

**FACTORS INFLUENCING SMALLHOLDER FARMERS' DECISION TO USE  
QUALITY SEED OF IMPROVED COMMON BEAN VARIETIES IN TANZANIA**

**JOSHUA SAMWEL KIDUDU**

**A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE  
DEGREE OF DOCTOR OF PHILOSOPHY OF SOKOINE UNIVERSITY OF  
AGRICULTURE. MOROGORO, TANZANIA**

**2019**

## **EXTENDED ABSTRACT**

This study was done in Iringa, Kigoma, Kilimanjaro, Manyara, Mbeya, Morogoro and Njombe regions, which represented major common beans producing regions in Western/Great Lakes, Northern, Southern and Eastern Zones. The study assessed the factors that influence smallholder farmers' decision to use quality seed of improved common bean varieties in Tanzania. Specifically, the study sought to: (1) Determine smallholder farmers' beliefs about quality seed of improved common bean varieties. (2) Determine attributes preferred by smallholder farmers in improved common bean varieties. (3) Examine smallholder farmers' knowledge about quality seed of improved common bean varieties. (4) Evaluate smallholder farmers' attitude towards quality seed of improved common bean varieties, and (5) Assess smallholder farmers' intention of using quality seed of improved common bean varieties. A serial cross-sectional research design with three-phases of data collection was employed. In the first phase, an elicitation study was conducted to determine smallholder farmers' beliefs about quality seed of improved common bean varieties. In this stage, data were collected in October 2016. The second phase was carried out in 2017, data were collected in three stages namely market, field, and cooking preference tests to determine attributes, which were preferred by smallholder farmers at flowering, maturity, harvesting, marketing, and consumption stages. The third phase was done in 2018, and involved a survey of the respondents to assess their knowledge, attitude toward and the intention of using quality seed of improved common bean varieties.

Questionnaire, focus group discussions, key informant interviews, and observation were used to collect data from a representative sample of farmers, extension workers, and stockists. Quantitative data were analyzed using the Statistical Package for Social

Sciences (SPSS), while content and thematic analyses were used for analysis of qualitative data. These analyses aimed at examining if beliefs, attitude, subjective norm, and perceived behavioural control influenced the respondents' decision to use quality seed of improved common bean varieties. Moreover, the analyses sought to examine the influence of intention and perceived behavioural control on actual use of the seeds. The analyses also determined if the respondents preferred quality seeds, and whether they had adequate knowledge to use quality seeds of improved common bean varieties.

The results showed that farmers' decision of using quality seed of improved common bean varieties was influenced by various behavioural, normative and control beliefs. Generally, smallholder farmers had weak to moderate positive attitudes toward quality seeds of improved common bean varieties. Additionally, smallholder farmers experienced weak to moderate social pressure on using quality seed of improved common bean varieties. Furthermore, smallholder farmers had a feeling of lacking or having very weak control over the use of quality seed of improved common bean varieties. These beliefs emanated from the fact that quality seeds of improved common bean varieties are not available, smallholder farmers had low income, produces from improved varieties had low market potential, there was inadequate extension services, and associated inputs had high costs among others.

These behavioural, normative, and control beliefs significantly influenced smallholder farmers' attitude ( $\beta = 0.583$ ;  $p \leq 0.001$ ), subjective norm ( $\beta = 0.121$ ;  $p \leq 0.05$ ), and perceived behavioural control ( $\beta = -0.141$ ;  $p \leq 0.05$ ) respectively. The results further indicated that smallholder farmers' attitude, subjective norm, and perceived behavioural control significantly influenced their intention to use quality seed at ( $\beta = 0.448$ ,  $p \leq 0.001$ ;  $\beta = 0.110$ ,  $p \leq 0.05$ ; and  $\beta = 0.164$ ,  $p \leq 0.001$ ) respectively. Moreover, the study found

that smallholder farmers' preferences, knowledge and perceived behavioural control statistically significantly influenced their actual quality seed use practices at ( $\beta = 0.593$ ,  $p \leq 0.001$ ;  $\beta = 0.530$ ,  $p \leq 0.001$ ; and  $\beta = 0.157$ ;  $p \leq 0.01$ ) respectively. Furthermore, smallholder farmers' sex, marital status, household size, and the number of acres grown to common beans significantly influenced actual use of quality seed at ( $\beta = 0.199$ ,  $p \leq 0.001$ ;  $\beta = 0.128$ ,  $p \leq 0.01$ ;  $\beta = -0.125$ ,  $p \leq 0.05$ ; and  $\beta = 0.219$ ,  $p \leq 0.001$ ) respectively.

It is then concluded that beliefs, preferred attributes, knowledge, attitude and intention vary considerably among smallholder farmers. Hence, the study, recommends that the efforts aimed at increasing the use of quality seed should address beliefs, attributes preferred, awareness creation and knowledge provision on quality seed. Smallholder farmers should be empowered to build their ability to acquire and confidence to use quality seed of improved common bean varieties.

**Key words:** Common beans, Improved common bean varieties, Quality seed of improved common bean varieties, beliefs, preferences, knowledge, attitude, perceived behavioural control, intention

## DECLARATION

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

---

Joshua Kidudu Samwel  
**(PhD Candidate)**

---

Date

The above declaration is confirmed by;

---

Prof. Dismas L. Mwaseba  
**(Supervisor)**

---

Date

---

Prof. Susan Nchimbi-Msolla  
**(Supervisor)**

---

Date

**COPYRIGHT**

No part of this thesis may be reproduced, stored in any retrieval system, or transmitted in any form or by any means without prior written permission of the author or Sokoine University of Agriculture in that behalf.

## **ACKNOWLEDGEMENTS**

First, I wish to thank the Almighty God for many blessings in my life. I also owe thanks to the Sokoine University of Agriculture, which granted me a study leave during the four years of my PhD programme. I am grateful to Kirkhouse Trust for financing this study. I wish to give my heartfelt thanks to my supervisors Prof. Dismas L. Mwaseba of the Department of Agricultural Extension and Community Development, College of Agriculture, Sokoine University of Agriculture (SUA) and Prof. Susan Nhimbi-Msolla of the Department of Crop Science and Horticulture, College of Agriculture, Sokoine University of Agriculture (SUA). Their encouragement and support were very useful for me to undertake this PhD programme.

My sincere appreciation goes to all staffs in the Department of Agricultural Extension and Community Development for their kindness, readiness to listen, help and give advice whenever I consulted them. My heartfelt thanks go to Agricultural Extension Officers, stockists and smallholder farmers in all the study Districts and Villages who participated in the study. Their contribution and hospitality are highly appreciated.

I wish to convey my sincere gratitude to my parents, brothers and sisters who have always prayed and wished me good health and luck throughout this period. Finally, I am deeply indebted to my loving wife Regina, my sons Samwel, Alex and Godcan and my daughters Daines and Neema for their encouragement, support, and understanding of my absence from home when I was pursuing the PhD programme.

**DEDICATION**

This work is dedicated to my late beloved father Samwel Kidudu Bhitita who passed away before the dreams of this work could come true; to my loving wife Regina and my children for their love and tireless support and understanding of my absence from home.



## TABLE OF CONTENTS

<b><i>EXTENDED ABSTRACT</i></b> .....	ii
<b><i>DECLARATION</i></b> .....	v
<b><i>COPYRIGHT</i></b> .....	vi
<b><i>ACKNOWLEDGEMENTS</i></b> .....	vii
<b><i>DEDICATION</i></b> .....	viii
<b><i>TABLE OF CONTENTS</i></b> .....	ix
LIST OF TABLES.....	xv
LIST OF FIGURES.....	xix
<b><i>LIST OF APPENDICES</i></b> .....	xx
<b><i>LIST OF ABBREVIATIONS AND ACRONYMS</i></b> .....	xxi
<b><i>CHAPTER ONE</i></b> .....	1
1.0 General Introduction.....	1
1.1 Background Information.....	1
1.2 Problem Statement.....	5
1.3 Justification of the Study.....	6
1.4 Objectives.....	6
1.4.1 Overall objective.....	6
1.4.2 Specific objectives.....	6
1.5 Research Questions.....	7
1.6 Theoretical Framework on Diffusion and Adoption of Agricultural Technologies....	7
1.7 Conceptual Framework for Smallholder Farmers’ Decision to Use Quality Seed of Improved Common Bean Varieties.....	10
1.7.1 Behavioural beliefs.....	13

1.7.2	Attitudes.....	13
1.7.3	Normative beliefs.....	13
1.7.4	Subjective norms.....	14
1.7.5	Control beliefs.....	14
1.7.6	Perceived behavioural control.....	14
1.7.7	Behavioural intention.....	15
1.8	Organization of the Thesis.....	15
1.9	Study Limitations.....	16
1.10	References.....	17
 <b>CHAPTER TWO.....</b>		<b>27</b>
<b>2.0</b>	<b><i>Smallholder Farmers' Beliefs on Quality Seeds of Improved Common Bean Varieties in Tanzania</i>.....</b>	<b>27</b>
2.1	Abstract.....	27
2.2	Introduction.....	28
2.3	Methodology.....	30
2.4	Results and Discussions.....	34
2.4.1	Behavioural beliefs.....	34
2.4.1.1	Attitude resulting from behavioural beliefs.....	37
2.4.1.2	The influence of behavioural beliefs on attitude.....	38
2.4.2	Normative beliefs.....	39
2.4.2.1	Subjective norm resulting from normative beliefs.....	41
2.4.2.2	The influence of normative beliefs on subjective norm.....	42
2.4.3	Control beliefs.....	42
2.4.3.1	Perceived behavioural control resulting from control beliefs.....	46

2.4.3.2	The influence of control beliefs on perceived behavioural control.....	47
2.5	Conclusions and recommendations.....	47
2.6	References.....	49
<b>CHAPTER THREE.....</b>		<b>55</b>
<b>3.0</b>	<b><i>The Influence of Smallholder Farmers' Preferences on Decision to Use Quality Seed of Improved Common Bean Varieties.....</i></b>	<b>55</b>
3.1	Abstract.....	55
3.2	Introduction.....	56
3.3	Materials and Methods.....	58
3.3.1	Market preferences tests.....	61
3.3.2	Field preferences tests.....	62
3.3.3	Preference tests during cooking.....	63
3.3.4	Data analysis.....	63
3.4	Results and Discussion.....	64
3.4.1	Preferred common beans.....	64
3.4.2	Attractive traits in preferred common beans.....	65
3.4.3	Attractive traits in improved common bean varieties.....	67
3.4.4	Market preferences test results.....	71
3.4.5	Field preference tests results.....	75
3.4.5.1	Preference tests at flowering stage.....	75
3.4.5.2	Preference tests at maturity stage.....	77
3.4.5.3	Preference tests results during cooking.....	80
3.5	Conclusions and Recommendations.....	84
3.6	References.....	85

<b>CHAPTER FOUR</b> .....	90
<b>4.0 Knowledge and its Influence on Smallholder Farmers’ Decision to Use Quality Seed of Improved Common Bean Varieties</b> .....	90
4.1 Abstract.....	90
4.2 Introduction.....	91
4.3 Methodology.....	93
4.4 Results and Discussion.....	95
4.4.1 Current status of common bean production and quality seed use.....	95
4.4.2 Smallholder farmers’ knowledge about quality seed of improved common bean varieties.....	97
4.5 Conclusions and Recommendations.....	104
4.6 References.....	105
<b>CHAPTER FIVE</b> .....	109
<b>5.0 Smallholder Farmers' Attitude Toward Quality Seed of Improved Common Bean Varieties in Tanzania</b> .....	109
5.1 Abstract.....	109
5.2 Introduction.....	110
5.3 Methodology.....	112
5.4 Results.....	114
5.5 Results from Focus Group Discussion.....	120
5.6 Discussion.....	120
5.7 Conclusions and Recommendations.....	123
5.8 References.....	124

<b>CHAPTER SIX</b> .....	127
<b>6.0 Smallholder Farmers' Intention to Use Quality Seed of Improved Common Bean Varieties in Tanzania</b> .....	127
6.1 Abstract.....	127
6.2 Introduction.....	128
6.3 Methodology.....	131
6.4 Results.....	138
6.4.1 Attitude resulting from Behavioural Beliefs.....	138
6.4.2 The influence of behavioural beliefs on attitude.....	138
6.4.3 Subjective norm resulting from normative beliefs.....	139
6.4.4 The influence of normative beliefs on subjective norm.....	140
6.4.5 Perceived Behavioural control resulting from Control beliefs.....	140
6.4.6 The influence of control beliefs on Perceived Behavioural Control.....	141
6.4.7 The influence of direct determinants on intention.....	141
6.4.8 Influence of intention and perceived behavioural control on actual seed use.....	144
6.5 Discussion.....	147
6.6 Conclusions and Recommendations.....	149
6.7 References.....	151
<b>CHAPTER SEVEN</b> .....	155
<b>7.0 Summary, Conclusions and Recommendations</b> .....	155
7.1 Summary of Major Results and Conclusions.....	155
7.1.1 Smallholder farmers' beliefs about quality seed of improved common bean varieties.....	156

7.1.2	Attributes preferred by smallholder farmers in improved common bean varieties.....	157
7.1.3	Smallholder farmers' knowledge about quality seed of improved common bean varieties.....	158
7.1.4	Smallholder farmers' attitude towards quality seed of improved common bean varieties.....	159
7.1.5	Smallholder farmers' intention to use quality seed of improved common bean varieties in Tanzania.....	160
7.2	Theoretical Reflections.....	162
7.3	Recommendations.....	165
7.3.1	Smallholder farmers' beliefs about quality seed of improved common bean varieties.....	165
7.3.2	Attributes preferred by smallholder farmers in improved common bean varieties.....	167
7.3.3	Smallholder farmers' knowledge about quality seed of improved common bean varieties.....	168
7.3.4	Smallholder farmers' attitude towards quality seed of improved common bean varieties.....	168
7.3.5	Smallholder farmers' intention to use quality seed of improved common bean varieties in Tanzania.....	169
7.4	Areas for Further Research.....	170
7.5	References.....	171
	<b>APPENDICES.....</b>	<b>172</b>

## LIST OF TABLES

Table 2.1:	Distribution of respondents by believed advantages of using quality seed of improved common bean varieties .....35
Table 2.2:	Distribution of respondents by believed challenges/disadvantages of using quality seed of improved common bean varieties.....36
Table 2.3:	The influence of behavioural beliefs on smallholder farmers' attitude towards quality seed.....39
Table 2.4:	Distribution of respondents by individuals/groups of people who approve the use of quality seed of improved common bean varieties .....39
Table 2.5:	Distribution of respondents by individuals/groups of people who disapprove of the use of quality seed of improved common bean varieties.....40
Table 2.6:	The influence of normative beliefs on subjective norm.....42
Table 2.7:	Distribution of respondents by factors which facilitate smallholder farmer's ability to use quality seed of improved common bean varieties .....43
Table 2.8:	Distribution of respondents by factors which make it difficult or impossible to use quality seed of improved common bean varieties .....44
Table 2.9:	The influence of control beliefs on perceived behavioural control.....47
Table 3.1:	Distribution of respondents by preferred common bean varieties.....64
Table 3.2:	Percentage distribution of respondents by attractive traits in most preferred common beans .....65

Table 3.3:	Percentage distribution of respondents by attractive features/ traits in improved common bean varieties .....	68
Table 3.4:	Differences among common bean varieties as preferred by smallholder farmers.....	72
Table 3.5:	Influence of attributes tested on overall variety preference.....	74
Table 3.6:	Factors influencing smallholder farmers' preference on marketability of common beans.....	74
Table 3.7:	Differences among common bean varieties at flowering stage.....	76
Table 3.8:	Factors influencing smallholder farmers' preferences for common beans at flowering stage.....	76
Table 3.9:	Distribution of respondents by attractive feature at maturity stage.....	78
Table 3.10:	Differences among common bean varieties at maturity stage.....	79
Table 3.11:	Factors influencing smallholder farmers' preferences for common beans at maturity stage.....	80
Table 3.12:	Differences among cooked common bean varieties tastes.....	80
Table 3.13:	Dunnett Post Hoc Test to determine actual variations between Uyole 96 and other cooked common bean varieties tastes.....	81
Table 3.14:	Scheffe Post Hoc Test to determine means for groups in homogeneous subsets.....	82
Table 3.15:	The influence of smallholder farmers' preferences on actual quality seed use.....	84
Table 4.1:	The position of common beans among crops produced by smallholder farmers .....	96
Table 4.2:	Trend of using quality seed of improved common bean varieties in production .....	96



Table 4.3:	Distribution of respondents by knowledge of sources of quality seed of improved common bean varieties .....	98
Table 4.4:	Distribution of respondents by knowledge of the differences between quality seed and grains used as seed .....	99
Table 4.5:	Distribution of respondents by knowledge of advantages of quality seed of improved common bean varieties .....	100
Table 4.6:	Distribution of respondents by knowledge of the qualities of quality seed of improved common bean varieties .....	100
Table 4.7:	Distribution of respondents by knowledge level about quality seed of improved common bean varieties .....	101
Table 4.8:	The influence of knowledge on actual quality seed use.....	101
Table 5.1:	Mean score per theme influencing smallholder farmers attitude towards quality seed of improved common bean varieties.....	115
Table 5.2:	The influence of various themes on smallholder farmers' attitude towards quality seed of improved common bean varieties.....	116
Table 5.3:	The influence of benefits attributes on smallholder farmers' attitude towards quality seed of improved common bean varieties.....	117
Table 5.4:	The influence of qualities of quality seed on smallholder farmers' attitude toward quality seed of improved common bean varieties.....	118
Table 5.5:	The influence of marketability of produce from quality seed of improved common bean varieties on smallholder farmers' attitude.....	119
Table 6.1:	The influence of behavioural beliefs on smallholder farmers' attitude towards quality seed.....	139
Table 6.2:	The influence of normative beliefs on subjective norm.....	140
Table 6.3:	The influence of control beliefs on perceived behavioural control.....	141
Table 6.4:	The influence of direct determinants on intention to use quality seed.....	142

Table 6.5:	Attitudinal factors influencing intention to use quality seed.....	142
Table 6.6:	Subjective norm features influencing intention to use quality seed.....	143
Table 6.7:	Perceived behavioural control factors influencing intention to use quality seed.....	144
Table 6.8:	Influence of intention and perceived behavioural control on use of quality seed of improved common bean varieties.....	145
Table 6.9:	Perceived behavioural control factors influencing quality seed use.....	146
Table 6.10:	Socioeconomic factors influencing quality seed use.....	146

## LIST OF FIGURES

Figure 1.1:	Conceptual framework of factors influencing use of quality seed of improved varieties.....	11
Figure 1.2:	Relationships among social psychological variables influencing smallholder farmers' intention to use quality seed of improved common bean varieties.....	12
Figure 2.1:	Map showing study areas.....	31
Figure 3.1:	Map showing study area.....	60
Figure 3.2:	Differences among common bean varieties at market preference test.....	73
Figure 3.3:	Differences among common bean varieties at flowering stage.....	77
Figure 3.4:	Differences among common bean varieties at maturity stage.....	79
Figure 3.5:	Differences in taste among cooked common bean varieties.....	83
Figure 6.1:	Map showing study areas.....	132

## LIST OF APPENDICES

<i>Appendix 1: Questionnaire for Eliciting Smallholder Farmers' Beliefs About Quality Seed of Improved Common Bean Varieties in Tanzania.....</i>	<i>172</i>
<i>Appendix 2: Questionnaire for Smallholder Farmers' Knowledge about Quality Seed of Improved Common Bean Varieties.....</i>	<i>175</i>
<i>Appendix 3: Questionnaire for smallholder farmers Attitude towards Quality Seed of Improved Common Bean Varieties.....</i>	<i>177</i>
<i>Appendix 4: Questionnaire for smallholder farmers' intention to use quality seed of improved common bean varieties.....</i>	<i>182</i>
<i>Appendix 5: Checklist at flowering stage.....</i>	<i>195</i>
<i>Appendix 6: Checklist at Maturity stage.....</i>	<i>196</i>
<i>Appendix 7: Checklist at marketing stage.....</i>	<i>196</i>
<i>Appendix 8: Checklist at taste preferences test during cooking.....</i>	<i>197</i>

**LIST OF ABBREVIATIONS AND ACRONYMS**

ANOVA	Analysis of Variance
ARIs	Agricultural Research Institutes
ASA	Agricultural Seed Agency
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
CTA	Technical Centre for Agricultural and Rural Cooperation
ESAFF	Eastern and Southern Africa Small Scale Farmers' Forum
FAO	Food and Agriculture Organization
KIT	Royal Tropical Institute
MAFC	Ministry of Agriculture Food Security and Cooperatives
MT	Metric tons
OECD	Organization for Economic Cooperation and Development
PABRA	Pan African Bean Research Alliance
QDS	Quality Declared Seed
SPSS	Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture
TOSCI	Tanzania Official Seed Certification Institute
TPB	Theory of Planned Behaviour
URT	United Republic of Tanzania

## CHAPTER ONE

### 1.0 General Introduction

#### 1.1 Background Information

Common bean is the most important food legume in the world. Globally 36 458 895 ha were allocated to common beans in 2017 and yielded 31 405 912 tonnes of dry common beans (FAOSTAT, 2019a). Global production statistics indicate that India, Brazil, Myanmar and China are the world largest producers of common beans while Tanzania, Uganda and Kenya are the leading common beans producers in Africa. Generally, common bean is the leading among leguminous crops accounting for 78 percent of the cultivated land under legumes with per capita consumption of 19.3 kg, contributing to 16.9 percent of protein, 7.3 percent of calorie, and 71 percent of leguminous protein in human diets (Binagwa *et al.*, 2018). In Tanzania common bean is the second most important crop after maize in the villages producing common beans.

Common bean is an important source of foreign currency. For instance, in 2017 alone Tanzania earned USD 33 983 000 from exporting common beans (FAOSTAT, 2019b). Additionally, common beans play an important role in household food security and income. Furthermore, common bean is important in nitrogen fixation, which improves availability of essential nitrogen for plant growth and a major source of affordable protein and other essential nutrients for human growth. Nutritional importance of common beans is widely reported in literature (See for example, Adamu *et al.*, 2015; Blair, 2013; Campos *et al.*, 2013; Gouveia *et al.*, 2014; Kirse and Karklina, 2013; Paredes *et al.*, 2009; Admassu, 2008; Arenas *et al.*, 2014; Brigide *et al.*, 2014; Fivawo and Msolla, 2011; Tryphone and Msolla, 2010; Mosha *et al.*, 2013). As a result of this widespread interest in the crop, many efforts have been made to improve its productivity (see for example,

Shenkalwa *et al.*, 2013; Bucheyeki and Mmbaga, 2013; Katungi *et al.*, 2010; Akibode and Maredia, 2011; Misangu *et al.*, 2007; Katungi *et al.*, 2009).

However, to achieve increased productivity and the required nutritional levels from common bean products the use of quality seed of improved varieties, among others, is required. In this study, quality seed refers to certified seed of improved common bean varieties. The importance of quality seed of improved varieties in agricultural production is well recognized. For instance, according to scholars (ASARECA/KIT, 2014; Njingulula *et al.* 2014; Bucheyeki and Mmbaga, 2013; MAFC, 2013, Sperling and McGuire, 2010; Lazaro and Muywanga, 2008) seed quality is a prerequisite for increased agricultural productivity. Studies on the contribution of quality seed of improved varieties to an increase of productivity are well documented. For example, Oyekale (2014) indicates that when quality seed of improved variety is used in production the yield increases by 10 to 15 percent. Similarly, Birachi *et al.* (2011) reported an increase of yields by 22 percent when improved common bean varieties are used in production.

In recognition of the importance of quality seed for improved common bean productivity, various efforts have been made on breeding programmes to produce quality seed of improved common bean varieties within and outside the country. Some of these breeding programmes have widely been reported in literature (Tryphone *et al.*, 2013; Amin *et al.*, 2014; Beebe *et al.*, 2008; Beebe *et al.*, 2013; Duncan *et al.*, 2011; Margaret *et al.*, 2014). Others include Mensack *et al.* (2010), Atnaf (2013), Misangu *et al.* (2007), Singh and Schwartz (2011), McClean *et al.* (2002), and Varshney *et al.* (2013). In addition, various promotional and multiplication efforts have been conducted (see for example, Ayieko and Tschirley, 2006; Hillocks *et al.*, 2006; Rubyogo *et al.*, 2007; Nagarajan *et al.*, 2007;

McGuire and Sperling, 2008; URT, 2009; Ajeigbe *et al.*, 2009; ASARECA/KIT, 2014; FAO, 2010; Buruchara *et al.*, 2011; OECD, 2012; Munyaka *et al.*, 2015).

