disagree

Statements	**1**	**2**	**3**	**4**	**5**
Tools developed are very useful in maize processing value chain					
Jua Kali tools are designed in a variety of shapes, qualities and functionalities for all farmers					
Jua Kali products utility is higher compared to manufactured tools					
Jua Kali tools are more common among rural farmers markets compared to other imported tools					
Tools developed by Jua Kali are long lasting and safe					
Tools developed by Jua Kali are easier to handle					

Any other Specify

……

……

……..

Appendix II: Questionnaire for Farmers

I am conducting research on **THE DETERMINATION OF JUA KALI INNOVATION ON AVAILABILITY OF TOOLS AND TECHNOLOGY FOR MAIZE PROCESSING VALUE CHAIN IN TRANSNZOIA COUNTY.** I kindly request you to participate in my study and your responses to the items in the questionnaire will be treated with utmost confidentiality, and will not be used for any other purposes except this study. The questionnaire is made up of two sections A and B.

SECTION A: BACKGROUND INFORMATION

1. What is your Gender?

Male [ ] Female [ ]

2. Your age in years (Please tick as appropriate)

20-24 years [ ]

25-29 years [ ]

30-34 years [ ]

40-44 years [ ]

45-49 years [ ]

Above 50 years [ ]

3. What is your level of education?

Primary level [ ]

Secondary level [ ]

Certificate level [ ]

Diploma level [ ]

4. How long have have you been a farmer?

Below 3 years [ ]

3-5 years [ ]

5-8 years [ ]

Over 9 years [ ]

SECTION B

5. How skills and competences influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.

Statements	**Yes**	**No**
Artisans have knowledge in producing tool for maize processing		
Artisans are experienced in producing tools for maize processing		
Artisans have the ability to produce quality tools for maize processing		
Artisans have attended a school to be taught on artisanship's to prepare products		
Artisans have worked as an apprentice in a Jua Kali shop before producing various artifacts		
We have praised artisans work heavily for products sold		

6. How training and outreach influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.

Key: 5 – Strongly Agree, 4 – Agree, 3 – Undecided, 2 – Disagree, 1 – Strongly Disagree

Statements	**Yes**	**No**
Farmers get field education from government and NGOs outreach programs on how to use our products		
Farmers are taught how to use various tools and technology in maize processing value chain by demonstration.		
Farmers carry out experimentation on the use of tools and technology in maize processing value chain.		
Farmers teach each other on how to use tools and technologies in maize farming		
We make time to go teach farmers on how to use our products		
Our products have a use manual which the farmers use		

7. How access to financial resources influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.

Statements	**1**	**2**
Artisans can access loans from financial institution hence they have no financial challenges		
Government and NGOs provide financial support to Artisans to make our products		
Artisans earn a lot of profit therefore they do not have financial challenges.		
Artisans products are made once a customer pays a specified amount so that we get operational funds		
The county has a kitty for us to help Artisans operate and then return funds issued		
The region has well-wishers who sponsor the development of this products		

8. How policies and regulations influence innovation of Jua Kali tools for maize processing in Trans Nzoia County.

Key: 5 – Strongly Agree, 4 – Agree, 3 – Undecided, 2 – Disagree, 1 – Strongly Disagree

Statements	**Yes**	**No**
Artisans price their products expensively due to high tax from government		
There are many manufactured imports substitutes for Jua Kali products		
Business licensing for Jua Kali is at its highest making cost of business high		
The county and national government assists Jua Kali market their products		
The county and national government have invested a lot in training artisans		
There are policies to assist Jua Kali access credit at any MFI		

Section C: Dependent Variable

9. Kindly rate the extent to which you agree with the following statements on innovation of Jua Kali tools for maize processing in Trans Nzoia County.

Statements	**Yes**	**No**
Tools developed are very useful in maize processing value chain		
Jua Kali tools are designed in a variety of shapes, qualities and functionalities for all farmers		
Jua Kali products utility is higher compared to manufactured tools		
Jua Kali tools are more common among rural farmers markets compared to other imported tools		
Tools developed by Jua Kali are long lasting and safe		
Tools developed by Jua Kali are easier to handle		