There have been several initiatives worldwide and across Africa of ensuring that farmers use quality seed of improved common bean varieties. These initiatives include the Pan African Bean Research Alliance (PABRA), which has focused on development and delivery of improved common bean varieties in Africa. PABRA covers 28 countries in Africa. It has been working through networks such as the Eastern and Central Africa Bean Research Network (ECABREN), Southern Africa Bean Research Network (SABRN), and Western and Central Africa Bean Research Network (WECABREN).

A similar initiative is implemented by the Feed the Future Programme that supports development and delivery of common bean germplasm with resistance to biotic constraints in East Africa and Southern Africa. Another initiative the Kirkhouse Trust supports development of improved legume crops in Sub-Saharan Africa and India using the African Bean Consortium, which deals with development of biotic resistant and high yielding common bean varieties.

To promote the use of quality seed of improved varieties among smallholder farmers, the Tanzania Government established seed multiplication farms, which are currently coordinated by the Agricultural Seed Agency (ASA). Furthermore, the government established the Tanzania Official Seed Certification Institute (TOSCI), which is mandated for certification and promotion of quality agricultural seeds. This institute safeguards the farming community from procuring poor quality or fake seeds from vendors of farm inputs.



To achieve increased use of quality seed of improved varieties, the United Republic of Tanzania formulated seed regulatory framework. Additionally, the Government has indicated the need for using quality seeds of improved varieties in several working documents including the agricultural policy of 2013, Seeds Act number 18 of 2003, reviewed Seeds Act i.e. CAP 308 number 4 of 2014, Seed Regulations of 2007, and the Agricultural Sector Development Programme. For instance, in the second component of the Agricultural Sector development programme II, the United Republic of Tanzania envisage to achieve enhanced agricultural productivity and profitability by paying attention on improving access to agricultural inputs including quality crop seeds among others (URT, 2016).

Recognizing the importance of public private partnership in the seed industry, the Tanzania Government allowed the private sector to participate actively in facilitating availability and accessibility of quality seeds of improved varieties including common bean varieties. In order to deliver quality seed to farmers, over 70 seed companies have established distribution networks using agro-dealers and stockists across the country (MAFC, 2015). Moreover, the Government allowed community-based seed production under the Quality Declared Seed (QDS) system. In principle, QDS is produced from quality seed of improved varieties released and registered formally. The production of this kind of seeds is under the supervision of District Authorized Seed Inspector and TOSCI. Under this system, an individual farmer or a group of registered farmers produce and distribute seeds within their localities up to the district level.

However, farmers in most developing countries including Tanzania mainly use grain as seed from farmer managed seed systems. Demand for quality seed of improved varieties among smallholder farmers has remained low for years. Seed studies have indicated low

usage of quality seeds of improved varieties among farmers at between 2 and 20 percent as reported in the literature (ASARECA/KIT, 2014; CTA, 2014; Etwire *et al.*, 2013; MAFC, 2013; Adetumbi *et al.*, 2010; Lazaro and Muywanga, 2008). This low usage of quality seeds of improved varieties has led to low crop productivity, which may in turn lead to food and nutrition insecurity as well as low family income.

## **1.2 Problem Statement**

The major aim of breeding improved common bean varieties is to enable the end users including smallholder farmers increase production, improve livelihood, and enhance food and nutrition security. To achieve this aim, 19 improved common bean varieties were released by the common bean improvement programs in the country between 1980 and 2004 (Hillocks *et al.*, 2006). A similar initiative across Africa (PABRA) since 1971 has released 34 improved bean varieties in Tanzania, and 18 of these varieties were released between 2001 and 2013 (Letaa *et al.*, 2015).

Despite these initiatives, there is still a huge gap between potential demand and actual use of quality seed of improved common bean varieties. The potential demand for quality seed of improved common bean varieties in Tanzania is about 10,840 MT (MAFC, 2014). However, only 111.8 MT in 2008/09, 219.9 MT in 2009/10, 110.6 MT in 2010/11, 223.8 MT in 2011/2012, 341.83 MT in 2012/13, and 401.31MT in 2013/2014 were used by the farming community (MAFC, *ibid*). Understanding the reasons behind this low use of quality seed of improved common bean varieties is an area, that requires attention in Tanzania. This is the motivation behind this study, which is set to investigate the factors influencing smallholder farmers' decision to use quality seed of improved common bean varieties in Tanzania.

### **1.3 Justification of the Study**

The findings from this study will provide the base for seed stakeholders to develop mechanisms, which would assist end users including smallholder farmers to use quality seed of improved common bean varieties. By using the findings from this study, breeders, ASA, and seed companies will be able to devise strategies, which would address the needs of end users before generating new varieties. Moreover, the findings would benefit TOSCI in ensuring that seed quality control mechanisms are instituted to safeguard users. Furthermore, the study findings would be used by the Ministry responsible for agriculture to formulate appropriate seed dissemination policy and extension strategy and designing mechanisms of enhancing smallholder farmers' demand for quality seed of improved common bean varieties.

### **1.4 Objectives**

#### **1.4.1 Overall objective**

The overall objective of this study was to establish factors influencing smallholder farmers' decision to use quality seed of improved common bean varieties.

#### **1.4.2 Specific objectives**

Specifically, the study intended to

- (i) Determine smallholder farmers' beliefs about quality seed of improved common bean varieties.
- (ii) Determine attributes preferred by smallholder farmers in improved common bean varieties.
- (iii) Examine smallholder farmers' knowledge about quality seed of improved common bean varieties.
- (iv) Assess smallholder farmers' attitude towards quality seed of improved common bean varieties

- (v) Identify the factors influencing smallholder farmers' intention to use quality seed of improved common bean varieties.

### **1.5 Research Questions**

- (i) What are the smallholder farmers' beliefs about quality seed of improved common bean varieties?
- (ii) What attributes do smallholder farmers prefer in common bean varieties?
- (iii) What do smallholder farmers know about quality seed of improved common bean varieties?
- (iv) What is the smallholder farmers' attitude towards quality seed of improved common bean varieties?
- (v) What are the factors influencing smallholder farmers' intention to use quality seed of improved common bean varieties?

### **1.6 Theoretical Framework on Diffusion and Adoption of Agricultural Technologies**

Studies on agricultural technology diffusion and adoption have identified four theories which explain how new practices, ideas, methods, and technologies reach farmers. These theories include innovation-diffusion model, the economic constraints model, the technology characteristics users' model (Adesina and Zinnah, 1993; Kormawa *et al.*, 2004), and the expected utility theory (Borges *et al.*, 2015). The four theories have widely been used to explain how agricultural innovations are diffused and are being adopted by farmers.

On one hand, the innovation-diffusion model informs that new practices, ideas, methods, and technologies are transferred from the source to the end users who are smallholder farmers, through the extension system. Using this model, quality seed of improved common bean varieties were traced from breeding stage through the extension services to smallholder farmers. Based on this model, understanding the breeding of common bean varieties, seed multiplication, certification, promotion, and distribution mechanisms were deemed necessary.

On the other hand, the economic constraints model pays attention on the resources owned by the person who is expected to adopt a given technology. This model categorizes adopters in terms of how one is endowed with resources, which facilitate ones' decision to use a given technology. Based on this model, to gain a thorough understanding of factors influencing smallholder farmers' decision to use quality seed of improved common bean varieties, the study paid attention on the acreage and the abilities of managing farm operations.

On the contrary, the technology characteristics users' model pays attention to the characteristics of the technology under consideration. The model acknowledges the adopters' perception towards the characteristics of the technology in question. According to Rogers (1983), innovation characteristics, which influence the decision to adopt a technology, would depend on the manner in which innovation is perceived to be economically and socially profitable and the manner in which innovation is consistent with previous values, experiences, beliefs and needs. Others include the manner in which innovation is perceived to be relatively difficult or ease to understand and use, the manner in which technology is perceived to be experimented on limited basis, and the manner in

which the benefits are perceived to be visible to others. The model also focuses on socio-economic and institutional contexts in which the adopters live.

Using this model, the study focused on the characteristics of common beans as self-pollinating crop and therefore the low rate of losing stability i.e the seed remains the same genetically, which enables farmers to continue with seed recycling. Seed recycling is considered as non-profitable seed business by seed companies because once farmers buy seeds they do not come back to buy again. This has made common beans fall under the crops termed as low volume or orphan crops as they lack much attention by seed stakeholders. The study also looked at the social system in which common bean production, marketing, distribution, and consumption takes place. This enabled understanding of socio-economic and institutional factors that influence smallholder farmers' decision of using quality seed of improved common bean varieties.

As for the expected utility theory, the English dictionary defines utility as a state or condition of being useful. It is the ability of a commodity to satisfy needs or wants. The satisfaction is experienced by the consumer of the given commodity. This aspect was addressed by looking at what smallholder farmers prefer in common beans. Their preferences in common beans were compared with what exists in quality seed of improved common bean varieties. This enabled the study to establish whether or not quality seed of improved common bean varieties satisfy needs of smallholder farmers on common beans production, marketing and consumption.

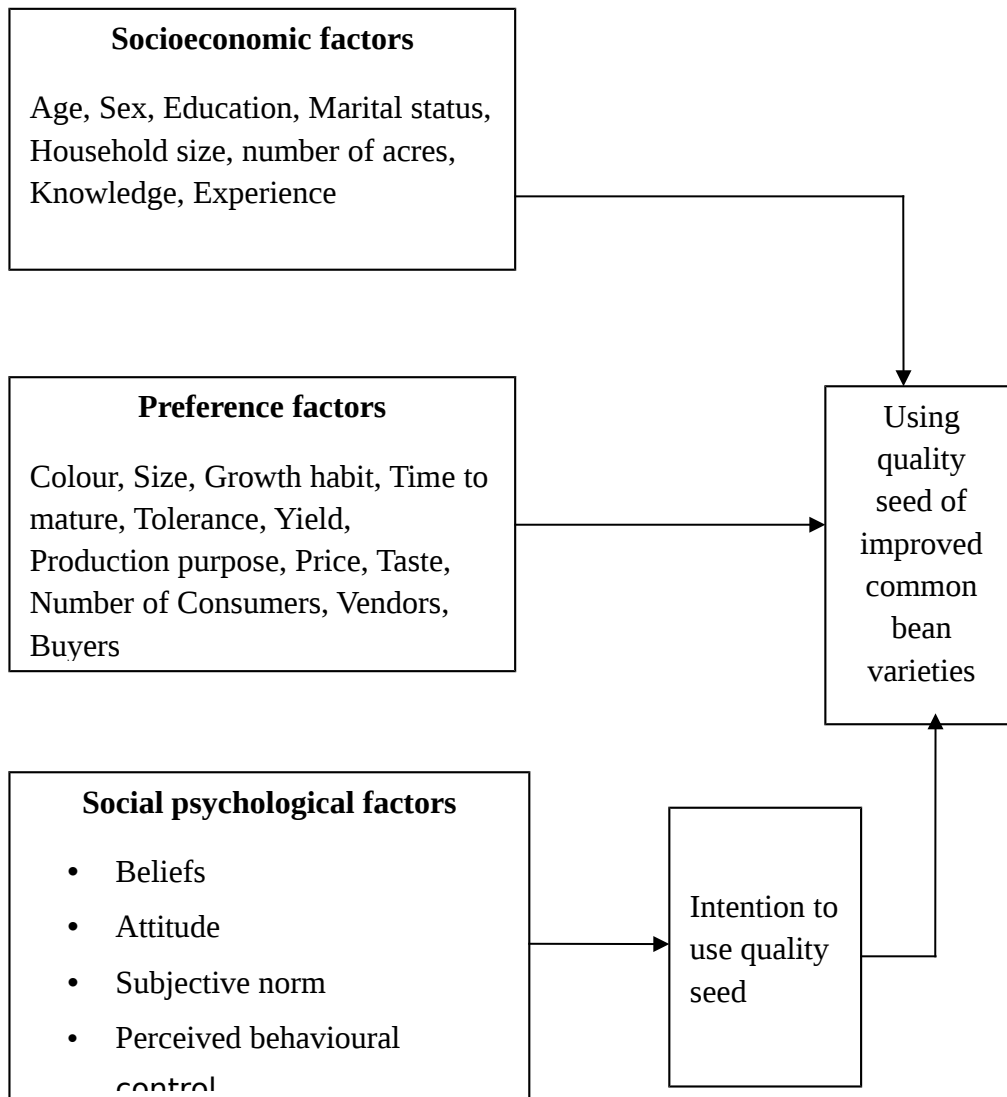
Nevertheless, studies on the Theory of Planned Behaviour have established that behavioural beliefs, attitudes, normative beliefs, subjective norms, control beliefs, perceived behavioural control and behavioural intention influence farmers' decision to use

the technologies (see Ahmed *et al.*, 2015; Kühne *et al.*, 2014; Herath, 2013; Sharifzadeh *et al.*, 2012). Therefore, apart from the four theories above, the theory of planned behaviour was used to determine the influence of beliefs, attitudes, subjective norm, perceived behavioural, and intention on smallholder farmers' decision to use quality seed of improved common bean varieties as presented in Figure 1.1.

### **1.7 Conceptual Framework for Smallholder Farmers' Decision to Use Quality Seed of Improved Common Bean Varieties**

According to the conceptual framework (Figure 1.1), the dependent variable, which is using quality seed of improved common bean varieties, depends on socioeconomic, preferences and social psychological factors. From the conceptual framework, socioeconomic and preferences factors have a direct influence on decision to use quality seed of improved common bean varieties. Social psychological factors are also shown to influence decision of using quality seed of improved common bean varieties via the intention of using quality seed. Details of the variables under socioeconomic, preferences and social psychological factors are given below.

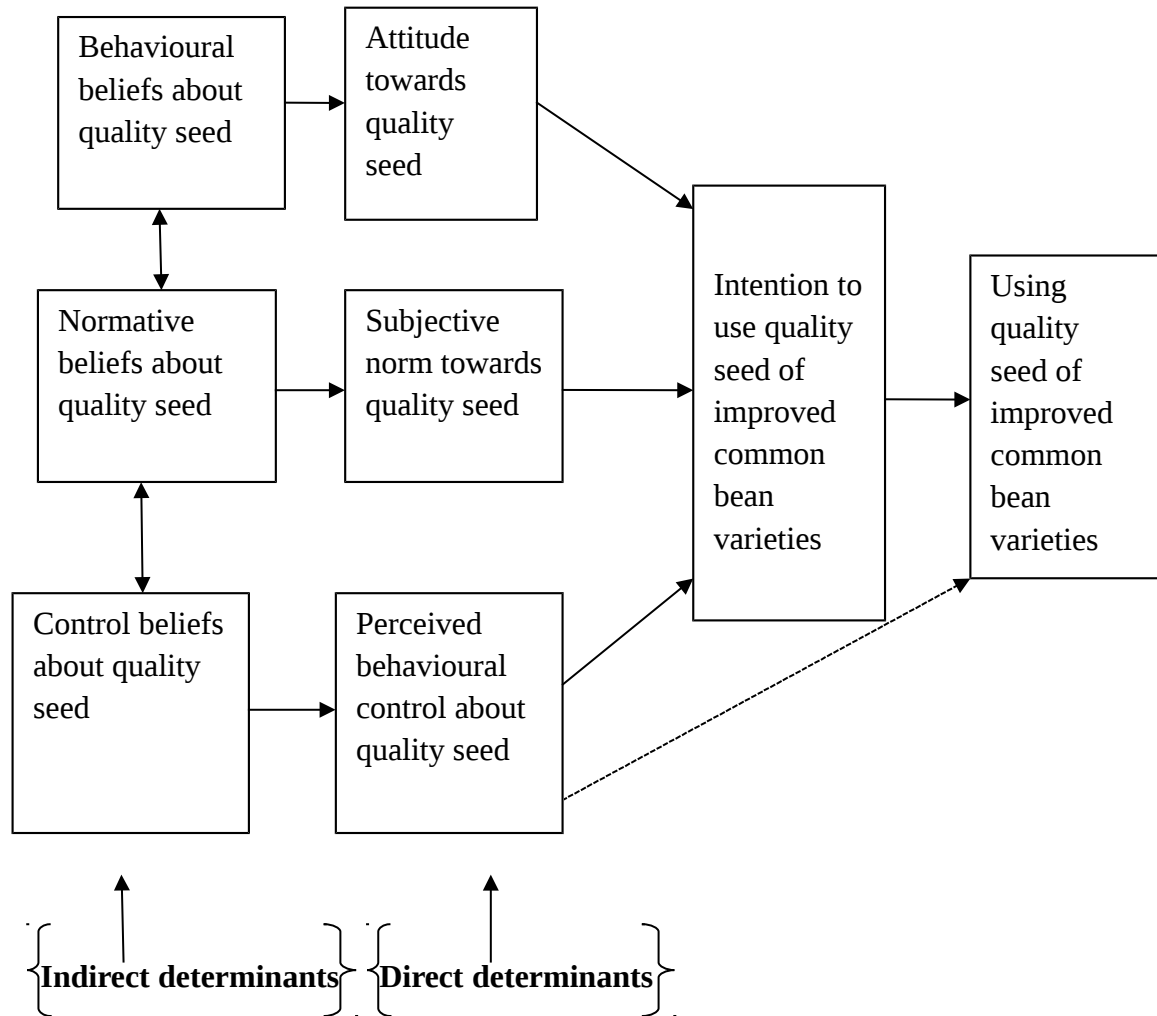
Socioeconomic factors included age, sex, education, marital status, household size, the number of household members involved in farming activities, the number of acres, experience in common bean production, and knowledge of quality seed of improved common bean varieties. Preference factors included grain colour, size, varieties' growth habit, time to mature, tolerance, and yield capacity. Furthermore, common bean production purpose, price, taste, and number of consumers, vendors, buyers who demand a particular variety were studied under preference.



**Figure 1.1: Conceptual framework of factors influencing use of quality seed of improved varieties**

The social psychological factors influence the decision to use quality seed of improved common bean varieties through intention to use quality seed; and this is indirectly influenced by behavioural, normative and control beliefs, and directly influenced by attitude, subjective norm and perceived control behaviour. These constructs are presented in Figure 1.2. The Figure clearly shows that perceived behavioural control may have direct influence on smallholder farmers' quality seed use practices.





**Figure 1.2: Relationships among social psychological variables influencing smallholder farmers' intention to use quality seed of improved common bean varieties**

Source: Adapted from Ajzen (2006).

### **1.7.1 Behavioural beliefs**

Behavioural beliefs refer to the degree to which smallholder farmers believe that using quality seed of improved common bean varieties would lead to valued outcomes either positively or negatively. These behavioural beliefs generate a favourable or unfavourable attitude toward the behaviour (Ajzen, 2006). Behavioural beliefs indicate the perceived usefulness, easiness, and compatibility of a technology under use (Kriek and Stols, 2010). In this study, behavioural beliefs reflect what is in the quality seed of improved common bean varieties, which smallholder farmers consider as useful, easy, difficult and compatible with their common beans production practices.

### **1.7.2 Attitudes**

Attitudes refer to the degree to which a smallholder farmer has positive or negative evaluation of quality seed of improved common bean varieties (Ahmed *et al.*, 2015). It refers to the outcomes, which will be obtained by using quality seed of improved common bean varieties. These include germination rates, vigour, growth characteristics whether bushy or climbing, yielding ability, maturity interval, taste, and market status for the grain produced from quality seed of improved common bean varieties. It also involves evaluation of the risks involved in using quality seed of improved common bean varieties.

### **1.7.3 Normative beliefs**

Normative beliefs are beliefs that certain referent individuals or groups support or oppose performance of certain behaviour (Fishbein and Ajzen, 2010). In the context of this study, Normative beliefs refers to the beliefs held among smallholder farmers' that one's decision of using quality seeds of improved common bean varieties is supported or discouraged by colleagues, sellers, buyers, and consumers. This is mainly because of the

practices, which are commonly used by smallholder farmers, buyers, and consumers regarding the use of quality seed of improved common bean varieties in production in a village or district.

#### **1.7.4 Subjective norms**

Subjective norms are a person's own estimates of the social pressure of performing or not performing the target behaviour (Francis *et al.*, 2004). Subjective norms relate to smallholder farmer's beliefs about how colleagues and other people who are important to him or her think s/he should or should not use quality seed of improved common bean varieties in the bean production.

#### **1.7.5 Control beliefs**

Control beliefs refer to beliefs that certain personal or situational factors, which facilitate or inhibit performance of the behaviour, are likely or unlikely to be present (Fishbein and Ajzen, 2010). Control beliefs refer to factors or circumstances, which facilitate or hinder smallholder farmers' ability to use quality seed of improved common bean varieties. Smallholder farmers' ability relates to resources in terms of information, knowledge, experiences, labour, material, financial, social capital, influence, and time available to enable a smallholder farmer use quality seed of improved common bean varieties.

#### **1.7.6 Perceived behavioural control**

Perceived behavioural control refers to one's evaluation about the easiness or difficulty of adopting a behaviour, including personal resources and skills for performing a behaviour (Downs and Hausenblas, 2005). Perceived behavioural control also refers to smallholder farmer's perception of how easy or difficult it is to use quality seed of improved common bean varieties. This ability tends to vary according to situations and actions thus resulting

in having a variety of perceptions. This can be reflected in terms of distance to stockists, quality seed availability, access to extension services, credit, subsidy, market services, information, costs of accessing and using the seeds, and social networks.

### **1.7.7 Behavioural intention**

This refers to motivational factors, which influence behaviour (Ajzen, 1991). They are factors, which influence the desire to use quality seed of improved common bean varieties. Behavioural intention is related to what smallholder farmers prefer in common beans, benefits associated with use of quality seed of improved common bean varieties as compared to landraces including yield, tolerance to a/biotic constraints, taste, nutrition value, cooking time, colour, and grain size. Others include the price of quality seed, the price of the grain, and consumer preferences. It also relates to whether the common bean is produced for consumption or for sale. The stronger the intention to use quality seed of improved common bean varieties in agricultural production the more likely that quality seed would be used.

## **1.8 Organization of the Thesis**

This thesis is organized in seven chapters. With the exception of chapters one and seven, others chapters are organized in a publishable manuscript format. Chapter one introduces the context of the study and provides a rationale and the theoretical foundation underpinning this study. Chapter two presents manuscript number one that assesses smallholder farmers' beliefs on quality seeds of improved common bean varieties in Tanzania. Chapter three addresses attributes, which are preferred by smallholder farmers in improved common bean varieties. The third manuscript in Chapter Four covers knowledge and its influence on smallholder farmers' decision to use quality seed of improved common bean varieties. Chapter five presents smallholder farmers' attitude

toward quality seed of improved common bean varieties in Tanzania. Chapter six presents smallholder farmers' intention of using quality seed of improved bean varieties in Tanzania. Lastly, Chapter Seven presents the summary of the thesis together with conclusions and recommendations.

### **1.9 Study Limitations**

The study used serial research design to collect data, which ended at actual quality seed use practices during the study. Although the study generated helpful information on the attempts of promoting quality seed use practices among smallholder farmers, longitudinal design could have added more value. Longitudinal design could have assisted, in later stages, in the determination of the actual use of quality seed among smallholder farmers who indicated the intention of using quality seed of improved common bean varieties. However, this was not possible given the PhD study duration.

This study presents the results based on the data from smallholder farmers' self-report about quality seed of improved common bean varieties. Therefore, respondents might have responded to questions in a socially desirable manner, which is likely to influence the conclusions drawn from the study results. Nevertheless, attempts were made to countercheck the responses provided. This included seeing the actual common beans at home, in the market, and in the farms.

### 1.10 References

- Adamu G. O. L., Ezeokoli O. T., Dawodu A. O., Adebayo A. O. O. and Ofodile L. N. (2015). Macronutrients and Micronutrients Profile of Some Underutilized Beans in South Western Nigeria. *International Journal of Biochemistry Research and Review* 7(2): 80 – 89.
- Adesina A. A. and Zinnah M. M. (1993). Technology characteristics, farmers' perceptions and adoption decisions: A Tobit model application in Sierra Leone. *Agricultural Economics* 9: 297 – 311.
- Adetumbi J. A., Saka J. O. and Fato B. F. (2010). Seed handling system and its implications on seed quality in South Western Nigeria. *Journal of Agricultural Extension and Rural Development* 2(6): 133 – 140.
- Admassu S. (2008). Variability in phytochemicals,  $\alpha$ -galactosides, sucrose composition and *in Vitro* protein digestibility of common bean (*Phaseolus vulgaris* L.) Varieties. *East African Journal of Sciences* 2(1): 45 – 54.
- Ahmed, H. U., Muhammad, A. and Musa, H. U. (2015). Exploring theory of planned behaviour for understanding agricultural information utilization by rural farmers in Katsina State. *Journal of Humanities and Social Science* 20(6): 27 – 32.
- Ajeigbe, H. A., Abdoulaye, T. and Chikoye, D. (2009). Legume and cereal seed production for improved crop yields in Nigeria. *Proceedings of the Training Workshop on Production of Legume and Cereal Seeds* held on 24 January–10 February 2008. Kano, Nigeria. 108pp.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50: 179 – 211.

- Ajzen, I. (2006). Constructing a TPB Questionnaire: Conceptual and methodological considerations. [<http://www.unibielefeld.de/ikg/zick/ajzen%20construction%20a%20tpb%20questionnaire.pdf>] site visited on 06/04/2016.
- Akibode, S. and Maredia, M. (2011). Global and regional trends in production, trade and consumption of food legume crops report submitted to the standing panel on impact assessment. [[https://www.researchgate.net/publication/266353209\\_Global\\_and\\_Regional\\_Trends\\_in\\_Production\\_Trade\\_and\\_Consumption\\_of\\_Food\\_Legume\\_Crops](https://www.researchgate.net/publication/266353209_Global_and_Regional_Trends_in_Production_Trade_and_Consumption_of_Food_Legume_Crops)] site visited on 30/09/2018.
- Amin, M., Fitsum, S., Selvaraj, T. and Mulugeta, N. (2014). Field management of anthracnose (*Colletotrichum lindemuthianum*) in common bean through fungicides and bioagents. *Advances in Crop Science and Technology* 2014: 2:2.
- Arenas, O. R., Huato, M. A. D., Tapia, J. A. R., Simón, A. B., Lara, M. H. and Huerta, E. C. (2013). The Nutritional value of Beans (*Phaseolus vulgaris* L.) and its importance for Feeding of Rural communities in Puebla-Mexico. *International Research Journal of Biological Sciences* 2(8): 59 – 65.
- Association for Agriculture Research in East and Central Africa/Tropical Royal Institute (2014). *Tanzania Seed Sector Assessment: A Participatory National Seed Sector Assessment for the Development of an Integrated Seed Sector Development. Programme in Tanzania*. Entebbe, Uganda.183pp.
- Atnaf, M., Mohammed, H. and Zelleke, H. (2013). Inheritance of primary yield component traits of common beans (*Phaseolus Vulgaris* L.): Number of seeds per pod and 1000 seed weight in an 8 × 8 diallel cross population. *International Journal of Genetics and Molecular Biology* 5(4): 42 – 48.

- Ayieko, M. W. and Tschirley, D. L. (2006). *Enhancing Access and Utilization of Quality Seed for improved Food Security in Kenya*. Working Paper No 27. Egerton University, Nairobi. 52pp.
- Beebe, S. E., Rao, I. M., Cajiao, C. and Grajales, M. (2008). Selection for drought resistance in common bean also improves yield in phosphorus limited and favorable environments. *Crop Science* 48: 582 – 592.
- Beebe, S. E., Rao, I. M., Blair, M. W. and Acosta, G. J. A (2013). Phenotyping common beans for adaptation to drought. *Frontiers in Physiology* 4(35): 1 – 20.
- Binagwa, P. H., Magdalena, W., Michael, K., Zakayo, E., Mbiu, J., Msaky, J., Mdachi, M., Kasubiri, F., Kisamo, A., Nestory, S. M. and Rubyogo, J. C. (2018). *Selian Agricultural Research Institute Released Seven (7) Improved Common Bean (Phaseolus vulgaris) Varieties. Fact Sheet 1*. Selian Agricultural Research Institute, Arusha, 5pp.
- Birachi, E. A., Ochieng, J., Wozemba, D., Ruraduma, C., Niyuhire, M. C. and Ochieng, D. (2011). Factors influencing smallholder farmers' bean production and supply to market in Burundi. *African Crop Science Journal* 19(4): 335 – 342.
- Blair, M. W. (2013). Mineral biofortification strategies for food staples: The Example of Common Bean. *Journal of Agricultural and Food Chemistry* 61: 8287 – 8294.
- Borges, J. A. R., Foletto, L. and Xavier, V. T. (2015). An interdisciplinary framework to study farmers' decisions on adoption of innovation: Insights from expected utility theory and theory of planned behavior. *African Journal of Agricultural Research* 10(29): 2814 – 2825.



- Brigide P., Brazaca, C. G. S. and Silva M. O. (2014). Nutritional characteristics of biofortified common beans. *Food Science Technology, Campinas* 34(3): 493 – 500.
- Bucheyeki, T. L. and Mmbaga, T. E. (2013). On-farm evaluation of beans varieties for adaptation and adoption in Kigoma Region in Tanzania. *ISRN Agronomy* 2013: 1 – 5.
- Buruchara, R., Chirwa, R., Sperling, L., Mukankusi, C., Rubyogo, J. C., Muthoni, R. and Abang, M. M. (2011). Development and delivery of bean varieties in Africa: The pan- africa bean research alliance model. *African Crop Science Journal* 19(4): 227–245.
- Bucheyeki, T. L. and Mmbaga, T. E. (2013). On-farm evaluation of beans varieties for adaptation and adoption in Kigoma Region in Tanzania. *Agronomy* 2013: 1 – 5.
- Campos V. R., Oomah B. D., Loarca P. G. and Vergara C. H. A. (2013). Common beans and their non-digestible fraction: Cancer inhibitory activity-an overview. *Foods* 2: 374 – 392.
- Downs, D. S. and Hausenblas, H. A. (2005). The theories of reasoned action and planned behavior applied to exercise: A Meta-analytic Update. *Journal of Physical Activity and Health* 2: 76 – 97.
- Duncan, R. W., Singh, S. P. and Gilbertson, R. L. (2011). Interaction of common bacterial blight bacteria with disease resistance quantitative trait loci in common bean. *Phytopathology* 101(4): 425 – 435.
- Etwire, P. M., Atokple, I. D. K., Buah, S. S. J., Abdulai, A. L., Karikari, A. S. and Asungre, P. (2013). Analysis of the seed system in Ghana. *International Journal of Advance Agricultural Research* 1: 7 – 13.

- FAO (2010). *Seeds in Emergencies: A technical handbook. Plant Production and Protection*. Working Paper No. 202. Food and Agriculture Organization, Rome. 88pp.
- FAO (2019a). FAOSTAT data on production/yield quantities of beans, dry in world + total 1994 – 2017. [<http://www.fao.org/faostat/en/#data/QC/visualize>] site visited on 14/11/2019.
- FAO (2019b). FAOSTAT data on crops and livestock products: Dry common beans [<http://www.fao.org/faostat/en/#data/TP>] site visited 14/11/2019.
- Fivawo, N. C. and Msolla, S. N. (2011). The diversity of common bean landraces in Tanzania. *Tanzania Journal of Natural and Applied Sciences* 2(1): 337 – 351.
- Fishbein, M. and Ajzen, I. (2010). *Predicting and Changing Behavior: The Reasoned Action Approach*. Psychology Press Taylor and Francis, New York. 538pp.
- Francis, J. J., Eccles, M. P., Johnston, M., Walker, A., Grimshaw, J., Foy R., Kaner, E. F. S., Smith, L. and Bonetti, D. (2004). Constructing questionnaires based on the theory of planned behaviour: A manual for health services researchers. [<http://web.fmk.edu.rs/files/blogs/2010-11/Psihologija/Socijalna/TPB.pdf>] site visited on 8/04/2016.
- Gouveia, C. S. S., Freitas, G., de Brito, J. H., Slaski, J. J. and de Carvalho, M. Â. A. P. (2014) Nutritional and mineral variability in 52 accessions of common bean varieties (*Phaseolus vulgaris* L.) from Madeira Island. *Agricultural Sciences* 5: 317 – 329.
- Herath, C. S. (2013). Scientific information: does intention lead to behaviour? A case study of the Czech Republic farmers. *Agricultural Economics* 59(3): 143–148.
- Hillocks, R. J., Madata, S. C., Chirwa, R., Minja, M. E. and Msolla, S. (2006). Phaseolus bean improvement in Tanzania 1956-2005. *Euphytica* 150: 215 – 231.

- Katungi, E., Farrow, A., Chianu, J., Sperling, L. and Beebe, S. (2009). Common bean in Eastern and Southern Africa: A situation and outlook analysis. [[https://www.researchgate.net/publication/228601612\\_Common\\_bean\\_in\\_Eastern\\_and\\_Southern\\_Africa\\_a\\_situation\\_and\\_outlook\\_analysis/link/02e7e52bae694ee7b2000000/download](https://www.researchgate.net/publication/228601612_Common_bean_in_Eastern_and_Southern_Africa_a_situation_and_outlook_analysis/link/02e7e52bae694ee7b2000000/download)] site visited 13/09/2017.
- Katungi, E., Farrow, A., Mutuoki, T., Gebeyehu, S., Karanja, D., Alamayehu, F., Sperling, L., Beebe, S., Rubyogo, J. C. and Buruchara, R. (2010). *Improving Common Bean Productivity: An Analysis of Socioeconomic Factors in Ethiopia and Eastern Kenya. Baseline Report Tropical Legume*. Centro Internacional de Agricultura Tropical, Cali, Colombia. 139pp.
- Kirse, A. and Karklina, D. (2013). Quality evaluation of new vegetarian bean spreads. *European Scientific Journal* 4: 1857 – 7881.
- Kormawa, P. M., Ezedinma, C. I. and Singh B. B. (2004). Factors influencing farmer-to-farmer transfer of an improved cowpea variety in Kano State, Nigeria. *Journal of Agriculture and Rural Development in the Tropics and Subtropics* 105(1): 1–13.
- Kriek, J. and Stols, G. (2010). Teachers' beliefs and their intention to use interactive simulations in their classrooms. *South African Journal of Education* 30: 439– 456.
- Kühne, B., Lambrecht, E., Vanhonacker, F., Pieniak, Z., and Gellynck, X. (2014). Factors underlying farmers' decisions to participate in networks. *International Journal on Food System Dynamics* 4(3): 198 – 213.
- Lazaro, E. A. and Muywanga, D. M. (2008). Seed production and poverty reduction: Case of Dodoma Rural District. *Tanzania Journal Agriculture Science* 8(2): 161 – 172.

- Letaa, E., Kabungo, C., Katungi, E., Ojara, M. and Ndunguru, A. (2015). Farm level adoption and spatial diffusion of improved common bean varieties in southern highlands of Tanzania. *African Crop Science Journal* 23(3): 261 – 277.
- Margaret, N., Tenywa, J. S., Otabbong, E., Mubiru, D. N. and Basamba, T. A. (2014). Development of common bean (*Phaseolus Vulgaris* L.) production under low soil phosphorus and drought in Sub-Saharan Africa: A Review. *Journal of Sustainable Development* 7(5): 128 – 139.
- McClellan, P. E., Lee, R. K., Otto, C., Gepts, P. and Bassett, M. J. (2002). Molecular and phenotypic mapping of genes controlling seed coat pattern and color in common bean (*Phaseolus vulgaris* L.). *The Journal of Heredity* 93(2): 148 – 152.
- McGuire, S. J. and Sperling, L. (2008). Leveraging farmers' strategies for coping with stress: Seed aid in Ethiopia. *Global Environmental Change* 18: 679 – 688.
- Mensack, M. M., Fitzgerald, V. K., Ryan, E. P., Matthew, R., Lewis, M. R., Thompson, H. J. Mark, A. and Brick, M. A. (2010). Evaluation of diversity among common beans (*Phaseolus vulgaris* L.) from two centers of domestication using 'omics' technologies. *BioMed Central Genomics* 2010: 11 – 686.
- Ministry of Agriculture Food Security and Cooperatives (2013). *National Agriculture Policy*. United Republic of Tanzania. Dar es Salaam. 51pp.
- Ministry of Agriculture Food Security and Cooperatives (2014). *The Review of the Current Status of Seed Industry in Tanzania Submitted to Seed Policy Action Node*. Ministry of Agriculture Food Security and Cooperatives, Dar es Salaam, Tanzania. 26pp.

- Ministry of Agriculture Food Security and Cooperatives (2015). List of active seed companies and registered agro-dealers. *Paper Presented at AGRA Seed Policy Action Node Seed Stakeholders Workshop*. 19-20 August 2015 held in Kigoma Region. 136pp.
- Misangu, R. N., Chipungilo, M. S., Reuben, S. O. W. M. and Mulungu, L. S. (2007). The effect of sowing bruchid damaged bean (*Phaseolus Vulgaris L.*) seeds on germination, plant development and yield. *Journal of Entomology* 4(4): 337 – 341.
- Mosha, T. C. E., Mwankemwa, J. S. A., Laswai, 1. H. S. and Maurice, B. R. (2013). Utilization of fortified bean-maize composite meal to improve the nutritional and immune status of HIV+ children in Morogoro, Tanzania. *Tanzania Food and Nutrition Journal* 13(1): 9 – 23.
- Munyaka, N., Mvumi, B. M. and Mazarura, U. M. (2015). Seed Security: Exploring the potential for smallholder production of certified seed crop at household level. *Journal of Sustainable Development* 8(2): 242 – 256.
- Nagarajan, L., Audi, P., Jones, R. and Smale, M. (2007). *Seed Provision and Dryland Crops in the Semiarid Regions of Eastern Kenya*. Discussion Paper No. 00738. International Food Policy Research Institute, Nairobi, Kenya. 40pp
- Njingulula, P., Wimba, P., Musakamba, M., Masuki, K. F., Katafiire, M., Ugen, M. and Birachi, E. (2014). Strengthening local seed systems within the bean value chain: Experience of agricultural innovation platforms in the Democratic Republic of Congo. *African Crop Science Journal* 22(4): 1003 – 1012.
- Organisation for Economic Co-operation and Development (2012). *Seed Schemes: A Synthesis of International Regulatory Aspects that Affect Seed Trade*. Organisation for Economic Co-operation and Development, Paris. 17pp.

- Oyekale, K. O. (2014). Growing an Effective Seed Management System: A Case Study of Nigeria. *Journal of Agriculture and Environmental Sciences* 3(2): 345 – 354.
- Paredes, C. M, Becerra, V. V. and Tay, U. J. (2009). Inorganic nutritional composition of common Bean (*Phaseolus vulgaris* L.) Genotypes Race Chile. *Chilean Journal of Agricultural Research* 69(4): 486 – 495.
- Rogers E. M. (1983). *Diffusion of Innovations*. (3<sup>rd</sup> Ed.), Macmillan Publishing Co. New York, Collier Macmillan, Canada. 236pp.
- Rubyogo, J. C., Sperling, L., Nasirumbi, L. and Kasambala, S. P. (2007). Developing seed systems with and for the marginalized: Case of common bean (*Phaseolus vulgaris* L.) in East, Central and Southern Africa. In: *Farmer First Revisited Conference, Sussex, England. Papers Presented. Future Agricultures Consortium*. Institute of Development Studies, Sussex. 10pp.
- Sharifzadeh, M., Zamani G. H., Khalili, D. and Karami, E. (2012). Agricultural climate information use: An application of the planned behaviour theory. *Journal of Agricultural Science and Technology* 14: 479 – 492.
- Shenkalwa, E. M., Mmbaga, M. E. T. and Kalala, A. (2013). Performance of improved bean varieties in Kasulu and Kibondo Districts of Kigoma Region, Tanzania. *African Journal of Food, Agriculture, Nutrition and Development* 13(3): 7804 – 7819.
- Singh, S. P. and Schwartz, H. F. (2011). Review: Breeding common bean for resistance to insect pests and nematodes. *Canadian Journal of Plant Science* 91: 239 – 250.
- Sperling, L. and McGuire, S. (2010). Understanding and Strengthening Informal Seed Markets. *Experimental Agriculture* 46(2): 119 – 136.

- Technical Centre for Agricultural and Rural Cooperation (2014). Seed systems, science and policy in East and Central Africa. [[https://cgspace.cgiar.org/bitstream/handle/10568/81086/1832\\_PDF.pdf?sequence=1&isAllowed=y](https://cgspace.cgiar.org/bitstream/handle/10568/81086/1832_PDF.pdf?sequence=1&isAllowed=y)] site visited 30/07/2019.
- Tryphone, G. M. and Nchimbi-Msolla, S. (2010). Diversity of common bean (*Phaseolus vulgaris* L.) genotypes in iron and zinc contents under screen house conditions. *African Journal of Agricultural Research* 5(8): 738 –747.
- Tryphone, G. M., Chilagane, L. A., Protas, D., Kusolwa, P. M. and Msolla, S. N. (2013). *Marker Assisted Selection for Common Bean Diseases Improvements in Tanzania: Prospects and Future Needs*. Plant Breeding from Laboratories to Fields. pp. 121 – 147.
- United Republic of Tanzania (2009). *Country Report on the State of Plant Genetic Resources*. Food and Agriculture Organization, Rome, Italy. 18pp.
- United Republic of Tanzania (2016). *Agricultural Sector Development Programme Phase Two*. Government Programme, Dar es Salaam, Tanzania. 213pp.
- Varshney, R. K., Roorkiwal, M. and Nguyen, H. T. (2013). Legume genomics: From genomic resources to molecular breeding. *The Plant Genome* 6(3): 1 – 7.

## CHAPTER TWO

### 2.0 Smallholder Farmers' Beliefs on Quality Seeds of Improved Common Bean Varieties in Tanzania

<sup>1</sup>Joshua S. Kidudu\*, <sup>2</sup>Dismas L. Mwaseba and <sup>3</sup>Susan Nchimbi-Msolla

<sup>1</sup>Department of Agricultural Extension and Community Development, College of Agriculture, Sokoine University of Agriculture, Chuo Kikuu, Morogoro 3002, Tanzania.

<sup>2</sup>Department of Agricultural Extension and Community Development, College of Agriculture, Sokoine University of Agriculture, Chuo Kikuu, Morogoro 3002, Tanzania.

<sup>3</sup>Department of Crop Science and Horticulture, College of Agriculture, Sokoine University of Agriculture, Chuo Kikuu, Morogoro 3005, Tanzania.

\*Corresponding author: Joshua Samwel Kidudu, master, seed systems; Phone: +255

754247945 Email:kidudujoshua@yahoo.com

**To be submitted to *Tanzania Journal of Agricultural Sciences- TAJAS***

#### 2.1 Abstract

Using a sample of randomly selected households from major common beans producing regions, this paper examined smallholder farmers' beliefs influencing their decision to use quality seed of improved common bean varieties. The study adopted the Theory of Planned Behaviour. The findings indicate that farmers' decision of using quality seed of improved common bean varieties is influenced by various behavioural, normative, and control beliefs. These included unavailability of quality seed, low family income, low market potential of produce from improved varieties, inadequate extension services, and high costs of associated inputs. The findings indicate further that behavioural, normative and control beliefs significantly influenced smallholder farmers' attitude, subjective norm



and perceived behavioural control respectively. Therefore, attempts of increasing smallholder farmers' use of quality seed of improved common bean varieties have to focus on changing farmers' negative beliefs toward quality seed.

**Key words:** Quality seeds, improved varieties, theory of planned behaviour, behavioural beliefs, normative beliefs, control beliefs

## 2.2 Introduction

Common bean is the most important food legume in the world. Globally 36 458 895 ha were allocated to common beans in 2017 and yielded 31 405 912 tonnes of dry common beans (FAOSTAT, 2019). Global production statistics indicate that India, Brazil, Myanmar and China are the world largest producers of common beans while Tanzania, Uganda and Kenya are the leading common beans producers in Africa.

The contribution of quality seed of improved varieties to increased productivity is well documented. For example, Oyekale (2014) indicates that when quality seed of improved variety is used in production, the yields increase by 10 to 15 percent. In a similar vein, Birach *et al.* (2011) reported an increase of yields by 22 percent when quality seed of improved common bean varieties were used in production. In this study, quality seed means certified seed of improved common bean varieties.

Despite its contribution to increased productivity, the demand of quality seed of improved varieties among smallholder farmers has remained low for years. For example, some seed studies have reported varied level of use of improved varieties at 4 percent (Adetumbi *et al.* 2010; Lazaro and Muywanga, 2008); 5 percent (ASARECA/KIT, 2014); 3-20 percent (CTA, 2014); 10 percent (MAFC, 2013); and <20 percent (Etwire *et al.*, 2014).

The major determinants of smallholder farmers' decision of using improved technologies in agricultural production have broadly been identified as being technological, economic, institutional, and human specific factors (Mwangi and Kariuki, 2015). However, studies on the adoption of improved agricultural technologies have paid little attention to how beliefs of the adopters as well as the social system influence the intention of using the recommended technologies.

The latter is better articulated by the Theory of Planned Behaviour (TPB), which was thus adopted for this study. Using this theory, this study adds insights to the existing body of knowledge by establishing beliefs held by smallholder farmers, which in turn influence their intention of using quality seed of improved common bean varieties. These beliefs are grouped into behavioural, normative, and control beliefs. On the one hand, behavioural beliefs focus on the usefulness, easiness, and compatibility of quality seed of improved common bean varieties with smallholder farmers' production practices. On the other hand, normative beliefs focus on individuals, people, institutions or practices, which encourage or discourage smallholder farmers' decision of using quality seed of improved common bean varieties in production.

In addition to behavioural and normative beliefs, control beliefs focus on the internal and external factors that influence smallholder farmers' decision of using quality seed of improved common bean varieties. Internal factors stem from the confidence smallholder farmers have in terms of knowledge, skills, experiences, exposure and abilities of using quality seed of improved common bean varieties in production. In contrast, external factors emanate from the opportunities and resources available to smallholder farmers to enable them use quality seed of improved common bean varieties in production.

According to the Theory of Planned Behaviour, behavioural beliefs, attitudes, normative beliefs, subjective norms, control beliefs, perceived behavioural control and behavioural intention are the major constructs, which determine behaviour (Ajzen, 1991; Ajzen, 2006; Borges *et al.* 2015; Chiou, 1998; Francis *et al.* 2004; Hasbullah, 2014; Lee *et al.* 2010). Studies employing the Theory of Planned Behaviour have established that behavioural beliefs, attitudes, normative beliefs, subjective norms, control beliefs, perceived behavioural control, and behavioural intention determine farmers' decision of using technologies (Ahmed *et al.*, 2015; Kühne *et al.*, 2014; Herath, 2013; Sharifzadeh *et al.*, 2012). Nevertheless, there are hardly any studies that used Theory of Planned Behaviour to predict smallholder farmers' decision of using quality seed of improved common bean varieties.

However, to establish the intention, one has to determine beliefs first. Shikukuu *et al.* (2019) maintain that the link between beliefs and human behaviour has long been recognized. Therefore, the fact that beliefs influence smallholder farmers' decision of using quality seed of improved common bean varieties need to be explored. The problem then is how does this take place? Therefore, this study investigated behavioural beliefs, normative beliefs, and control beliefs as indirect predictors of intention of using quality seed of improved common bean varieties.

### **2.3 Methodology**

The study was conducted in the districts of Kilolo in Iringa region, Kasulu in Kigoma region, Siha and Moshi in Kilimanjaro region, Babati in Manyara region, Mbeya in Mbeya region, Mvomero in Morogoro region, and Wanging'ombe in Njombe region as indicated in Figure 2.1. The sampled regions represented major common beans producing regions in Western/Great lakes, Northern, Southern and Eastern Zones.

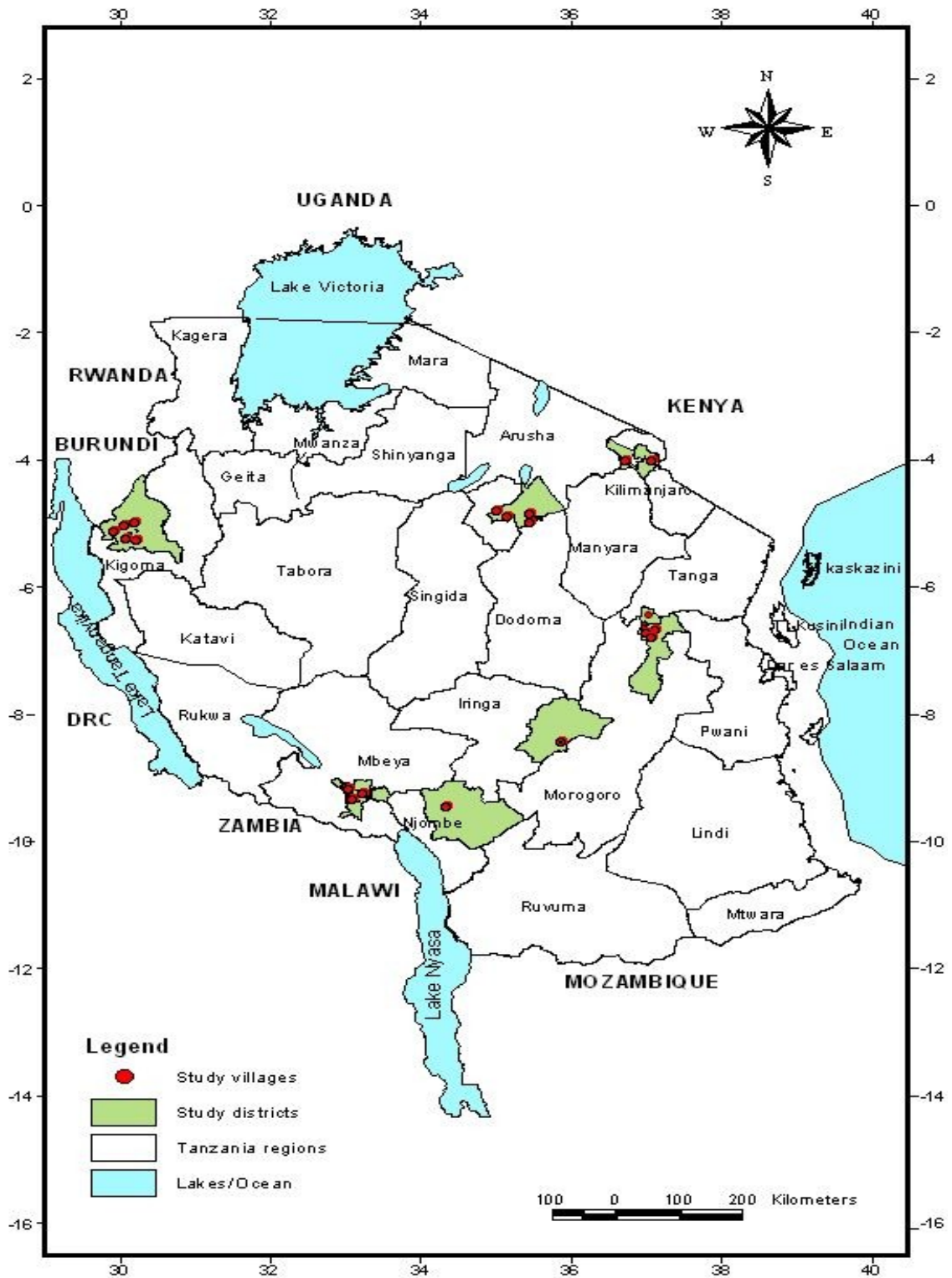


Figure 2.1: Map showing study areas

Using a serial cross-sectional research design, quantitative and qualitative data were collected in two phases. In the first phase, an elicitation study was conducted to determine smallholder farmers' salient beliefs regarding the use of quality seed of improved common bean varieties.

To obtain representative sample of smallholder farmers, multistage sampling technique was used. In the first stage, study regions were randomly selected out of all major producing regions. In the second stage, study districts were randomly selected from the sampled regions. This was followed by random selection of one village per study district. Finally, smallholder farmers were randomly selected to participate in an elicitation study. In this regard, Kasulu, Kilolo, Mbeya, Moshi, Mvomero, Siha and Wanging'ombe Districts were used for elicitation study.

Using systematic random sampling technique 107 respondents were selected to participate in the study. An open ended questionnaire was used to solicit information on beliefs held by smallholder farmers about quality seed of improved common bean varieties (Appendix 1). Data obtained during elicitation study were used to develop a questionnaire to be used during the second phase. The questionnaire was pretested to smallholder farmers from Njelenje Village in Gairo District. Reliability for direct measures of intention i.e. attitudes, subjective norm and perceived behavioural control was established using an index of internal consistency while test-retest reliability was used for indirect determinants of intention i.e. behavioural, normative and control beliefs as recommended by Francis *et al.* (2004).

In the second phase, a survey was conducted in Babati, Kasulu, Mbeya and Mvomero Districts to collect data for determining the influence of beliefs on smallholder farmers'

intention of using quality seed of improved common bean varieties. Data on behavioural beliefs, normative beliefs, and control beliefs were collected from 311 systematically randomly selected smallholder farmers to determine the influence of such beliefs on attitude, subjective norm and perceived behavioral control respectively.

Content and thematic analysis were used to establish themes, which represented various behavioural, normative, and control beliefs. Descriptive analysis involving frequencies and percentages were used to determine the most frequently reported beliefs.

To determine attitude from its associated beliefs, behavioural beliefs and outcome evaluation were scored. Weighted attitude from behavioural beliefs and their associated outcome evaluations were calculated using the formula  $A = \sum (Be \times Oe)/N$ . Where A=Total attitude score, Be=Behavioural beliefs, Oe=Outcome evaluation, and N=Total number of respondents. If A, that is, the overall attitude is positive then the smallholder farmers are in favour of quality seed of improved common bean varieties. If A, that is, the overall attitude is negative then the smallholder farmers are not in favour of quality seed of improved common bean varieties.

To determine subjective norm from its associated beliefs, normative beliefs and motivation to comply were scored. Subjective norm was then determined using the formula  $Sn = \sum (No_{be} \times Mo_{co})/N$ . Where Sn =Total subjective norm score,  $No_{be}$ = Normative beliefs,  $Mo_{co}$ = Motivation to comply was used and N=Number of respondents. By this formula, a positive (+) Sn score means that, overall, the participant experiences social pressure of using quality seed of improved common bean varieties.

On the other hand, a negative (-) score means that, overall, the participant experiences social pressure of not using quality seed of improved common bean varieties.

To determine perceived behavioural control from its associated beliefs, control beliefs and control belief power were scored. Perceived behavioural control was then computed by the formula  $PBC = \sum (Co_{be} \times Co_{bepo})/N$ ; Where PBC=Total Power Belief Control score,  $Co_{be}$ = Control beliefs,  $Co_{bepo}$  = Control belief power and N=Number of respondents. By this formula, a positive (+) PBC score means that, overall, the participant feels to have control over the use of quality seed of improved common bean varieties. On the other hand a negative (-) score means that, overall, the participant does not feel to have control over the use of quality seed of improved common bean varieties.

Linear regression analysis was then conducted to determine the influence of beliefs on direct determinants of intention. On the one hand, weighted behavioural beliefs were regressed with attitude to determine their influence on quality seed use. On the other hand, weighted normative beliefs were regressed with subjective norm. Finally, weighted control beliefs were regressed with perceived behavioural control.

## **2.4 Results and Discussions**

### **2.4.1 Behavioural beliefs**

To determine smallholder farmers' behavioural beliefs, the study focused on what farmers believed to be the advantages of using quality seed of improved common bean varieties. This was aimed at capturing valued outcomes from using quality seed of improved common bean varieties. The results in Table 2.1 indicate that the most important advantage of using quality seeds are attractive agronomic traits (94%)<sup>1</sup> followed by

---

<sup>1</sup> The traits included high germination rate, vigour, attractive colour, early maturity, low fertilizer need, growth uniformity, no climber, not mixed, very productive, high yielding, very attractive, large seeded

livelihood improvement (69%) and attractive traits with the potential for marketability (52%). Other advantages were considered as less important.

**Table 2.1: Distribution of respondents by believed advantages of using quality seed of improved common bean varieties (n=107)**

Advantage	Frequency (n=107)	Percent
Attractive agronomic traits	101	94.0
Livelihood improvement	74	69.0
Attractive traits with potential for marketability	56	52.0
Quality assurance	45	42.0
Tolerant/resistant to a/biotic stresses	32	30.0
Uniformity	9	8.0

Smallholder farmers' beliefs clearly indicate the aim of releasing new improved, varieties, which is developing high yielding varieties (De Luque and Creemer, 2014). These findings are similar to the findings in a study by Letaa *et al.* (2015) who found agronomic traits as weighted highly by the respondents. The fact that smallholder farmers do not like climbers was also reported by Steven *et al.* (2017) when determining factors, which influence commercialization of common beans among smallholder farmers in Rwanda. In their study, Steven *et al.* (2017) identified the type of beans that influenced the decision of commercializing common beans with bush bean type being more preferred for commercialization. The respondents indicated beliefs on a number of advantages as well as disadvantages of using quality seed of improved common bean varieties (Table 2.2).



**Table 2.2: Distribution of respondents by believed challenges/disadvantages of using quality seed of improved common bean varieties (n=107)**

Challenge/disadvantage	Frequency (n=107)	Percent
Costs to meet additional inputs	32	30.0
Low marketing potential	28	26.2
Lack of tolerance/resistance to a/biotic stresses	25	23.4
Unavailability of quality seed	27	21.5
Inadequate extension services	22	20.6
Microclimate factors	15	14.0
Non attractive agronomic traits	15	14.0
Seed quality attributes	13	12.1
Farm management/operational costs associated with using these seed	7	6.5

The respondents indicated that there are costs of meeting additional inputs. Similar findings are reported by Macharia *et al.* (2017) who, among others, found that inputs were costly leading to minimal use of improved practices. Having low market potential also implies difficulties in selling produces from improved common bean varieties. To a smallholder farmer assured market is a key factor, because the produce has to be sold to enable farmers buy other necessities. The fact that new improved varieties face marketing challenges was also found by Letaa *et al.* (2015) who found that continued use of new improved common bean varieties was a challenge because the varieties were not easily marketable. As a result, farmers continued to use old improved varieties because of its assured market outlet. In a situation where there is low market potential for the produce from improved common beans varieties, commercialization becomes difficult if not impossible. Basically, the beliefs possessed by respondents in the current study reflect what De Luque and Creamer (2014) found to be the principal constraint against commercialization of common beans. Markets for rural areas were also reported by

Shikuku *et al.* (2019) who recommended that production and consumption decisions should not be treated separately.

Tolerance against a/biotic stresses, pests, and diseases is very important in areas with high incidences of weather variability. This is reported by De Luque and Creamer (2014) who considered pests and diseases as principal constraints against the production of common beans. Inadequate extension services are also reported to have constrained farmers even further. In such situation, it is not surprising that farmers lack advice on quality seed of improved common bean varieties. Several studies have indicated that extension services play a significant role in the adoption of improved agricultural technologies. In the exploration of households' socioeconomic characteristics and institutional factors influencing the adoption of improved maize varieties, Mmbando and Baiyegunhi (2014) found that access to extension services and credit facilities exert significant influence on the decision of the adoption of improved varieties. Similarly, Njuguna *et al.* (2015) when studying the influence of demographic characteristics on the adoption found access to extension services and credit as key factors, which influence the adoption.

Extension services play a key role in creating awareness, promoting, educating and linking researchers and other agricultural experts with farmers. Availability of extension services is likely to make quality seeds of improved common bean varieties widely used by farmers. Extension services are considered as an important source of knowledge and information (Lwoga *et al.*, 2011). Tahirou *et al.* (2015) found extension services to influence significantly the adoption of improved cassava varieties in Nigeria. Inadequate extension services make farmers less exposed to knowledge on quality seed of improved common bean varieties leading to lack of adoption of these varieties among farmers.

#### **2.4.1.1 Attitude resulting from behavioural beliefs**

Using the formula  $A = \sum (Be \times Oe)$ ,  $A = +4198.618$ . Where  $A$ =Total attitude score,  $be$ =Behavioural beliefs,  $Oe$ =Outcome evaluation. The overall attitude is positive suggesting that smallholder farmers are in favour of quality seeds of improved common bean varieties. Possible score could be  $[7x+/-3] \times 311 = 6531$ . Where  $[7x+/-3]$  is possible score that is scores ranging from -3 to +3, 311 is the number of respondents. Therefore, the possible range is from -6531 to +6531 implying that smallholder farmers have weak to moderate positive attitude towards quality seed of improved common bean varieties. The overall smallholder farmers' attitude toward quality seed of improved varieties is the mean value obtained by using the formula  $[A = \sum(Be \times Oe) / N = +4198.618 / 311 = 13.5004]$ . Where  $N$ =Total number of respondents The maximum score range is -21 to +21. The average score 13.5004 indicates that smallholder farmers have weak to moderate positive attitude toward quality seed of improved common bean varieties. Besides, this finding indicates that smallholder farmers are generally in favour of using quality seed of improved common bean varieties.

#### **2.4.1.2 The influence of behavioural beliefs on attitude**

Linear regression analysis was conducted to determine the influence of smallholder farmers' behavioural beliefs on attitude towards quality seed of improved common bean varieties. The findings in Table 2.3 indicate that behavioural beliefs have significant influence on smallholder farmers' attitude towards quality seed of improved common bean varieties.

**Table 2.3: The influence of behavioural beliefs on smallholder farmers' attitude towards quality seed**

Factor	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	4.389	.102		43.104	.000**
Weighted attitude*	.089	.007	.583	12.629	.000**

\*Attitude being a product of behavioural beliefs and outcome evaluation

\*\* . Significant at the 0.001 level

#### 2.4.2 Normative beliefs

To determine normative beliefs, the study examined individuals/groups of people who encourage farmers into using quality seed of improved common bean varieties.

The findings are presented in Table 2.4.

**Table 2.4: Distribution of respondents by individuals/groups of people who approve the use of quality seed of improved common bean varieties (n=107)**

Individuals/groups	Frequency (n=107)	Percent
Agricultural experts	107	100
Relatives	99	92.5
Group members	52	48.6
Leaders	27	25.2
Friends	21	19.6
Common bean buyers	19	17.8
Neighbours	15	14
Faith related people	10	9.3
Community members they live with	2	1.9

Findings in Table 2.4 indicate that agricultural experts are the most important individuals who encourage smallholder farmers into using quality seed of improved common bean

varieties. This was indicated by 100 percent of the respondents involved in the study. Agricultural experts included Agricultural Extension Officers, irrigation technician, NGOs, Company, Institutions, Farmer facilitators, Agricultural Projects Officers, agricultural researchers, and development partners. In addition, the results indicate further that relatives are the second most important individuals who encourage smallholder farmers into using quality seed of improved common bean varieties. This was indicated by 92.6 percent of the respondents. This is followed by relatives, who include wives, husbands, children, uncles, aunties, brothers, father, sisters, in law, and similar family members. Besides individuals or groups that encourage farmers into using quality seed of improved common bean varieties, the study also identified individuals/groups of people who discourage farmers against using quality seed of improved common bean varieties (Table 2.5).

**Table 2.5: Distribution of respondents by individuals/groups of people who disapprove of the use of quality seed of improved common bean varieties (n=107)**

Individuals/groups	Frequency (n=107)	Percent
Fellow farmers	21	19.6
Businessmen	18	16.8
Neighbours	14	13.1
Relatives	13	12.1
Agro input sellers	12	11.2
Friends	10	9.3
Older people	9	8.4
Common bean vendors	8	7.5
NGOs	3	2.8
Seed companies	2	1.9
Livestock keepers	1	0.9
Farmers sowing by tractors	1	0.9
Farmers with large farms	1	0.9

Table 2.5 indicates various individuals who discourage smallholder farmers against using quality seed of improved varieties. This list is long and contains mostly primary stakeholders of common beans. Smallholder farmers are surrounded with individuals who have a strong influence on their common bean production practices.

These are key individuals who are the major source of information and knowledge about agricultural production, and who are essential in influencing decision. For instance, in their study Lwoga *et al.* (2011) found neighbours, friends, parents, family, and extension personnel as the main source of agricultural information and knowledge in Tanzania. Similarly, Macharia *et al.* (2017) found farmers in five major common bean producing regions in Tanzania relying on own experience, neighbours and extension agents as major sources of agricultural information. Furthermore, in their study on the determinants of seed demand in Nigeria, Ayoola *et al.* (2014) found that members to particular groups are more likely to demand for quality seed of improved varieties than is the case among non group members. Similarly, Mmbando and Baiyegunhi (2016) found that membership to farmers group influences the adoption of improved maize varieties.

#### **2.4.2.1 Subjective norm resulting from normative beliefs**

The formula  $S_n = \sum (N_{o_{be}} \times M_{o_{co}}) = +3786.813$ . Where  $S_n$  = Total subjective norm score,  $N_{o_{be}}$  = Normative beliefs,  $M_{o_{co}}$  = Motivation to comply was used. By this formula, a positive (+)  $S_n$  score [+3786.813] means that, overall, the participant experiences social pressure of using quality seed of improved common bean varieties. The possible score could be  $[7x+/-3] \times 311$  where  $[7x+/-3]$  is possible score range that is, the score ranged from -3 to +3, while 311 is the number of respondents indicating that the variable has been scored 311 times. The possible range is -6531 to +6531. The

overall subjective norm of smallholder farmers toward quality seed of improved common bean varieties is the average calculated by the formula  $[Sn = \sum (No_{be} \times Mo_{co})/N = +3786.13/311=12.1762]$ . Where N=Total number of respondents. The maximum score range is -21 to +21.

The average score 12.1762 indicates that smallholder farmers experience weak to moderate social pressure on using quality seed of improved common bean varieties.

#### 2.4.2.2 The influence of normative beliefs on subjective norm

Linear regression analysis was conducted to determine the influence of smallholder farmers' normative beliefs on subjective norm towards quality seed of improved common bean varieties. The findings in Table 2.6 indicate that normative beliefs have a significant influence on smallholder farmers' subjective norm towards quality seed of improved common bean varieties.

**Table 2.6: The influence of normative beliefs on subjective norm**

Factor	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	4.954	.096			
Subjective norm*	.014	.007	.121	2.141	.033**

\*Resulting from the product of normative beliefs and motivation to comply

\*\* Significant at the 0.05 level

#### 2.4.3 Control beliefs

To determine control beliefs of smallholder farmers towards quality seeds of improved common bean varieties, the study examined factors, which simplify or facilitate the respondents' ability of using quality seed of improved common bean varieties. The results in Table 2.7 indicate that owning farming capital (reported by 81.3%), fertile land for

common bean production (55.1%) were the most important factors which facilitated respondents' ability to use quality seeds.

**Table 2.7: Distribution of respondents by factors which facilitate smallholder farmer's ability to use quality seed of improved common bean varieties (n=107)**

Factor	Frequency (n=107)	Percent
Having farming capital	87	81.3
Having fertile land for common bean production	59	55.1
Presence of sufficient rainfall	36	34.0
Having crop stock for sale to manage farm operations	34	32.0
Having knowledge on how to use improved seed	33	31.0
Availability of an Agricultural Extension Officer	27	25.2
Having oxen for managing farm operations	18	17.0
Availability of producers and distributors of quality seed of improved common bean varieties	9	8.4
Reliable markets	2	1.9

In addition to factors, which facilitate respondent's ability of using quality seed of improved common bean varieties, factors which make it difficult or impossible for the respondents to use quality seed of improved common bean varieties were also examined (Table 2.8). The findings in Table 2.8 indicate that low family income (reported by 78%), unavailability of quality seed of improved varieties (76%), weather variability (37%), high costs of associated inputs (35%), and inadequate extension services (34%) make it difficult or impossible for farmers to use quality seed of improved common bean varieties.



**Table 2.8: Distribution of respondents by factors which make it difficult or impossible to use quality seed of improved common bean varieties (n=107)**

Factor	Frequency (n=107)	Percent
Low family income	83	78.0
Unavailability of quality seed of improved varieties	81	76.0
Weather variability	40	37.0
High costs of associated inputs	37	35.0
Inadequate extension services	36	34.0
Lack of agricultural land	27	25.2
Lack of markets for produce from improved varieties	18	17.0
Lack of agricultural machinery	10	9.3
Seed quality	8	7.5
Farm management costs associated with using improved varieties	7	6.5
High seed prices	4	3.7

These findings are more or less similar to the findings reported by Mwangi and Kariuki (2015) who found that economic factors, which included farm size, net gain from adoption, the cost of adopting the technology, and high cost of the technology, influence the adoption of technologies. They also found access to extension services and credits as key factors in the adoption of technologies. ASARECA/KIT (2014) found that availability of pre-basic seed is highly inadequate which leads to unavailability of certified seed. Similarly, Mitschke (2015) found that unavailability of quality seed of improved varieties are the constraints against the adoption of improved common bean varieties and seed in

Hai District in Tanzania and concluded that there is no supply chain in place. In another study, Ayoola *et al.* (2011) found that seed availability to be a proximate determinant for seed demand in Nigeria. Similarly, Birachi *et al.* (2011) found lack of improved varieties as having some influence on the production and marketing of common beans in Burundi. This implies that if improved varieties are not available, then they cannot be demanded. In respect, it becomes difficult if not impossible to use quality seed of improved common bean varieties. Accordingly, Buruchara *et al.* (2011) recommend for the promotion of breeder and foundation seed production. Similarly, Munyanka *et al.* (2011) recommend that agricultural research institutions should promote the uptake of their newer varieties through interactions with farmers. The authors recommend further that smallholder farmers or community seed enterprises should be contracted to produce certified seed in their communities for supply in their local communities. Lack of improved varieties was also reported by Birachi *et al.* (2011) as a constraint against common beans production and supply to the markets in Burundi.

Mneney *et al.* (2016) found unavailability of quality seed of improved varieties to have been caused by limited demand for quality seed. In order to create demand for quality seed of improved varieties agricultural research institutions, Agricultural Seed Agency (ASA), and seed companies have to play their roles. Since seed companies have low interest in common beans, ASA has to be more proactive to ensure that quality seed of improved common varieties are available. ASA has to ensure that there are adequate distribution channels at least in major common beans producing regions. This can even be achieved by having contract farmers in major common beans producing regions.

Since low family income is common among smallholder farmers in rural areas, it is not surprising that farmers are not using quality seed of improved common bean varieties.

*Matters are made even worse by unavailability of seeds. Furthermore, high prices and high costs of associated inputs make it difficult for farmers to use quality seed of improved common bean varieties. Although they are unavailable and very expensive, purchasing them is a risk due to adulteration, which affects the quality of seeds. Ayoola et al. (2014) found attitude to seed price to be a proximate determinant for seed demand. In a situation where farmers perceive seed to have high price while produces from these seeds are sold at lower prices or sometimes lack the market, it is difficult for farmers to use the technologies easily. Mneney et al. (2011) found that good quality seeds were not accessed by farmers in Arusha and Mbeya due to high prices. In establishing factors influencing common bean profitability in Babati District Tanzania, Venance et al. (2016) found selling price and access to credit to have affected the gross margin realized by smallholder farmers.*

#### **2.4.3.1 Perceived behavioural control resulting from control beliefs**

Perceived behavioural control is the weighted score which is computed by the formula  $PBC = \sum (C_{be} \times C_{bepo}) = +601.084$ ; Where PBC=Total Perceived Behavioural Control score,  $C_{be}$ = Control beliefs,  $C_{bepo}$  = Control belief power. Based on this formula, a positive (+) PBC= +601.084 score means that, overall, the participant feels to have control over the use of quality seed of improved common bean varieties. Possible score could be  $[7x+/-3] \times 311$ ; where  $[7x+/-3]$  indicates the possible score range that is, from -3 to +3, while 311 represents the number of respondents indicating the number of times a variable is answered. The possible range could have therefore been -6531 to +6531, which indicates that smallholder farmers had neutral

to weak feeling of having control over the use of quality seed of improved common bean varieties.

The overall Perceived Behavioural Control of smallholder farmers toward quality seed of improved varieties is the average score determined by the formula  $[PBC = \sum (Co_{be} \times Co_{bepo})/N = +601.084/311=1.9327]$ . Where N=Total number of respondents. The maximum score range is -21 to +21. The average score 1.9327, indicates that smallholder farmers feel like lacking or having very weak control over the use of quality seed of improved common bean varieties.

#### 2.4.3.2 The influence of control beliefs on perceived behavioural control

Linear regression analysis was conducted to determine the influence of smallholder farmers' control beliefs on perceived behavioural control towards quality seed of improved common bean varieties. The findings in Table 2.9 indicate that control beliefs have a significant influence on smallholder farmers' perceived behavioural control towards quality seed of improved common bean varieties.

**Table 2.9: The influence of control beliefs on perceived behavioural control**

Factor	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
Constant	5.605	.068		82.606	.000
Perceived behavioural control*	-.023	.009	-.141	-2.510	.013*

\*Perceived behavioural control resulting from control beliefs and power of control factors

\*Significant at the 0.05 level

## **2.5 Conclusions and recommendations**

Generally, smallholder farmers have various behavioural, normative, and control beliefs towards quality seed of improved common bean varieties, and which influence their attitudes, subjective norm and perceived behavioural control.

Smallholder farmers were found to have weak to moderate positive attitude toward quality seed of improved common bean varieties. Moreover, smallholder farmers experience weak to moderate social pressure on using quality seed of improved common bean varieties. Furthermore, smallholder farmers lack or have very weak control over the use of quality seed of improved common bean varieties. These factors are mainly resulting from unavailability of quality seed of improved common bean varieties, low family income, low market potential of produce from improved common bean varieties, high costs of associated inputs, and inadequate extension services.

Since quality seed of improved common bean varieties are not easily available to the farming community, efforts of making them available and accessible have to consider distribution channels which come closer to the farming community mainly smallholder farmers. Evidence has indicated that seed dealers are not interested in trading quality seed of improved common bean varieties due to seed recycling hence unavailability. There is need of searching for alternative seed delivery systems for common beans.

Since produces from quality seed of improved common bean varieties experience low marketing potential, there is need for strengthening breeding activities which target market led varieties. Several varieties have been released but not easily adopted due to lack of market outlet for these varieties. Smallholder farmers sell their products to common bean vendors and/or common bean businessmen who know where to take the

produces. Involving common beans vendors, traders and consumers who play a significant role in distribution and marketing is very important for the adoption of improved common beans among smallholder farmers.

In a situation where there are inadequate extension services, improving access to extension services is essential. There is a need of strengthening extension services dealing with quality seed of improved common bean varieties. There is a need of improving the quantity and quality of extension services. This would increase the possibility for smallholder farmers to use quality seed of improved common bean varieties. Evidence indicated that even vendors, common beans buyers, and consumers are not aware of most of these released varieties. Therefore, strengthening extension services would not only benefit farmers but also other common beans stakeholders.

Besides, where there is high cost of associated inputs coupled with low family income, credits are considered paramount. There is a need of establishing credits scheme, which would be specific to producers of common beans. The main initiative targeting seed is National Agriculture Input Voucher Scheme, but then again this scheme does not pay much attention to quality seed of improved common bean varieties.

## **2.6 References**

- Adetumbi, J. A., Saka, J. O. and Fato, B. F. (2010). Seed handling system and its implications on seed quality in South Western Nigeria. *Journal of Agricultural Extension and Rural Development* 2(6): 133 – 140.
- Ahmed, H. U., Muhammad, A. and Musa, H. U. (2015). Exploring theory of planned behaviour for understanding agricultural information utilization by rural

- farmers in Katsina State. *Journal of Humanities and Social Science* 20(6): 27 – 32.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50: 179-211.
- Ajzen, I. (2006). Constructing a TPB questionnaire: conceptual and methodological considerations.[<http://www.unibielefeld.de/ikg/zick/ajzen%20construction%20a%20tpb%20questionnaire.pdf>] site visited 06/04/2016.
- Association for Agriculture Research in East and Central Africa/Tropical Royal Institute (2014). *Tanzania Seed Sector Assessment: A Participatory National Seed Sector Assessment*. Development of an Integrated Seed Sector Development, Entebbe, Uganda.183pp.
- Ayoola, J. B., Ayoola, G. B. and Oyeleke, R. O. (2014). Proximate derminants of seed demand- a panacea for formation of agricultural input policy for Nigeria. *International Journal of Development Research* 4(5): 1062 – 1067.
- Birachi E. A., Ochieng J., Wozemba D., Ruraduma C., Niyuhire M. C. and Ochieng D. (2011). Factors influencing smallholder farmers' bean production and supply to market in Burundi. *African Crop Science Journal* 19(4): 335 – 342.
- Borges, J. A. R., Foletto, L. and Xavier, V. T. (2015). An interdisciplinary framework to study farmers' decisions on adoption of innovation: Insights from Expected Utility Theory and Theory of Planned Behavior. *African Journal of Agricultural Research* 10(29): 2814 – 2825.
- Buruchara, R., Chirwa, R., Sperling, L., Mukankusi, C., Rubyogo, J. C., Muthoni, R. and Abang, M. M. (2011). Development and delivery of bean varieties in Africa: the pan- Africa bean research alliance model. *African Crop Science Journal* 19(4): 227 – 245.

- Chiou, J. S. (1998). The effects of attitude, subjective norm, and perceived behavioral control on consumers' purchase intentions: The moderating effects of product knowledge and attention to social comparison information. *Proceedings of the National Science Council, Republic of China Part 9(2)*: 298 – 308.
- De Luque J. J. R. and Creamer B. (2014). Major Constraints and trends for common bean production and commercialization; establishing priorities for future research. *Agronomia Columbiana* 32(3): 423 – 431.
- Etwire P. M., Atokple I. D. K., Buah S. S. J., Abdulai A. L., Karikari A. S. and Asungre P. (2013). Analysis of the seed system in Ghana. *International Journal of Advance Agricultural Research* 1: 7 – 13.
- FAO (2019). FAOSTAT data on production/yield quantities of beans, dry in world + Total1994– 2017. [<http://www.fao.org/faostat/en/#data/QC/visualize>] site visited on 14/11/2019.
- Francis, J. J., Eccles, M. P., Johnston, M., Walker A., Grimshaw, J., Foy R., Kaner, E. F. S., Smith L. and Bonetti D. (2004). Constructing questionnaires based on the theory of planned behaviour: A manual for health services researchers. [<http://web.fmk.edu.rs/files/blogs/2010-11/Psihologija/Socijalna/TPB.pdf>] site visited on 8/04/2016.
- Hasbullah, N., Mahajar, A. J. and Salleh, M. I. (2014). Extending the Theory of Planned Behavior: Evidence of the Arguments of its Sufficiency. *International Journal of Humanities and Social Science* 4(14): 101 – 105.
- Herath, C. S. (2013). Scientific Information: Does intention lead to behaviour? A case study of the Czech Republic farmers. *Agricultural Economics* 59(3): 143–148.



- Kühne, B., Lambrecht, E., Vanhonacker, F., Pieniak, Z., and Gellynck, X. (2014). Factors underlying farmers' decisions to participate in networks. *International Journal on Food System Dynamics* 4(3): 198 - 213.
- Lazaro, E. A. and Muywanga, D.M. (2008). Seed production and poverty reduction: Case of Dodoma Rural District. *Tanzania Journal Agriculture Science* 8(2): 161 – 172.
- Lee, J., Cerreto, F. A. and Lee, J. (2010). Theory of planned behavior and teachers' decisions regarding use of educational technology. *Educational Technology and Society* 13(1): 152–164.
- Letaa, E., Kabungo, C., Katungi, E., Ojara, M. and Ndunguru, A. (2015). Farm level adoption and spatial diffusion of improved common bean varieties in southern highlands of Tanzania. *African Crop Science Journal* 23(3): 261 – 277.
- Lwoga, E. T., Stilwell, C. and Ngulube, P. (2011). Access and use of agricultural information and knowledge in Tanzania. *Library Review* 60(5): 383 – 395.
- Macharia, M., Kansiime, M., Baars, E., Rutatora, D. and Silvestri, S. (2017). *Gender and the Regime Alliance: Integrating Multi-Media Communication Approaches and Input Brokerage. Intra-Household Survey Report-Tanzania*. Centre for Agriculture Bio International, Nairobi, Kenya. 31pp.
- Ministry of Agriculture Food Security and Cooperatives (2013). *National Agriculture Policy*. United Republic of Tanzania, Dar es Salaam. 51pp.
- Mitschke V. (2015). *Farmers' Constraints Vis-A'-Vis the Adoption of Improved Bean Varieties and Seeds in Hai District, Tanzania. Internship Report*. Wageningen University, The Netherland. 87pp .

- Mmbando, F. E. and Baiyegunhi, L. J. S. (2016). Soci-economic and Institutional factors influencing adoption of Improved Maize varieties in Hai District, Tanzania. *Journal of Human Ecology* 53(1): 49 – 56.
- Mneney, E., Mashindano, O. and Nagarajan, L. (2016). *Tanzania Early Generation Seed Study*. United State Agency for International Development, 97pp
- Munyaka, N., Mvumi, B. M. and Mazarura, U. M. (2015). Seed Security: Exploring the potential for smallholder production of certified seed crop at household level. *Journal of Sustainable Development* 8(2): 242 – 256.
- Mwangi, M. and Kariuki, S. (2015). Factors determining adoption of new agricultural technology by smallholder farmers in developing countries. *Journal of Economics and Sustainable Development* 6(5): 208 – 216.
- Njuguna I. M., Munyua C. N. and Makal S. K. (2015). Influence of demographic characteristics on adoption of improved potato varieties by smallholder farmers in Mumberes Division, Baringo County, Kenya. *Journal of Agricultural Extension and Rural Development* 7(4): 114 – 121.
- Oyekale, K. O. (2014). Growing an effective seed management system: A Case Study of Nigeria. *Journal of Agriculture and Environmental Sciences* 3(2): 345-354.
- Sharifzadeh, M., Zamani, G. H., Khalili, D. and Karami, E. (2012). Agricultural climate information use: An application of the planned behaviour theory. *Journal of Agricultural Science and Technology* 14: 479 – 492.
- Shikuku, K. M., Okello, J. J., Sindi, K., Low, J. W. and Mcewan, M. (2019). Effect of farmers' multidimensional beliefs on adoption of biofortified crops: Evidence from sweetpotato farmers in Tanzania. *The Journal of Development Studies* 55(2): 227 – 242.

- Singh S. and Hensel O. (2014). Impact of extension education on improving knowledge of sustainable technical agricultural practices. *Agricultural Engineering International Journal* 16(1): 198 – 206.
- Steven, K., Patience, M. and Eliud, B. (2017). Factors influencing commercialization of beans among smallholder farmers in Rwanda. *Journal of Agriculture and Veterinary Science* 10(8): 30 – 34.
- Tahirou A., Bamire A. S., Oparinde A. and Akinola A. A. (2015). *Determinants of Adoption of Improved Cassava Varieties among Farming Households in Oyo, Benue and Akwa Ibom States of Nigeria*. Harvest Plus Working Paper No. 20. Nigeria. 21pp.
- Technical Centre for Agricultural and Rural Cooperation (2014). Seed systems, science and policy in East and Central Africa. [[https://cgspace.cgiar.org/bitstream/handle/10568/81086/1832\\_PDF.pdf?sequence=1&isAllowed=y](https://cgspace.cgiar.org/bitstream/handle/10568/81086/1832_PDF.pdf?sequence=1&isAllowed=y)] site visited 30/07/2019.
- Venance, S. K., Mshenga, P. and Birachi, E. A. (2016). Factors influencing on-farm common bean profitability: The case of smallholder bean farmers in Babati District, Tanzania. *Journal of Economics and Sustainable Development* 7(22): 196 – 201.

## CHAPTER THREE

### **3.0 The Influence of Smallholder Farmers' Preferences on Decision to Use Quality Seed of Improved Common Bean Varieties**

Joshua S. Kidudu

Department of Agricultural Extension and Community Development, College of Agriculture, Sokoine University of Agriculture, P.O Box 3002, Morogoro, Tanzania.

Email:kidudujoshua@yahoo.com

**To be submitted to *International Journal of Agricultural Sustainability***

#### **3.1 Abstract**

Using serial cross-sectional research design, preference tests were conducted to determine traits, which are preferred by smallholder farmers in common beans. Farmers were involved in all stages in tracing these traits from production to consumption stages. The findings indicate that at each stage, farmers have different preferred traits. Improved varieties are more superior at production stage but inferior at post production stages. Although, germination, vigour, time to flower, time to mature, high yield and tolerance of improved common bean varieties influenced preferences, such traits did not increase smallholder farmers' decision to use quality seed of improved common bean varieties. Postproduction traits including marketability, consumers' availability, taste and price significantly influenced smallholder farmers' decision of using quality seed of improved common bean varieties. The findings suggest that efforts in promoting the use of quality seed of improved common bean varieties have to consider postproduction traits instead of paying attention to production traits alone.

Key words: Common beans, quality seeds, improved varieties, preference test, preferred traits

### 3.2 Introduction

Common bean is the most important food legume in the world. Globally 36 458 895 ha were allocated to common beans in 2017 and yielded 31 405 912 tonnes of dry common beans (FAOSTAT, 2019). Global production statistics indicate that India, Brazil, Myanmar and China are the world largest producers of common beans while Tanzania, Uganda and Kenya are the leading common beans producers in Africa. Common beans play an important role in household food security and income. It is a major source of affordable protein as well as other nutrients, which are essential for human growth. It is also important in nitrogen fixation, which improves availability of nitrogen essential for plant growth. Common beans provide 20 percent protein, 32 percent energy, generous amounts of micro-nutrients especially iron and zinc, as well as vitamins A and B complex to over 50 million resource poor rural and urban consumers in eastern Africa (Karanja *et al.*, 2011). In this regard, landraces are being improved by modifying their tolerance to a/biotic stresses, yield capacity, and addition of nutritional value to generate improved varieties.

Similarly, efforts are ongoing to ensure that farmers use quality seeds of improved common bean varieties for improved productivity to improve their livelihoods. The contribution of quality seed of improved varieties of increasing productivity has been well documented (Oyekale, 2014; Birachi *et al.*, 2011). In this study, quality seed means certified seed of improved common bean varieties. Although there have been ongoing efforts of generating various improved technologies, smallholder farmers' demand for quality seed of improved varieties has remained low for years (ASARECA/KIT, 2014; CTA, 2014; Etwire *et al.*, 2013; MAFC, 2013; Adetumbi *et al.*, 2010; Lazaro and Muywanga, 2008). This trend has led to low crop productivity, which in turn may lead to food and nutrition insecurity as well as low family income.

This variation in technology adoption among smallholder farmers has been attributed to various factors, which influence adoption. Studies, on smallholder farmers' decision of using improved technologies in agricultural production have broadly identified technological, economic, institutional, and human specific factors (Mwangi and Kariuki, 2015) as major determinants of adoption. Nevertheless, studies on adoption of improved agricultural technologies have paid little attention to smallholder farmers' preferences.

Preference theory has been used to explain and predict choices among given alternatives. Hakim (2003) used preference theory to explain and predict women's choices between market work and family work. Concurring with Hakim (2003), Kan (2005) showed that women's attitudes toward home and work play a significant role in their career trajectories. Moreover, Harsanyi (1992) distinguished person's actual preferences as indicated by his/her choice behaviour as well as verbal statements, from his/her informed preferences, defined as the hypothetical preferences he/she would have had if he/she had all the relevant information and he/she had made full use of this information.

Building on preferences theory, this study considered smallholder farmers as producers of common beans who produce for food, cash, as well as food and cash. On the one hand, those producing crops for food tend to focus on common beans cooking traits including delicious soup, absence of gas when consumed, short cooking time, and high yield. On the other hand, those producing crops for cash would go for common beans with high market demand in terms of customers' availability, high price, and high yield. However, those who produce crops for both food and cash tend to focus on high yield, cooking attributes, and marketability.

Several studies (see for instance Asrat *et al.*, 2010; Balcha and Tigabu, 2015; Bucheyeki and Mmbaga, 2013; Mulu *et al.*, 2016) have been conducted to determine farmer variety selection. However, these studies focused on production stages where agronomic attributes have been key determinants of variety selection. Indeed this has been the concern of most breeding initiatives under participatory variety selection which paid little attention on the postproduction attributes. Furthermore, these studies aimed at selecting varieties among others for variety release and popularization rather than for what farmers actually prefer in common beans. In this respect therefore, the current study focused on determining the attributes, which are actually preferred by smallholder farmers from the preproduction to the consumption stages of common beans. The study examined further, whether the preferred attributes among smallholder farmers are present either in landraces or in improved common bean varieties. The preferred attributes in common beans were traced from preproduction, production, marketing, to the consumption stages. To determine the preferred attributes among smallholder farmers in common beans, a comparison was made between local landraces and improved varieties from preproduction through production, consumption to marketing.

### **3.3 Materials and Methods**

This study used a serial cross-sectional research design. This design, allows data to be collected from more than once in the same study population at different time points (Pandis, 2014). Using this design, qualitative and quantitative data were collected in four different phases namely elicitation, market, field and cooking preferences tests. The study population comprised smallholder farmers producing common beans in major producing regions. These included Arusha, Kilimanjaro and Manyara (Northern Zone), Iringa, Katavi, Mbeya, Njombe, Rukwa, Ruvuma and Songwe

(Southern), Morogoro and Tanga (Eastern), Geita, Kagera, Kigoma and Mwanza (Western/Great Lakes).

To select elicitation study areas multistage sampling technique was used. In the first stage, Iringa, Kigoma, Kilimanjaro, Mbeya, Morogoro and Njombe regions were randomly selected. The sampled regions represented major common beans producing regions in Western/Great lakes, Northern, Southern and Eastern Zones. In the second stage, study districts were randomly selected from the sampled regions. Accordingly, Kasulu, Kilolo, Mbeya, Moshi, Mvomero, Siha and Wanging'ombe were selected as indicated in Figure 3.1. This was followed by random selection of 107 respondents.



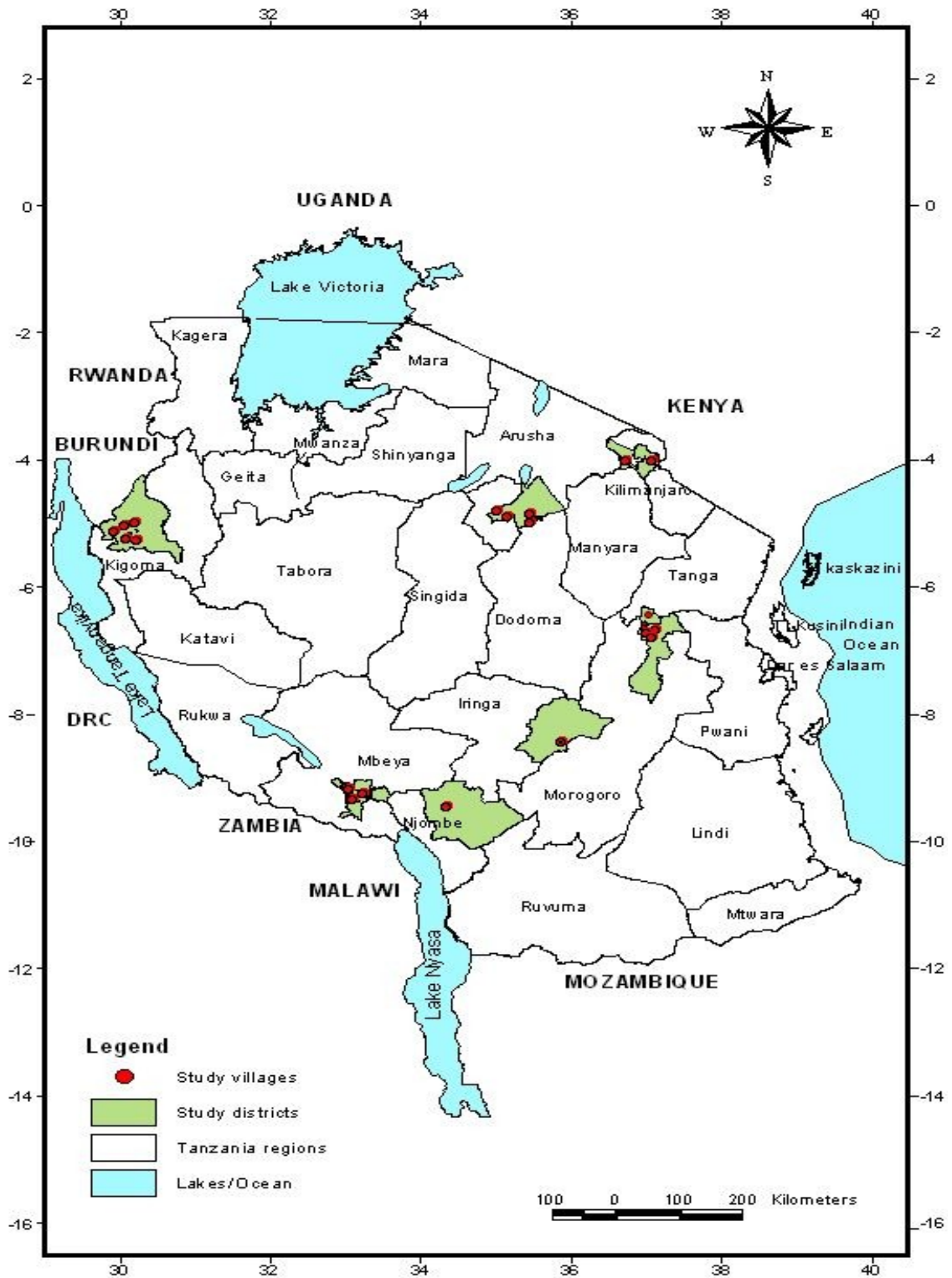


Figure 3.1: Map showing study area

Similarly, multistage sampling technique was used to obtain study area for market, field and taste preference tests. From all regions producing common beans, one region was randomly selected. This was followed by the random selection of one study district. From the wards producing common beans in the selected district, one ward was randomly selected for the study. This was followed by the random selection of three study villages in the sampled ward. Therefore, Morogoro Region, Mvomero District and Kinda Ward were selected. From Kinda Ward, Kinda, Makate, and Ndole villages were used for the study.

### **3.3.1 Market preferences tests**

The first phase involved market preferences test. The released varieties were collected from Sokoine University of Agriculture, Uyole Agricultural Research Institute, Selian Agricultural Research Institute and seed companies. A total of 22 varieties were obtained from SUA, ARIs, and seed companies while seven landraces were obtained from smallholder farmers. Those from SUA, ARIs and seed companies included Lyamungo 85, Lyamungo 90, Njano Uyole, Rosenda, Pesa, Wanja, Uyole 03, Fibea, and Cheupe. Others include, Selian 06, Uyole 84, Jeska, Uyole 96, Uyole 94, Selian 97, Selian 94, Rojo, Uyole 16, Selian 05, Roba, SUA 90, and Mshindi. Landraces included Kablanket round (Soya Golori Nyekundu), Kablanket White (Soya nyeupe), Njano, Njano Goroli, Njano Kigoma, Maini, and Maini Nyeupe.

In this phase, 29 different common bean varieties and landraces were displayed in Ndole market during the market day, which is Wednesday every week. On this day smallholder farmers from Kinda, Makate and Ndole villages as well as other farmers from other villages and businessmen come to sell and buy different commodities. Using a simple

random sampling technique, 67 smallholder farmers were randomly selected from villages served by Ndole market to participate in market preference tests.

Smallholder farmers were allowed to see, touch, and ask questions on the varieties displayed. Then 67 randomly selected farmers were given a questionnaire to list the preferred varieties in their villages, sources of seed for each preferred variety, and attributes that attract farmers in each preferred variety. Adding to varieties preferred in their villages, farmers evaluated grain colour, grain size, prevailing market price, marketing potential, consumer preferences and diffusion of the displayed varieties.

The varieties were randomly assigned numbers and arranged as follows, 1=Rojo, 2=Maini Nyeupe, 3=Njano Uyole, 4=Wanja, 5=Uyole 03, 6=Selian 94, 7=Selian 06, 8=Selian 05, 9=Kigoma Yellow, 10=Fibea, 11=Calima Uyole, 12=Mshindi, 13=Selian 97, 14=Roba, 15=Uyole 84, 16=Kablankei, 17=Lyamungo 90, 18=Rosenda, 19=Uyole 94, 20=Uyole 16, 21=Maini, 22=Njano golori, 23=Pesa, 24=Jesca, 25=Cheupe, 26=Lyamungo 85, 27=SUA 90, 28=Uyole 96, 29=Mixed varieties.

### **3.3.2 Field preferences tests**

In the second phase, the varieties collected from SUA, ARIs, seed companies and smallholder farmers were planted in four different plots located in three villages in Mvomero District. The villages included Kinda, Makate, and Ndole where all varieties and landraces were planted. Using randomized complete block design varieties were randomly assigned to blocks in each of the four plots.

In addition to collection of data during the market day, smallholder farmers in all the three villages participated in evaluating the varieties at flowering, maturity, and harvesting

stage. At flowering stage, the data collected included germination, vigour, number of leaves, height above soil, flowering and overall plant growth. Data on diseases, maturity, and yield were collected at sixty days old.

In the third phase, common bean varieties and landraces, which were evaluated in the market and in field, were cooked and tasted by smallholder farmers. During cooking and taste preferences test, simple random sampling technique was used to selected 51 smallholder farmers who participated in evaluating 21 common bean varieties.

### **3.3.3 Preference tests during cooking**

Smallholder farmers from the three study villages participated in evaluating the cooked common bean varieties and landraces. Both local and improved common bean varieties were cooked and tasted. During the taste preference tests, 21 varieties were cooked. The varieties included 1=Rojo, 2=Maini Nyeupe, 3=Njano Uyole, 4=Wanja, 5=Uyole 03, 6=Selian 06, 7=Njano Golori, 8=Kigoma Yellow, 9=Fibea, 10=Calima Uyole, 11=Mshindi, 12=Selian 97, 13=Kablanketi, 14=Lyamungo 90, 15=Rosenda, 16=Uyole 16, 17=Maini, 18=Pesa, 19=Jesca, 20=SUA 90 and 21= Uyole 96.

### **3.3.4 Data analysis**

To determine smallholder farmers' preferences, data on attributes, which were preferred by smallholder farmers in quality seed of improved common bean varieties, were analyzed using descriptive statistics to generate frequencies and percentages. To determine differences among varieties, landraces, and between improved varieties and local ones, the Analysis of Variance was conducted. Normality tests were conducted for all preferences tests data. To determine the influence of various traits on the decision to

use a certain common bean variety, multiple linear regression analysis was conducted. For qualitative data, content analysis was used to determine imaging themes.

### 3.4 Results and Discussion

#### 3.4.1 Preferred common beans

The preferred common beans were examined. The results in Table 3.1 indicate that local landraces are more preferred than is the case with improved varieties.

**Table 3.1: Distribution of respondents by preferred common bean varieties (n=107)**

Common bean variety	Frequency (n=107)	Percent
Yellow landraces	81	76.0
Kablanketi landraces	74	69.0
Lyamungo	53	50.0
Wanja	29	27.0
Canadian wonder	21	19.6
Njano Uyole	21	19.6
Selian 06	13	12.0
Uyole 03	1	0.9

The results show that yellow landraces are the most preferred (76%). This is followed by Kablanketi landraces (69%). These findings are close to what Mitschke (2015) found in Hai District Tanzania where Soya njano was the most preferred as it cooks faster, tastes sweeter, contains less gas, and it is easier to digest. Among the improved varieties, Lyamungo was the most preferred. It is important to note that the names given by farmers vary considerably from those given by researchers. Furthermore, some improved varieties have been used by farmers for long time to the extent that they are already considered as local varieties.

### 3.4.2 Attractive traits in preferred common beans

As indicated in Table 3.1, there were different preferences among farmers towards common bean varieties. Accordingly, the study went further to establish traits or attributes of the most preferred varieties as indicated in Table 3.2.

**Table 3.2: Percentage distribution of respondents by attractive traits in most preferred common beans (n=107)**

Attractive feature/trait	Frequency (n=107)	Percent
Cooking traits of the common bean variety	107	100
Marketability of produce from common bean variety	79	74.0
Agronomic traits of the common bean variety	64	60.0
Tolerance/resistance to a/biotic stresses	15	14.0
Availability of quality seeds of common bean varieties	3	2.8

Results in Table 3.2 indicate that cooking traits were the most preferred attributes as was expressed by all respondents (100%). These cooking traits included cooking duration, taste, absence of gas when consumed, production of good soup and the ability to be cooked without using cooking oil. Similar results are reported by Tumeo *et al.* (2017) when determining consumer choice in Lilongwe City Malawi. In their study, the authors found grain size, gravy quality and cooking time to have influenced the decision to consume common beans. This was also more or less similar to what was reported by Katungi *et al.* (2011), when determining the relative importance of common beans attributes and variety demand in drought areas of Kenya. The authors found cooking time, quality, and grain colour to have influenced the demand. Furthermore, when determining physical and cooking characteristics of some Indian Kidney beans Wani *et al.* (2014) found cooking quality to be important for consumer acceptance. These findings imply that

breeding and multiplication of common beans should pay attention to cooking traits as they influence consumers preference and hence marketability. Cooking traits attribute was followed by marketability of produce from a given common bean variety as indicated by 74 percent of the respondents. The traits, which were considered in this category, included high produce price, good produce weight, excellent variety for business, being highly demanded, having high selling ability, market being readily available, being highly preferred by community members and consumers, and being readily available. Marketability determines potential for commercialization.

Moreover, smallholder farmers indicated to have been attracted by agronomic traits (60% of the respondents) of the given common bean variety. The agronomic traits, which attract smallholder farmers included high germination rate, vigour, attractive colour, early maturity, low fertilizer need, growth uniformity, absence of climber, not being mixed, very productive, being high yielding, being very attractive, and having large seeds. These traits are more or less similar to what Shiferaw *et al.* (2005) found in pigeon peas. In their study, Shiferaw *et al.* (ibid) found high yield, early maturity, and even/uniform maturity among others as important criteria for selecting pigeon pea variety. Similar results are reported by Katungi *et al.* (2015), who indicated that changes in yields are a key in farmers' evaluation in Kenya. Moreover, during participatory variety selection of common beans in Wolata Ethiopia, Balcha and Tigabu (2015) found high yield, early flowering, maturity and fast cooking time to have influenced farmers' preferences. This is in line with the targets of breeding the varieties concerned.

In addition to being highly preferred traits, 14 percent of the respondents indicated tolerance or resistance against weather-water logging, drought, flood, humidity, biotic-pests and diseases as playing a role in attracting smallholder farmers. Weather variability

and biotic constraints are evident in most farming systems. Therefore, tolerance or resistance is a key of attraction of the variety to smallholder farmers due to high incidence of pests, diseases, and weather variability accompanied by drought and or floods. For instance, Katungi *et al.* (2015) did a study in Kenya and found seeds resilience to environmental stresses as being important attributes to farmers. Additionally, Gidoi *et al.* (2015) found pests and diseases as the most important challenges limiting increased crop production in Bukedi subzone in Uganda. A similar case was found by Mneney *et al.* (2016) in Tanzania when studying early generation seed. The problem was serious during field preferences tests, which were carried out during the current study to the extent that traditional varieties could hardly survive. Despite this situation, Lwoga *et al.* (2011) found major gaps in information and knowledge related to the control of plant diseases and pests in Tanzania. This calls for a special attention by seed stakeholders, because breeders, multipliers and farmers face this challenge in production of common beans seed as well as grain.

#### **3.4.3 Attractive traits in improved common bean varieties**

The results in Table 3.1 show that local landraces are more preferred than improved common bean varieties. Results in Table 3.2 indicate that, farmers mostly prefer cooking traits, marketability and agronomic traits endowed in the local varieties. However, when it comes to improved common bean varieties, the order of preference changes to some extent, as indicated by the results in Table 3.3.



**Table 3.3: Percentage distribution of respondents by attractive features/traits in improved common bean varieties (n=107)**

Attractive trait/feature	Frequency (n=107)	Percent
Agronomic traits of the improved variety	107	100
Produce from improved variety have good market qualities	96	90.0
Tolerance/resistance	66	62.0
Seed quality assurance	50	47.0
Cooking traits	47	44.0
Suitability to microclimate conditions	19	18.0
Availability of quality seeds of improved varieties	11	10.0

All respondents (100%) indicated that agronomic traits of the improved varieties are the most preferred followed by good market qualities (90%), tolerance or resistance (62%), seed quality assurance (47%), and cooking traits (44%). While with local varieties marketable traits included price of the produce, weight of the produce, being for business only, demand, ability of being sold, having a readily available market, and being preferred by community members and consumers. The case was different with for improved varieties, where the produces were reported to be uniform, they have good weight, hence offer a good chance of being good for business, which is not the case currently. Uniformity in colour, size and shape also attracts buyers and consumers.

Mulu *et al.* (2016) found uniformity as the basis for farmers' selection of the varieties Hawasa Dume and Dimtu in Borecha District of Southern Ethiopia during participatory variety evaluation of red common beans. However, this is well handled by breeders when they produce new varieties. What remains a challenge is the fact that the produce from improved common bean varieties is not much preferred by community members and consumers as opposed to local varieties. Being preferred by community members implies that the market is available within and outside the village. A similar situation is indicated

by other respondents who indicated cooking traits as being attractive attributes. While all the respondents (100%) in Table 3.2 preferred local varieties because of cooking traits, it was only 44 percent of the respondents in Table 3.3 who indicated that improved varieties are good for cooking.

Since common bean is grown for cooking and for sale, one is likely to go for local varieties more than for improved ones. This is because having local varieties creates assurance with taste, soup, high price, and readily available market when one opts for selling the produce for raising income. This was well explained during the focus group discussion where participants concluded with confidence that *“Varieties with high price, do you eat sesame? We produce for sale because sesame fetches high price”*. This was in response to what farmers consider to be quality seed of improved common bean varieties. During the same group discussion, the following example of one of the local landraces was provided.

*Kigoma yellow is best because we buy and sell amongst ourselves here in the village-therefore the market for Kigoma yellow is readily available-if you take produce to Mbalizi, Mwanjelwa or Uyole you are the king, no one like you anymore, because they are taken to other regions/Dar Es Salaam and abroad especially Congo”*.

Furthermore, participants advised that when quality seed of improved varieties need to be introduced then *“Bring varieties with good market, the ones which can easily be sold when the child is sick not the ones with nowhere to sell”*.

In another focus group discussion participants indicated that *“The yellow variety is excellent, it has assured marketability, best cooking traits and has high social status attached to it”*. These results suggest that unattractive cooking traits and lack of consumers for improved common bean varieties may be the reasons as to why

smallholder farmers do not use them in production. These findings are in line with what was gathered by Bucheyeki and Mmbaga (2013) from farmers during on farm trials in Kasulu District Kigoma Region. Their statistical analysis ranked Lyamungu 90, and Jesca as the best varieties due to high yield and cooking time. To their surprise, farmers insisted that Kigoma yellow is their best choice. To date if you visit markets in Kigoma you will hardly find Lyamungu and Jesca.

Basically, what Bucheyeki and Mmbaga (2013) found is what was obtained from field preferences tests in this current study. In terms of yield, Selian 06 the climber was the most preferred variety. However, during cooking farmers indicated their worries. They had made questions such as, “*where will you take this variety? Who will buy it?*” At the end of the preference tests, what they used to prefer remained the same although agronomically improved varieties outperformed local landraces. Similar findings were reported by Letaa *et al.* (2015) who revealed that new improved varieties had more attractive agronomic traits; however, farmers continued to use old ones because of market attributes. Where to sale remains a challenge, which requires research that starts with consumer preferences. These findings suggest that breeding programmes should stick on what farmers prefer as well as what markets (consumers) prefer. This is because common beans are no longer for subsistence but rather for both household consumption and income generation. Therefore, introducing marketable varieties is necessary.

Most of these improved varieties are new to both consumers, buyers, vendors, market systems and smallholder farmers. Therefore, awareness creation is very necessary. For instance, according to Mazuma *et al.* (2011), farmers, consumers, traders and other rural service providers have low exposure to new improved varieties, which limits their use. Furthermore, Simtowe *et al.* (2016) found 27 percent adoption gap due to incomplete

exposure to improved pigeon pea varieties in Malawi. These results imply that there is a need for extension services providers and seed dealers to play their role actively. There is also a need of promoting these varieties through demonstrations, farmer field schools, seed fairs, agricultural shows, and other information and communication media.

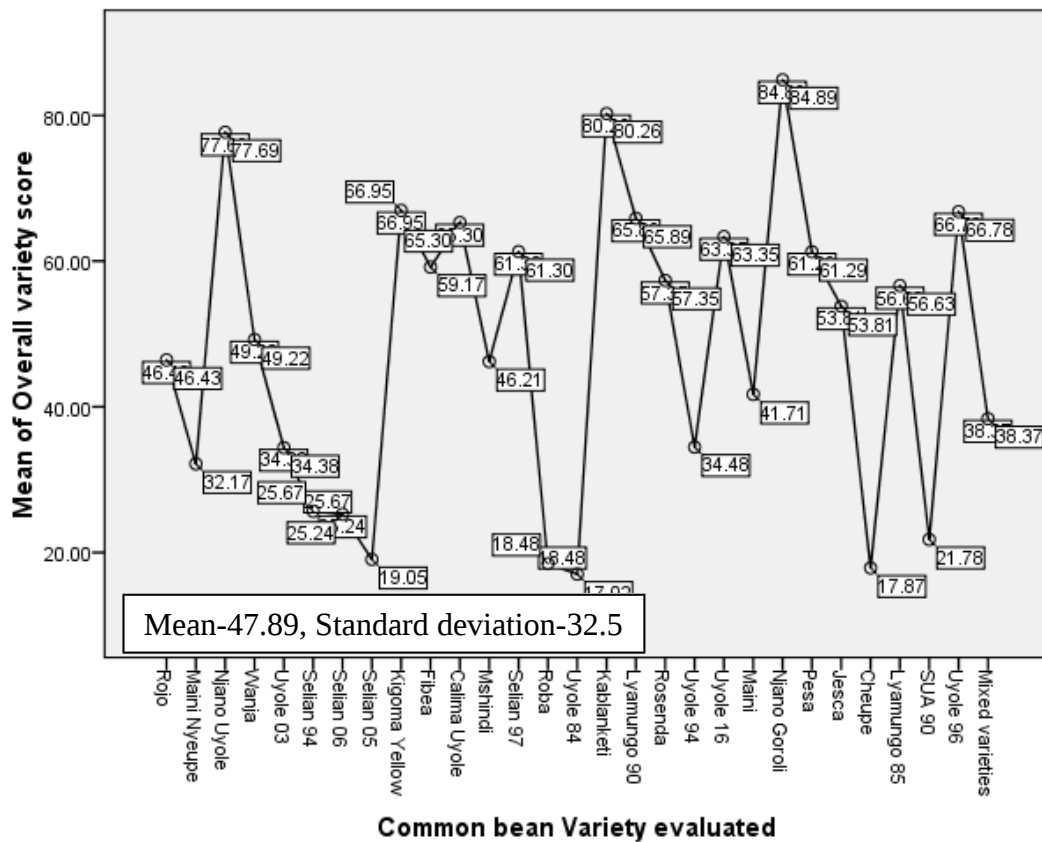
#### **3.4.4 Market preferences test results**

Data from respondents were subjected to Analysis of Variance (ANOVA) to compare the mean scores for each evaluated attribute. The findings in Table 3.4 indicate that the respondents' preferences varied significantly in accordance to variety colour, grain size, price, marketability, and availability of consumers. These traits influenced overall preference for a particular variety among smallholder farmers as indicated in Figure 3.2.

**Table 3.4: Differences among common bean varieties as preferred by smallholder farmers**

Differences among common bean varieties		Sum of				
traits		Squares	df	Mean Square	F	Sig.
Colour	Between Groups	769 735.924	28	27 490.569	43.773	.000**
	Within Groups	1 129 189.683	1798	628.025		
	Total	1 898 925.607	1826			
Grain size	Between Groups	6 793 99.380	28	24 264.264	40.798	.000**
	Within Groups	1 069 336.857	1798	594.737		
	Total	1 748 736.238	1826			
Price	Between Groups	785 747.813	28	28 062.422	49.729	.000**
	Within Groups	1 014 615.143	1798	564.302		
	Total	1 800 362.956	1826			
Market availability	Between Groups	833 615.741	28	29 771.991	49.237	.000**
	Within Groups	1 087 195.865	1798	604.670		
	Total	1 920 811.606	1826			
Consumers availability	Between Groups	805 354.745	28	28 762.669	47.177	.000**
	Within Groups	1 096 187.873	1798	609.671		
	Total	1 901 542.619	1826			
Overall variety score	Between Groups	728 461.630	28	26 016.487	38.972	.000**
	Within Groups	1 200 303.800	1798	667.577		
	Total	1 928 765.430	1826			

\*\* Significant at the 0.001 level



**Figure 3.2: Differences among common bean varieties at market preference test**

In addition to ANOVA, data from respondents were subjected to linear regression analysis. Findings in Tables 3.5 and 3.6 indicate that the overall score assigned to a variety is significantly influenced by colour, grain size, price, market, and consumer availability. These findings are in line with the findings of Sichilima *et al.* (2016) who found that grain size and colour influenced significantly price received traders in Zambia. In their study, Sichilima *et al.* (ibid) found that medium sized and yellow common beans were highly preferred. Similar results were reported by Mwenda and Chirwa (2007) whereby among other traits colour and size influenced the adoption of improved common beans among farmers in Malawi. Katungi *et al.* (2015) found consumption traits as being more important than production traits to farmers in Kenya. Therefore, based on the

findings, one may conclude that variety colour, grain size, price, market and consumers availability significantly influences smallholder farmers' preferences and hence the decision of using a particular variety in production. This conclusion may hold true because farmers produce common beans for consumption and for sale. This assures smallholder farmers that if they have common beans selling is not a problem because market and consumers are available. Furthermore, certain varieties have higher market price as opposed to other varieties, thus producing these varieties is an assurance that the producer would increase on farm based income.

**Table 3.5: Influence of attributes tested on overall variety preference**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.874 <sup>a</sup>	.764	.763	15.80914

a. Predictors: (Constant), Percentage of availability of consumers, Percentage assigned to grain size, Percentage assigned to common bean variety colour, Percentage assigned to price of the variety, Percentage of availability of the market

**Table 3.6: Factors influencing smallholder farmers' preference on marketability of common beans**

	Unstandardized Coefficients		Coefficients <sup>a</sup>		Sig.
	B	Std. Error	Standardized Coefficients	t	
Attribute tested(Constant)	4.425	.785		5.639	.000**
Percent assigned to common bean variety colour	.080	.018	.079	4.496	.000**
Percent assigned to grain size	.122	.018	.116	6.722	.000**
Percent assigned to price of the variety	.153	.025	.147	6.134	.000**
Percent to availability of market	.201	.027	.201	7.504	.000**
Percent to availability of consumers	.423	.026	.420	16.572	.000**

a. Dependent Variable: Overall variety score

\*\* . Correlation is significant at the 0.001 level

### **3.4.5 Field preference tests results**

#### **3.4.5.1 Preference tests at flowering stage**

Efforts were made to explore traits preferred by smallholder farmers during flowering stage. The study examined differences among common bean varieties in terms of germination, vigour, growth, and flowering intensity. The results indicate that common bean varieties performed differently in the aspects studied. Based on preferences farmers were requested to give overall score per variety. Results in Table 3.7 indicate that there was a significant difference among varieties in terms of the ability to germinate, growth intensity, flowering intensity, and the overall variety performance in the field at flowering stage.



**Table 3.7: Differences among common bean varieties at flowering stage**

Differences among common bean varieties' attribute		Sum of Squares	df	Mean Square	F	Sig.
Germination percent	Between Groups	310 761.744	26	11 952.375	15.189	.000**
	Within Groups	996 225.488	1266	786.908		
	Total	1 306 987.231	1292			
Growth percent	Between Groups	281 891.198	26	10 841.969	13.586	.000**
	Within Groups	1 010 277.479	1266	798.007		
	Total	1 292 168.677	1292			
Common bean variety flowering percent	Between Groups	257 608.856	26	9 908.033	10.180	.000**
	Within Groups	1 232 159.252	1266	973.270		
	Total	1 489 768.108	1292			
Overall variety score	Between Groups	253 210.748	26	9 738.875	6.195	.000**
	Within Groups	199 0061.361	1266	1 571.928		
	Total	2 243 272.108	1292			

\*\* . Significant at the 0.001 level

Variety germination, growth and flowering intensity influenced overall smallholder farmers' preference for a particular variety as indicated in Table 3.8 and Figure 3.3.

**Table 3.8: Factors influencing smallholder farmers' preferences for common beans at flowering stage**

Factor	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
Constant	21.864	3.011		7.263	.000**
Common bean variety evaluated	-.237	.113	-.049	-2.089	.037*
Germination percent	.171	.046	.130	3.742	.000**
Growth percent	.275	.048	.209	5.707	.000**
Common bean variety flowering percent	.355	.036	.290	9.952	.000**

\*\* . Significant at the 0.001 level

Factor	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	21.864	3.011		7.263	.000**
Common bean variety evaluated	-.237	.113	-.049	-2.089	.037*
Germination percent	.171	.046	.130	3.742	.000**
Growth percent	.275	.048	.209	5.707	.000**
Common bean variety flowering percent	.355	.036	.290	9.952	.000**

\*. Significant at the 0.05 level

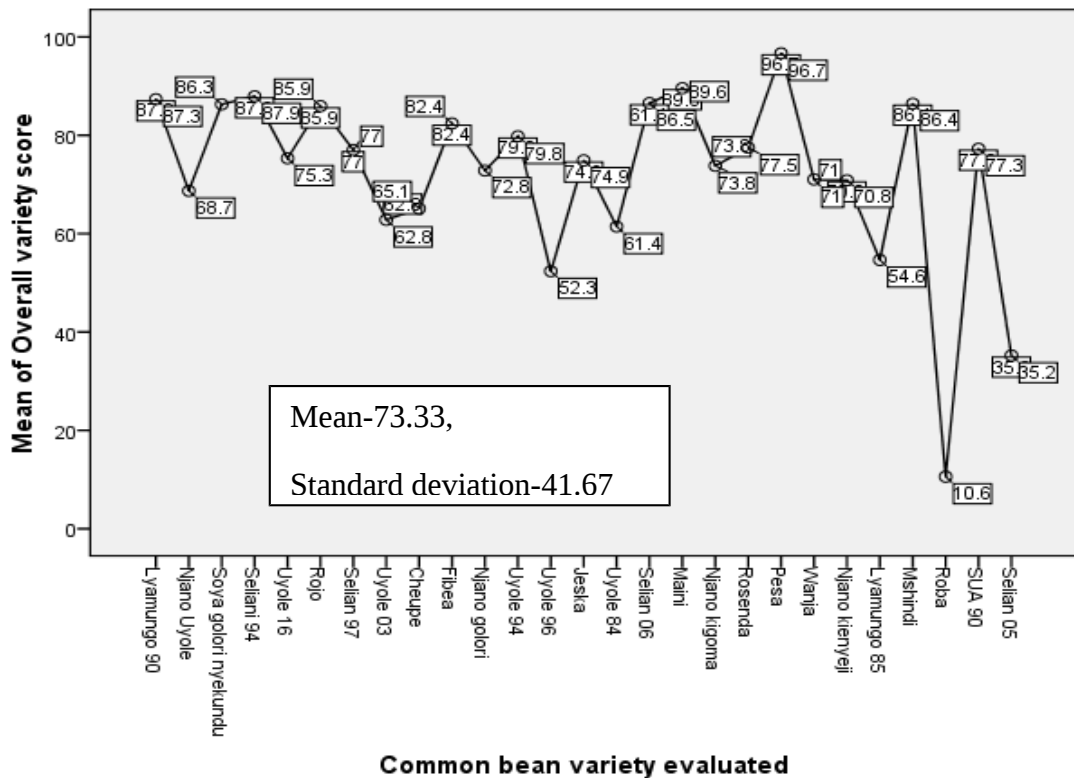


Figure 3.3: Differences among common bean varieties at flowering stage

### 3.4.5.2 Preference tests at maturity stage

Further investigation of traits preferred by smallholder farmers was conducted in the field at maturity stage. Smallholder farmers observed all the varieties at maturity and scored each variety. Farmers were asked to provide the reasons, which influenced them to assign

a particular score, and listed the attributes, which motivated them to assign a particular score, for the varieties, which were scored highly. Conversely, they listed attributes, which encouraged them to assign a low score to a particular variety.

The findings, which are summarized in Table 3.9, indicate that, high yields due to increased number of pods, attractive growth due to having many leaves, tolerance against heavy rainfall and diseases motivated farmers to assign a given variety high score. On the other hand, low yield indicated resulting from having few pods, lack of tolerance against heavy rainfall and unattractive growth due to having few leaves made farmers assign low score to a particular variety.

As indicated earlier, that season had heavy rainfall that is why; non-tolerance/resistance against heavy rainfall was among the factors, which influenced score at maturity stage. However, this is not a common trend in most production seasons. Nevertheless, smallholder farmers imply that there is a need for breeders to consider yields and tolerance to a/biotic stresses in breeding. However, focusing on yields and tolerance/resistance to a/biotic factors has been a common practice for many breeding programmes. What needs to be found out is why are smallholder farmers not using improved varieties, despite that the latter have all the good traits addressed by breeding programmes.

**Table 3.9: *Distribution of respondents by attractive feature at maturity stage***

Attractive feature	Frequency (n=792)	Percent
High yield-many pods	434	55.0
Attractive growth-many leaves	414	52.3
Tolerant to heavy rainfall	406	51.2
Average yield	141	18.0

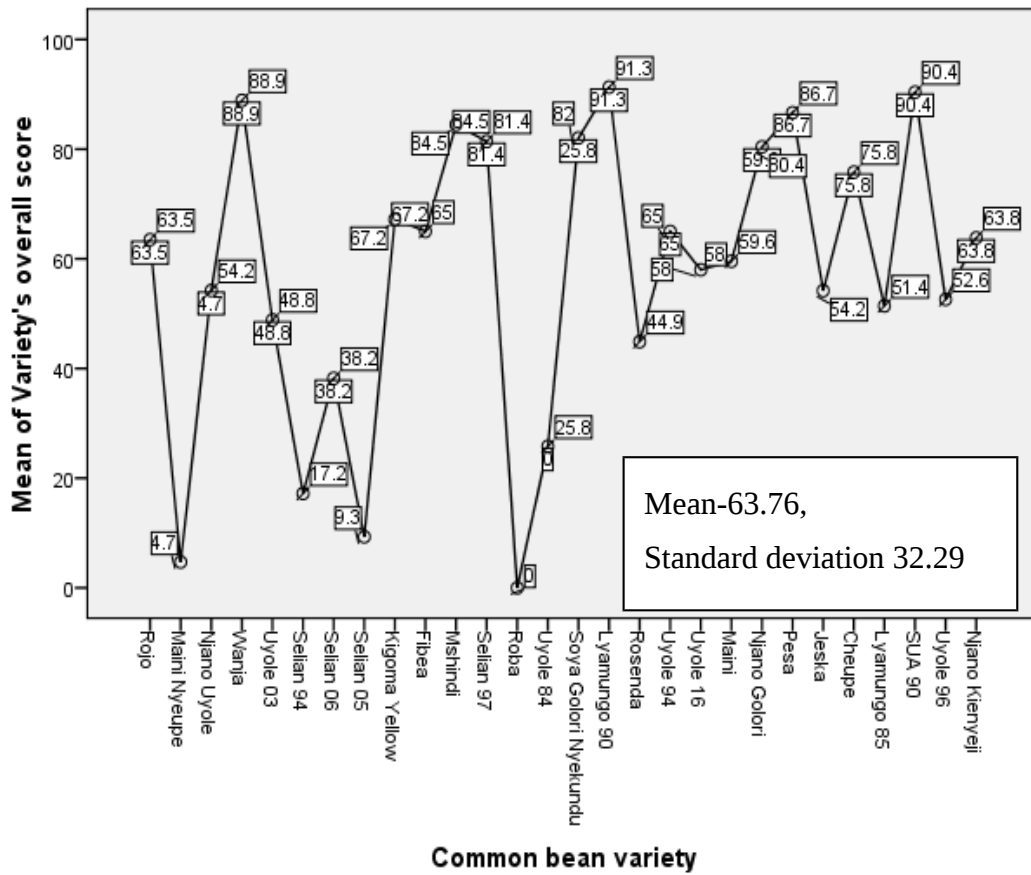
Tolerant to diseases	122	15.4
Early maturity	21	3.0

Based on the traits presented in Table 3.9, using ANOVA smallholder farmers' preferences towards varieties were evaluated. The findings in Table 3.10 indicate that smallholder farmers' preferences varied significantly among the evaluated common bean varieties. These differences are indicated in Figure 3.4.

**Table 3.10: Differences among common bean varieties at maturity stage**

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	303 552.480	27	11 242.684	17.401	.000**
Within Groups	448 400.617	694	646.110		
Total	751 953.097	721			

\*\*Significant at the 0.001 level



**Figure 3.4: Differences among common bean varieties at maturity stage**

Variety, its yields, growth and tolerance or resistance ability influenced overall smallholder farmers’ preference for a particular variety as indicated in Table 3.11.

**Table 3.11: Factors influencing smallholder farmers’ preferences for common beans at maturity stage**

Factor	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	95.429	2.855		33.420	.000**
Common bean variety	.559	.114	.146	4.903	.000**
High yield	-3.276	.287	-.354	-11.417	.000**
Attractive growth	-2.015	.330	-.191	-6.100	.000**
Tolerance to a/biotic stresses	-2.885	.343	-.271	-8.418	.000**

\*\* . Significant at the 0.001 level

### 3.4.5.3 Preference tests results during cooking

21 common bean varieties were cooked and tasted, to determine consumer preferences on cooked common bean varieties. This was an additional investigation because it had already been established that smallholder farmers prefer common bean varieties due to their taste. As indicated earlier, local common bean varieties are preferred more than improved ones because of their cooking and marketing traits. On the other hand, improved varieties are preferred more due to their agronomic traits.

The Analysis of variance was carried out to determine the differences in taste among different cooked common bean varieties. The findings in Table 3.12 indicate that the taste varied significantly among cooked common bean varieties. Having shown a significant variation, post hoc tests were performed to determine which varieties actually varied significantly.

**Table 3.12: Differences among cooked common bean varieties tastes**

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	62 715.621	20	3 135.781	5.759	.000**
Within Groups	571 741.245	1050	544.515		
Total	634 456.866	1070			

\*\*Significant at the 0.001 level

Dunnett Post Hoc Test presented in Table 3.13 indicates that Uyole 96 varied significantly only with SUA 90, Jesca and Wanja. Although, Uyole 96, which is considered the reference point, varied with nearly all other varieties. The differences in taste were not significant, suggesting that if one is able to consume Uyole 96 comfortably, then the same could be felt when one consumes any other variety except SUA 90, Jesca and Wanja.

**Table 3.13: Dunnett Post Hoc Test to determine actual variations between Uyole 96 and other *cooked common bean varieties tastes***

(I) Common bean variety tasted	(J) Common bean variety tasted	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
					Rojo	Uyole 96
Maini Nyeupe	Uyole 96	-6.39216	4.62099	.856	-19.8438	7.0595
Njano Uyole	Uyole 96	-3.07843	4.62099	1.000	-16.5301	10.3732
Wanja	Uyole 96	-16.58824*	4.62099	.006	-30.0399	-3.1366
Uyole 03	Uyole 96	3.29412	4.62099	1.000	-10.1575	16.7458
Selian 06	Uyole 96	-10.98039	4.62099	.189	-24.4320	2.4713
Kigoma Yellow	Uyole 96	-3.09804	4.62099	1.000	-16.5497	10.3536
Fibea	Uyole 96	-4.74510	4.62099	.987	-18.1967	8.7065
Calima Uyole	Uyole 96	-12.17647	4.62099	.104	-25.6281	1.2752
Mshindi	Uyole 96	-5.60784	4.62099	.941	-19.0595	7.8438
Selian 97	Uyole 96	-1.45098	4.62099	1.000	-14.9026	12.0007
Kablanketi soya golori nyekundu	Uyole 96	-4.72549	4.62099	.987	-18.1771	8.7262
Lyamungo 90	Uyole 96	-5.50980	4.62099	.949	-18.9615	7.9418
Rosenda	Uyole 96	-2.70588	4.62099	1.000	-16.1575	10.7458
Uyole 16	Uyole 96	-.05882	4.62099	1.000	-13.5105	13.3928
Maini	Uyole 96	-6.49020	4.62099	.843	-19.9418	6.9615
Njano Golori	Uyole 96	9.87255	4.62099	.307	-3.5791	23.3242
Pesa	Uyole 96	-8.70588	4.62099	.475	-22.1575	4.7458
Jesca	Uyole 96	-19.82353*	4.62099	.000	-33.2752	-6.3719
SUA 90	Uyole 96	-25.88235*	4.62099	.000	-39.3340	-12.4307

Scheffe Post Hoc Test presented in Table 3.14 indicates common bean varieties, which fall in homogeneous subset. These results suggest that if one is able to consume one of the varieties in a given subset and finds it tasting delicious, then the same person can consume any variety in that category and finds it delicious. The findings indicate that local varieties were categorized in improved varieties indicating that there is no significant difference between improved and local varieties in taste.

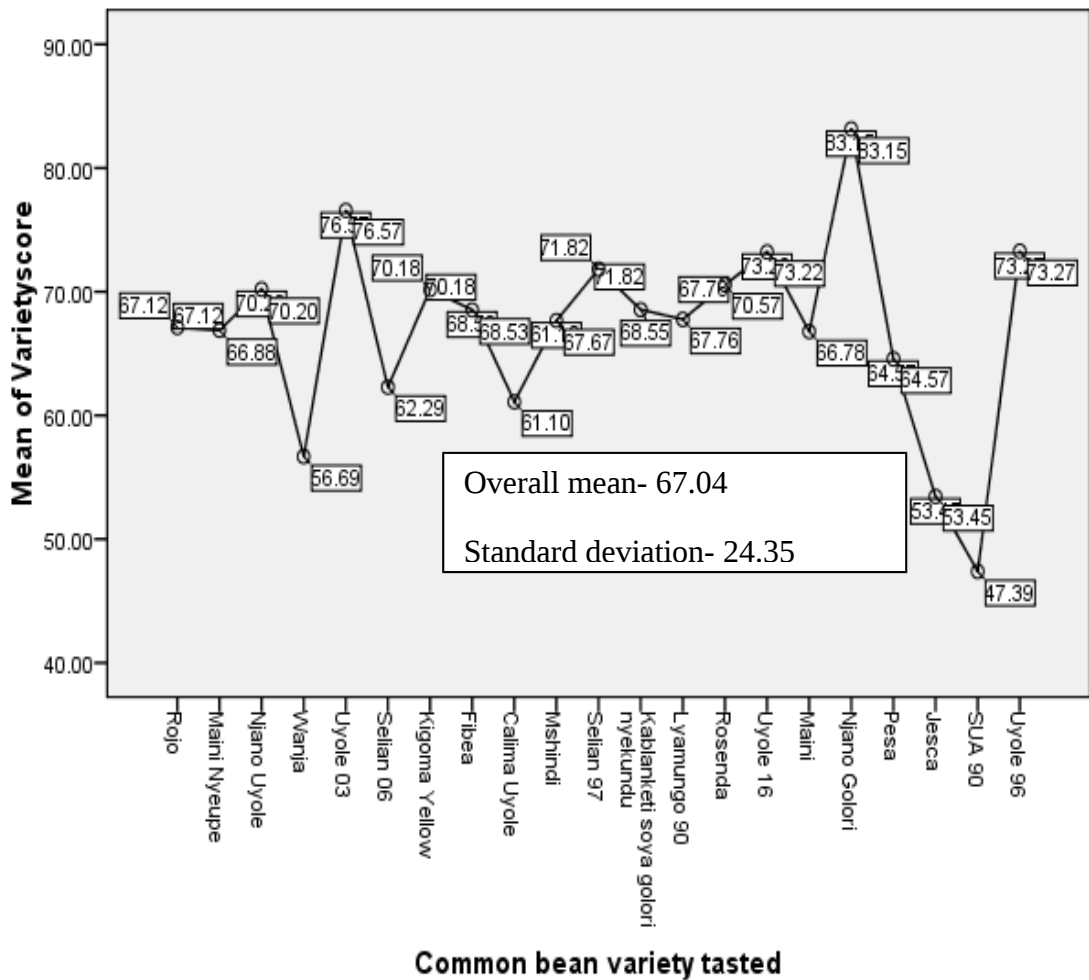
**Table 3.14: Scheffe Post Hoc Test to determine means for groups in homogeneous subsets**



Common bean variety tasted	n	Subset for alpha = 0.05		
		1	2	3
SUA 90	51	47.3922		
Jesca	51	53.4510	53.4510	
Wanja	51	56.6863	56.6863	
Calima Uyole	51	61.0980	61.0980	61.0980
Selian 06	51	62.2941	62.2941	62.2941
Pesa	51	64.5686	64.5686	64.5686
Maini	51	66.7843	66.7843	66.7843
Maini Nyeupe	51	66.8824	66.8824	66.8824
Rojo	51	67.1176	67.1176	67.1176
Mshindi	51	67.6667	67.6667	67.6667
Lyamungo 90	51	67.7647	67.7647	67.7647
Fibea	51	68.5294	68.5294	68.5294
Kablanketi soya golori nyekundu	51	68.5490	68.5490	68.5490
Kigoma Yellow	51	70.1765	70.1765	70.1765
Njano Uyole	51	70.1961	70.1961	70.1961
Rosenda	51	70.5686	70.5686	70.5686
Selian 97	51	71.8235	71.8235	71.8235
Uyole 16	51	73.2157	73.2157	73.2157
Uyole 96	51	73.2745	73.2745	73.2745
Uyole 03	51		76.5686	76.5686
Njano Golori	51			83.1471
Sig.		.053	.204	.303

The results in Tables 3.13, 3.14, and Figure 3.4 indicate that the most preferred local varieties namely Kigoma yellow and Kablanketi were not delicious as much as was for some improved varieties. The varieties which were more delicious than the most preferred landraces included Njano Uyole, Rosenda, Selian 97, Uyole 16, Uyole 96 and Uyole 03.

Similarly other local varieties Maini and Maini Nyeupe were not as tasty as Rojo, Mshindi, Lyamungo 90 and Fibea as well as those, which outperformed Kigoma yellow and Kablanketi. However, it is worth pointing out that the local variety Njano golori outperformed all the tasted varieties.



**Figure 3.5: Differences in taste among cooked common bean varieties**

Generally, the findings in Table 3.15 indicate that smallholder farmers’ preferences significantly influence current actual quality seed use practices.

**Table 3.15: The influence of smallholder farmers' preferences on actual quality seed use**

Factor	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
(Constant)	-.516	1.089		-.474	.636
Common bean varieties produced in this village	1.473	.114	.593	12.947	.000**

\*\* . Significant at the 0.001 level

### 3.5 Conclusions and Recommendations

Smallholder farmers' preferences are crucial in any attempt of increasing the use of quality seed of improved common bean varieties. Smallholder farmers produce common beans for their own consumption and for sale to vendors who later sell to consumers. Thus, it is very crucial to focus attention on what they prefer in common beans consumption as well as what vendors prefer to buy.

Smallholder farmers' post production preferences is significantly influenced by grain colour, grain size, variety grain price, grain market availability, and grain consumers availability. However, in the production stages such as flowering and maturity stage, farmers have different preferred attributes from those in the postproduction stages. For instance at flowering stage, smallholder farmers' preferences are significantly influenced by germination, growth vigour, and flowering intensity. On the other hand, at maturity stage, smallholder farmers' preferences are significantly influenced by high yield, attractive growth and tolerance to a/biotic factors.

Since common beans are produced by smallholder farmers mainly for sale and consumption, there is a need of addressing both production and postproduction attributes.

Although there are some convergences between farmers and breeders on what are considered the best qualities of seed, divergences also exist. To farmers, consumption and marketability or market potential of the produce from the variety are the key determinants. These findings imply that breeding and multiplication of common beans should pay attention on marketability of the varieties. Therefore, breeders, ASA and seed companies should target breeding and multiplying market led varieties which can be achieved through backcrossing.

### 3.6 References

- Adetumbi, J. A., Saka, J. O. and Fato, B. F. (2010). Seed handling system and its implications on seed quality in South Western Nigeria. *Journal of Agricultural Extension and Rural Development* 2(6): 133 – 140.
- Asrat, S., Yesuf, M., Carlsson, F. and Wale, E. (2010). Farmers' preferences for crop variety traits: Lessons for on-farm conservation and technology adoption. *Ecological Economics* 69: 2394 – 2401.
- Association for Agriculture Research in East and Central Africa/Tropical Royal Institute (2014). *Tanzania Seed Sector Assessment: A Participatory National Seed Sector Assessment for the Development of an Integrated Seed Sector Development. Programme in Tanzania*. Entebbe, Uganda.183pp.
- Balcha, A. and Tigabu, R. (2015). Participatory varietal selection of common bean (*Phaseolus Vulgaris L.*) in Wolata, Ethiopia. *Asian Journal of Crop Science* 7(4): 295 – 300.
- Birachi, E. A., Ochieng, J., Wozemba, D., Ruraduma, C., Niyuhire, M. C. and Ochieng, D. (2011). Factors influencing smallholder farmers' bean production and supply to market in Burundi. *African Crop Science Journal* 19(4): 335 – 342.

- Bucheyeki, T. L. and Mmbaga, T. E. (2013). On-farm evaluation of beans varieties for adaptation and adoption in Kigoma Region in Tanzania. *International Scholarly Research Notices Agronomy* 2013: 1 – 5.
- Etwire, P. M., Atokple, I. D. K., Buah, S. S. J., Abdulai, A. L., Karikari, A. S. and Asungre, P. (2013). Analysis of the seed system in Ghana. *International Journal of Advance Agricultural Research* 1: 7 – 13.
- Gidoi, R., Owoyesigire, B., Enuke, G., Wasukira, A. and Owere, L. (2015). Farmers' perceptions and knowledge of crop and livestock production in Bukedi Subzone of Uganda. *Journal of Biology, Agriculture and Healthcare* 5(20): 30 – 39.
- Hakim, C. (2003). Competing family models, competing social policies. *Family Matters Autumn* 64: 52 – 61.
- Harsanyi, J. C. (1992). *Utilities, Preferences, and Substantive Goods*. Working Paper No. 101. University of California in Berkeley, California. 50pp
- Kan, M. Y. (2005). *Work Orientation and Wives' Employment Careers: An Evaluation of Hakim's Preference Theory*. ISER Working Paper No. 27. University of Essex, Colchester. 38pp.
- Karanja, D., Endire, S., Ruraduma, C., Kimani, P., Kweka, S. and Louis, B. (2011). *Value Added Bean Technologies for Enhancing Food Security, Nutrition, to cope with Climate Change Income and Resilience and Variability Challenges in Eastern Africa*. International Livestock Research Institute, Nairobi, Kenya. 43pp.
- Katungi, E., Kikulwe, E. and Emongor, R. (2015). Analysis of farmers' valuation of common bean attributes and preference heterogeneity under environmental stresses of Kenya. *African Journal of Agricultural Research* 10(30): 2889 – 2901.

- Katungi, E., Sperling, L., Karanja, D., Farrow, D. and Beebe, S. (2011). Relative importance of Common bean attributes and Variety demand in the drought areas of Kenya. *Journal of Development and Agricultural Economics* 3(8): 411 – 422.
- Lazaro, E. A. and Muywanga, D. M. (2008). Seed production and poverty reduction: Case of Dodoma Rural District. *Tanzania Journal Agriculture Science* 8(2): 161 – 172.
- Letaa, E., Kabungo, C., Katungi, E., Ojara, M. and Ndunguru, A. (2015). Farm Level Adoption and Spatial Diffusion of Improved Common Bean Varieties in Southern Highlands of Tanzania. *African Crop Science Journal* 23(3): 261 – 277.
- Lwoga, E. T., Stilwell, C. and Ngulube, (2011). Access and use of agricultural information and knowledge in Tanzania. *Library Review* 60(5): 383 – 395.
- Mazuma, E. D. L., Rubyogo, J. C., Chirwa, R. M., Tembo, F. and Magreta, R. (2011). Creating Impact oriented bean seed delivery systems for the poor in Malawi. *African Crop Science* 10: 339 – 347.
- Ministry of Agriculture Food Security and Cooperatives (2013). *National Agriculture Policy*. United Republic of Tanzania, Dar es Salaam. 51pp.
- Mitschke, V. (2015). *Farmers' constraints Vis-a'-vis the Adoption of improved bean varieties and seeds in Hai District, Tanzania. Internship Report*. Wageningen University. 86pp .
- Mneney, E., Mashindano, O. and Nagarajan, L. (2016). *Tanzania Early Generation Seed Study*. United State Agency for International Development, USA. 97pp.

- Mulu, A., Gedebo, A. and Mohammed, H. (2016). Participatory variety evaluation of red common bean (*Phaseolus Vulgaris* L.) in Borecha District of Southern Ethiopia. *Advances in Crop Science and Technology* 4(5): 1 – 4.
- Mwangi, M. and Kariuki, S. (2015). Factors determining adoption of new agricultural technology by smallholder farmers in developing countries. *Journal of Economics and Sustainable Development* 6(5): 208 – 216.
- Mwenda, A. R. E. and Chirwa, R. M. (2007). An assessment of the Adoption rates of new bean varieties in three districts of Dedza, Dowa and Rumphi districts in Malawi. *Malawi Journal of Agricultural Sciences* 3(1): 74 – 81.
- Oyekale, K. O. (2014). Growing an Effective Seed Management System: A Case Study of Nigeria. *Journal of Agriculture and Environmental Sciences* 3(2): 345 – 354.
- Pandis N. (2014). Statistics and research design: Cross-sectional studies. *American Journal of Orthodontics and Dentofacial Orthopedics* 146(1): 127 – 129.
- Shiferaw, B., Silim, S., Muricho, G., Audi, P., Mligo, J., Lyimo, S., You, L. and Christianse, J. L. (2005). Assessment of the adoption and impact of improved pigeonpea varieties in Tanzania. *Journal of SAT Agricultural Research* 3(1): 1 – 27.
- Sichilima, T., Mapemba, L. and Tembo, G. (2016). Drivers of Dry common beans trade in Lusaka, Zambia: A traders perspective. *Sustainable Agriculture Research* 5(2): 15 – 26.
- Simtowe, F., Asfaw, S. and Abate, T. (2016). Determinants of agricultural technology adoption under partial population awareness: The case of Pigeon pea in Malawi. *Agricultural and Food Economics* 4(7): 1 – 21.

- Technical Centre for Agricultural and Rural Cooperation (2014). Seed systems, science and policy in East and Central Africa. [[https://cgspace.cgiar.org/bitstream/handle/10568/81086/1832\\_PDF.pdf?sequence=1&isAllowed=y](https://cgspace.cgiar.org/bitstream/handle/10568/81086/1832_PDF.pdf?sequence=1&isAllowed=y)] site visited 30/07/2019.
- Tumeo, M., Mapemba, L., Edris, A. K. and Phiri, H. (2017). *Consumer Choice of Dry Common Beans in Malawi: The Case of Lilongwe City. Strategy Support Programme. Working Paper No 19.* International Food Policy Research Institute, Malawi. 20pp
- Wani, I. A., Sogi, D. S., Wani, A. A. and Gill, B. S. (2014). Physical and cooking characteristics of some Indian Kidney bean (*Phaseolus Vulgaris L.*). *Journal of the Saudi Society of Agricultural Science* 16: 7 – 15.



## CHAPTER FOUR

### **4.0 Knowledge and its Influence on Smallholder Farmers' Decision to Use Quality Seed of Improved Common Bean Varieties**

Joshua S. Kidudu

Department of Agricultural Extension and Community Development, College of Agriculture, Sokoine University of Agriculture, P.O. Box 3002, Chuo Kikuu, Morogoro, Tanzania. Email:kidudujoshua@yahoo.com, Mobile: +255754247945

**To be submitted to *Journal of Agriculture, Science and Technology***

#### **4.1 Abstract**

This study sought to determine smallholder farmers' knowledge of quality seed and its influence on their decision of using quality seed of improved common bean varieties. Using cross-sectional research design a survey was used to collect data on smallholder farmers' knowledge of quality seed of improved common bean varieties. The survey was conducted in randomly selected major regions that produce common beans in Tanzania. The findings indicate that 37, 50.8, 10.6 and 1.6 percent of smallholder farmers had no knowledge, low knowledge, moderate knowledge and high knowledge respectively about quality seed of improved common bean varieties. Furthermore, the findings indicated that smallholder farmers' knowledge had significant influence ( $\beta = 0.530$ ;  $p \leq 0.001$ ) on farmers' decision of using quality seed of improved common bean varieties. The findings suggest that efforts of promoting the use of quality seed of improved common bean varieties need to focus on creating awareness and knowledge among smallholder farmers about quality seed of improved common bean varieties.

**Key words:** Quality seed, knowledge, improved common bean varieties, smallholder farmers, availability of quality seed and marketability of produces from improved varieties

## 4.2 Introduction

Common bean is the most important food legume in the world. Globally 36 458 895 ha were allocated to common beans in 2017 and yielded 31 405 912 tonnes of dry common beans (FAOSTAT, 2019). Global production statistics indicate that India, Brazil, Myanmar and China are the world largest producers of common beans while Tanzania, Uganda and Kenya are the leading common beans producers in Africa. Common bean is the second most important crop after maize in the common beans producing villages. Common bean is the leading among leguminous crops accounting for 78 percent of the cultivated land under legumes with per capita consumption of 19.3kg, contributing to 16.9 percent of protein, 7.3 percent of calorie, and 71 percent of leguminous protein in human diets (Binagwa *et al.*, 2018).

Over the years, smallholder farmers have experienced low productivity of the crop. The reason behind low productivity among others is that farmers predominantly rely on the use of grains as seed in production of the crop. The contribution of quality seed of improved varieties to increased productivity is well documented. For example, Oyekale (2014) indicates that when quality seed of improved variety is used in production yield increases by 10 to 15percent. In a similar vein, Birachi *et al.* (2011) reported an increase by 22 percent, when improved common bean varieties are used in production. In this study, quality seed means certified seed of improved common bean varieties.

Nevertheless, smallholder farmers' demand for quality seed of improved varieties has remained low for years. Various studies (for example, ASARECA/KIT, 2014; CTA, 2014; Etwire *et al.*, 2013; MAFC, 2013; Adetumbi *et al.*, 2010; Lazaro and Muywanga, 2008) have indicated low levels of the use of quality seed of improved varieties. This trend has led to low crop productivity, which in turn may lead to food and nutrition insecurity as

well as to low family income. Despite the low use of quality seed of improved common bean varieties among smallholder farmers, information regarding this trend is scanty. Efforts have been made and are still made to introduce various improved agricultural technologies but diffusion, adoption and use of these improved agricultural technologies have continued to vary among technology users. This variation in adoption among smallholder farmers has been attributed to various factors. Studies, which are based on various theories on smallholder farmers' decision of using improved technologies in agricultural production have broadly identified technological, economic, institutional, and human specific factors (Mwangi and Kariuki, 2015) as the major determinants of adoption.

However, these studies on the adoption of improved agricultural technologies tend to pay little attention on smallholder farmers' knowledge of the practice to be adopted. Instead, most of the studies on adoption tend to focus on education level of the respondents ignoring whether or not they have knowledge about the practice, which is being studied. Therefore, this study aimed at investigating whether or not smallholder farmers have knowledge about quality seed of improved common bean varieties. This investigation was necessary before farmers are accused of not using quality seeds.

Uriarte (2008) identified two types of knowledge namely tacit, which is personal as it is stored in peoples' heads and explicit, which can be availed to others by codifying, documenting, and archiving. Paying attention on the types and qualities of knowledge De Jong and Ferguson-Hessler (1996) indicated that types of knowledge include situational, conceptual, procedural and strategic while qualities of knowledge include level (surface vs deep), structure (isolated elements vs structured knowledge), automation (declarative vs compiled), modality (verbal vs pictorial) and generality (general vs specific domain).

Additionally, Star and Stylianides (2013) grouped knowledge into conceptual knowledge referring to knowledge of concepts, principles, and definitions; and procedural knowledge, which is knowledge of procedures, comprising action sequences and algorithms used in problem solving.

Drawing from these authors, smallholder farmers' knowledge of quality seed of improved common bean varieties was measured in terms of what is known about quality seeds and how well it is known. Furthermore, this study examined what is known in quality seeds of improved common bean varieties and how what is known influenced farmers decision of using quality seed of improved common bean varieties.

### **4.3 Methodology**

A survey of smallholder farmers in four regions was conducted using cross-sectional research design. To obtain representative smallholder farmers who participated in a survey, a multistage sampling technique was used. In the first stage, the main common beans producing regions were randomly selected from major common beans producing zones. These zones included Eastern, Lake/western, Northern, and southern highlands. For the eastern zone main common beans, producing regions included Morogoro and Tanga. In the lake/western zone, the regions included Geita, Kagera, and Kigoma. For the northern zone, the regions included Arusha, Kilimanjaro and Manyara. The southern zone comprised Iringa, Katavi, Mbeya, Njombe, Rukwa, Ruvuma, and Songwe.

In the first stage, therefore Kigoma, Manyara, Mbeya and Morogoro regions were randomly selected to represent major common beans producing zones. In the second stage, one representative district was randomly selected from each representative region.

At this stage, Babati, Kasulu, Mbeya and Mvomero Districts were selected. In the third stage, study villages were randomly selected from representative districts.

The study villages included Belmi, Orngadadi, Tsamani, Seloto, Dudiye, Gallapo, Endanoga and Tsaayo, from Babati. From Kasulu the sampled villages were Murufiti, Mganza, Nyumbigwa, Heru juu, Kanazi, Kigondo, and Ruhita. Villages from Mbeya were Mapogolo, Itimba, Idiga, Itimu, Iwindi, Mshewe and Songwe Viwandani. The sampled villages from Mvomero were Ndole and Magunga. In the fourth stage, using systematic random sampling technique 320 smallholder farmers were randomly selected to represent other farmers producing common beans in Tanzania. However, 311 respondents participated in the study. Nine of earlier selected smallholder farmers were not able to participate in the study because of other responsibilities during data collection.

During the survey, selected villages from each ward were randomly assigned to either a questionnaire or focus group discussion data collection checklist. In this regard the questionnaire was used to collect data in Dudiye, Endanoga, Gallapo and Tsaayo villages from Babati District. From Kasulu District, the questionnaire was used in Heru Juu, Kanazi, Kigondo and Ruhita villages. For Mbeya District, the questionnaire was used in Idiga, Itimu, Iwindi, Mshewe and Songwe Viwandani villages. For Mvomero District, the questionnaire was used in Ndole and Magunga villages.

Besides the questionnaire, focus group discussions were conducted in Belmi, Orngadadi, Tsamani, and Seloto villages in Babati District. In Kasulu District, focus group discussions were conducted in Murufiti, Mganza, Nyumbigwa and Ruhita villages. In Mbeya focus group was conducted in Mapogolo and Itimba Villages.

Smallholder farmers also completed the knowledge test, which was scored and graded. Based on the scores obtained by the respondent, smallholder farmers were classified as lacking knowledge, having low, moderate, or high level of knowledge about quality seed of improved common bean varieties. Lastly, Key informant interviews were conducted with seed stockists.

Data on farmers' knowledge were analyzed using descriptive statistics to yield frequencies and percentages. The knowledge test was scored and the respondents were classified into those with no knowledge, having low, moderate, and high knowledge levels. Linear regression analysis was conducted to determine the influence of knowledge on the actual use of quality seed of improved common bean varieties. Content analysis was used to analyse qualitative data from focus group discussions and key informant interviews.

#### **4.4 Results and Discussion**

##### **4.4.1 Current status of common bean production and quality seed use**

The findings in Table 4.1 indicate that most farmers (95.8%) responded that common bean was the first up to the third most important crop produced by them. The detailed analysis indicates that common bean was ranked first by 37.6 percent, second by 47.3 percent and third by 10.9 percent, of the respondents.

**Table 4.1: The position of common beans among crops produced by smallholder farmers (n=311)**

Rank	Frequency (n=311)	Percent
First	117	37.6
Second	147	47.3
Third	34	10.9
Tenth	6	1.9
Fourth	5	1.6
Fifth	1	0.3
Sixth	1	0.3
Total	311	100.0

Despite that common beans are highly ranked among crops produced by smallholder farmers, the findings in Table 4.2 indicate that most (74.3%) of the respondents have never used quality seed of improved common bean varieties in production. Seed recycling and use of grains as seed are predominant practices among smallholder farmers producing common beans.

**Table 4.2: Trend of using quality seed of improved common bean varieties in production (n=311)**

	Frequency (n=311)	Percent
No	231	74.3
Yes	80	25.7
Total	311	100.0

Interviews with stockists showed that farmers do not buy quality seed of improved common bean varieties as evidenced by one who said:

*“We have never sold quality seed of improved common bean varieties; frequently they use grains from market; most agro input shop they do not sell quality seed of improved common bean varieties; farmers do not ask at all”.*

*“We have never sold common bean seed; I have never heard any person coming to ask for quality seed of improved common bean varieties for all the years we*

*have been selling; Kiboseed or seedco could bring quality seed of improved common bean varieties to us or we could follow them from Kiboseed or seedco; they have no customers in our area they could have been brought; I do not know a place where they sell quality seed of improved common bean varieties”.*

In another discussion a stockist observed:

*“You check a commodity which can be sold; common beans! customers do not ask at all, so we do not sell at all; we have never seen customers for quality seed of improved common bean varieties; no farmer who asks for these seeds; I have never seen nor heard a farmer asking for common bean seed; farmers sow recycled seed”.*

Another stockist noted that *“For the last time we brought seed from Agricultural Seed Agency (ASA) in 2008, the seeds were not bought we decided to return them. Ever since, we have never troubled ourselves about quality seed of improved common bean varieties; it is a none-paying business”.*

#### **4.4.2 Smallholder farmers’ knowledge about quality seed of improved common bean varieties**

The study sought to find out if the respondents had knowledge of sources of quality seed of improved common bean varieties. The results, which are presented in Table 4.3, indicate that a large proportion of the respondents declared to have no knowledge of where they can get quality seed of improved common bean varieties. Although the same respondents knew where to get maize and vegetable seeds it was not known to them where they can get quality seed of improved common bean varieties.



**Table 4.3: Distribution of respondents by knowledge of sources of quality seed of improved common bean varieties (n=311)**

Knowledge of sources of quality seed of improved common bean varieties	Frequency (n=311)	Percent
Have no knowledge	106	34.1
Agro input shops	79	25.4
Extension officer	61	19.6
Researchers	39	12.5
Seed companies	15	4.8
AGRA Nyakitonto	4	1.3
They are not available here, even at district agro input shops	3	1.0
ASA-Bugaga seed farm	1	0.3
FIPS Africa	1	0.3
CARITAS	1	0.3
Certified seed producers	1	0.3

Although only one percent indicated that quality seed of improved common bean varieties are not available in the village and even at district agro input shops, this seems to be among major hindrances of smallholder farmers' decision of using quality seed of improved common bean varieties. The same was reflected in a focus group discussion where participant reported that "*quality seed of improved common bean varieties are not sold in our village, district and region; they are not even promoted in radios and agricultural fairs*". The participant in focus group discussion indicated that "*when you travel along highways, you find many demonstration plots for different maize varieties; but not for common beans, why?*" we think quality seed of improved common bean varieties are not important". In a similar vein, another participant indicated, "*quality seed of improved common bean varieties are not necessary as they are not promoted by the government*". Another participant questioned, "*why are quality seeds of improved common bean varieties not included in the National Agricultural Input Voucher Scheme if they are necessary for producing common beans*".

The study sought to know if the respondents have knowledge of the differences between quality seed of improved common bean varieties and grains used as seed. The results are

presented in Table 4.4. According to the results, a little over a third of the respondents did not know the differences between quality seed and grains used as seed. Moreover, the highest percentage (50.2%) of the respondents was knowledgeable of the fact that quality seeds are high yielding. On the other hand, the study shows that other attributes of these seeds were largely not known suggesting that their knowledge was limited.

**Table 4.4: Distribution of respondents by knowledge of the differences between quality seed and grains used as seed (n=311)**

Knowledge of differences between quality seed and grains used as seed	Frequency	
	(n=311)	Percent
They are high yielding	156	50.2
Have no knowledge	111	35.7
Marketability is high for local landraces	14	4.5
They are certified	11	3.5
Disease tolerant	8	2.6
Attractive due to large grain size	7	2.3
High germination rate	6	1.9
They are tolerant to drought	4	1.3
No significant difference	4	1.3

The study also examined whether the respondents had knowledge of the advantages of quality seed of improved common bean varieties. The results in Table 4.5 indicate that over half of the respondents knew that quality seeds lead to high yields. Despite that most respondents indicated to have knowledge of quality seeds, they knew only one advantage. This implies that the respondents do not have adequate knowledge of the advantages of quality seeds. Nevertheless, a good number of respondents declared to have no knowledge of the advantages of quality seed of improved common bean varieties. Therefore, exposing smallholder farmers to the advantages of quality seed is likely to motivate them to use quality seed of improved common bean varieties.

**Table 4.5: Distribution of respondents by knowledge of advantages of quality seed of improved common bean varieties (n=311)**

Knowledge of advantages of using quality seed in production	Frequency (n=311)	Percent
Improved seed have high yield than grain	165	53.1
Have no knowledge	89	28.6
They are preferred in the market	33	10.6
High germination	10	3.2
Certified as quality seed	5	1.6
Tolerant to a/biotic	3	1.0
Assured quality	3	1.0
Early maturity	2	0.6
Tolerant to a/biotic stress	1	0.3

The study determined further whether the respondents had knowledge of the qualities of quality seed of improved common bean varieties. The results are indicated in Table 4.6. The findings indicate that majority knew only one quality of quality seed of improved common bean varieties. This indicates that majority of smallholder farmers have low knowledge about quality seed of improved common bean varieties. The findings also indicate that a good number of respondents reported to lack knowledge of qualities of quality seed of improved common bean varieties. This implies that there is a need of exposing farmers to quality seed of improved common bean varieties.

**Table 4.6: Distribution of respondents by knowledge of the qualities of quality seed of improved common bean varieties (n=311)**

Knowledge of qualities of quality seed	Frequency (n=311)	Percent
High yield	159	51.1
Have no knowledge	100	32.2
They are attractive	30	9.6
Tolerant to a/biotic stresses	12	3.9
High germination percent	6	1.9
Early maturity	4	1.3

The study determined further the level of knowledge of the respondents about quality seed of improved common bean varieties. The results presented in Table 4.7 indicate that over half of the respondents have low knowledge of quality seed of improved common

bean varieties. Generally, the findings indicate that few farmers have moderate level of knowledge while very few had high knowledge about quality seeds of improved common bean varieties.

**Table 4.7: Distribution of respondents by knowledge level about quality seed of improved common bean varieties (n=311)**

Smallholder farmers knowledge level on quality seed of improved common bean varieties	Frequency	
	(n=311)	Percent
Have no knowledge about quality seed of improved common bean varieties	115	37.0
Have low knowledge about quality seed of improved common bean varieties	158	50.8
Have moderate Knowledge about quality seed of improved common bean varieties	33	10.6
Have high knowledge about quality seed of improved common bean varieties	5	1.6

To determine the influence of smallholder farmers' knowledge of quality seed of improved common bean varieties on the actual use of the seeds, linear regression analysis was conducted. The results in Table 4.8 indicate that smallholder farmers' knowledge of quality seed of improved common bean varieties significantly influenced farmers' use of quality seed.

**Table 4.8: The influence of knowledge on actual quality seed use**

Factor	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	-20.685	2.687		-7.698	.000**
Smallholder farmer's knowledge	15.508	1.414	.530	10.970	.000**

\*\* . Significant at the 0.001 level

To establish a thorough understanding of smallholder farmers' knowledge about quality seed of improved common bean varieties, the respondents in focus groups were asked about the qualities of seeds. During group discussion, one of the respondents said,

*“We don’t know which is a quality seed, we only care about germination”* and insisted, *“We only rely on buying the local variety (Kigoma yellow) from one another and nothing else”*.

The same was explored in another group in a different region where one of the respondents agreed that *“marketable common bean variety with high price, do we eat sesame? Why do we produce them? We produce sesame for sale because has high price”* and *“high yielding variety”*. Although there are some convergences between farmers and breeders on what are considered as the best qualities of seed, divergences also exist. To farmers, marketability or market potential of the produce from the variety seems to be a key determinant.

The results show that farmers’ knowledge about quality seed of improved common bean varieties vary among farmers. While some farmers have knowledge on quality seed of improved common bean varieties, others do not have. This was indicated in the focus group discussion where the group concluded with certainty that there are no quality seed of improved common bean varieties. One of the participants had this to say *“there is no quality seed of improved common bean varieties, if you go to agro input shops you don’t find them, even if you go to the district you don’t get them, no advertisements about them; they are nonexistent because we have never seen them”*.

This has a strong implication to breeders, Agricultural Seed Agency, seed companies, stockists and extension services providers. It means that breeding, multiplication, distribution, marketing and promotion programmes are not adequately carried out for quality seed of improved common bean varieties. These are the factors influencing smallholder farmers’ decision of using quality seed of improved common bean varieties because one cannot decide to use a technology, which s/he does not know.

On the contrary, one group of participants had a different level of knowledge about quality seed of improved common bean varieties. The group indicated that quality seed is

*“the one which is well sorted, not mixed, more than 90% germination capacity, high yielding, has been researched by an authorized institution, has many consumers, has high market”*. However, some participants from this group had worked with researchers from Selian Agricultural Research Institute on quality declared seed production hence they had more knowledge on quality seed. Nevertheless, it is important to note that they also indicated marketability and cooking criteria as factors influencing farmers’ decision of using the seeds.

Generally, smallholder farmers had different knowledge levels about quality seed of improved common bean varieties. While over half of the respondents had low knowledge, nearly four out of ten had no knowledge about quality seed of improved common bean varieties. In a situation where majority of farmers have no or limited knowledge on the use of quality seed of improved common bean varieties, it is not surprising that farmers are not using these seeds. It is this lack of adequate knowledge, which in turn influences smallholder farmers’ decision of using quality seed of improved common bean varieties.

Rogers (1983) considered knowledge as a key stage in the adoption of an innovation. Similarly, Singh and Hensel (2014) argue that for sustainable cultivation of any crop, the first requirement is enough knowledge of technical agricultural practices which is required by farmers to enable them grow, harvest, and trade that crop efficiently. Moreover, Assis and Mohd (2011) observed that the final decision of farmers to use a new practice is usually the result of their knowledge of the practices. Furthermore, Asfaw *et al.* (2011) found knowledge of the existing varieties, among others, as a major determinant of the adoption of improved technologies. Studying the adoption of improved maize

varieties, Cavane (2011) found knowledge of improved varieties among others as the determinant of adoption.

Jabbar *et al.* (2003) indicated that a new decision about adoption might be taken later after acquiring more knowledge and/or by observing the performance of those who had already adopted. A similar observation is made by Sai *et al.* (2013) who said that advanced knowledge is essential for the adoption of improved technology. Elsewhere, David and Asamoah (2011) found that improved knowledge is likely to translate into improved practice. A similar finding is reported by Singh *et al.* (2014) who found technology use to be correlated highly and positively with smallholder farmers' knowledge.

#### **4.5 Conclusions and Recommendations**

Knowledge of the quality seed of improved common bean varieties plays an important role in smallholder farmers' decision of using quality seed. However, smallholder farmers were found to have varying knowledge levels, with only very few having adequate knowledge on the use of quality seeds of improved common bean varieties. Majority lacked sufficient knowledge to be able to use quality seed of improved common bean varieties. Furthermore, smallholder farmers' knowledge of quality seed of improved common bean varieties was found to significantly influence their seed use practices.

For farmers to decide to use quality seed of improved common bean varieties there is a need of assisting them to improve their knowledge level on quality seed. Once they have acquired sufficient knowledge about quality seed of improved common bean varieties, it is likely that they would use the varieties. This is possible because those who had

adequate knowledge to be able to use quality seed of improved common bean varieties are the ones who worked with researchers. This calls for extension services providers and seed dealers to play their role actively. There is a need of promoting these improved varieties through demonstrations, farmer field schools, seed fairs, agricultural shows, and other information and communication media.

#### 4.6 References

- Adetumbi J. A., Saka J. O. and Fato B. F. (2010). Seed handling system and its implications on seed quality in South Western Nigeria. *Journal of Agricultural Extension and Rural Development* 2(6): 133 – 140.
- Association for Agriculture Research in East and Central Africa/Tropical Royal Institute (2014). *Tanzania Seed Sector Assessment: A Participatory National Seed Sector Assessment for the Development of an Integrated Seed Sector Development. Programme in Tanzania*. Entebbe, Uganda.183pp.
- Asfaw, S., Shiferaw, B., Simtowe, F. and Haile, M. G. (2011). Agricultural technology adoption, seed access constraints and commercialization in Ethiopia. *Journal of Development and Agricultural Economics* 3(9): 436 – 447.
- Assis, K. and Mohd, I. H.A. (2011). Knowledge, attitude and practices of farmers towards organic farming. *International Journal of Economic Research* 2(3): 1 – 6.
- Binagwa, P. H., Magdalena, W., Michael, K., Zakayo, E., Mbiu, J., Msaky, J., Mdachi, M., Kasubiri, F., Kisamo, A., Nestory, S. M. and Rubyogo, J. C. (2018). *Selian Agricultural Research Institute Released Seven (7) Improved Common Bean (Phaseolus*



*vulgaris*) Varieties. Selian Agricultural Research Institute, Arusha. 5pp.

- Birachi E. A., Ochieng J., Wozemba D., Ruraduma C., Niyuhire M. C. and Ochieng D. (2011). Factors influencing smallholder farmers' bean production and supply to market in Burundi. *African Crop Science Journal* 19(4): 335 – 342.
- Cavane, E. (2011). Farmers' attitude and adoption of improved maize varieties and chemical fertilizers in Mozambique. *Indian Research Journal of Extension Education* 11(1): 1 – 6.
- David S. and Asamoah C. (2011). Farmer knowledge as an early indicator of IPM Adoption: A case study from cocoa farmer field schools in Ghana. *Journal of Sustainable Development in Africa* 13(4): 213 – 224.
- De Jong T. and Ferguson-Hessler M. G. M. (1996). Types and qualities of knowledge. *Educational Psychologist* 31(2): 105 – 113.
- Etwire P. M., Atokple I. D. K., Buah S. S. J., Abdulai A. L., Karikari A. S. and Asungre P. (2013). Analysis of the seed system in Ghana. *International Journal of Advance Agricultural Research* 1: 7 – 13.
- FAO (2019). FAOSTAT data on production/yield quantities of beans, dry in World + Total. 1994 – 2017. [<http://www.fao.org/faostat/en/#data/QC/visualize>] site visited on 14/11/2019
- Jabbar, M.A., Saleem, M.A. M., Beyene, H. and Gebreselassie, S. (2003). Role of knowledge in the adoption of new agricultural technologies: An approach and an application. *International Journal Agricultural Resources, Governance and Ecology* 2(4): 312 – 327.
- Lazaro, E. A. and Muywanga, D. M. (2008). Seed production and poverty reduction: Case of Dodoma Rural District. *Tanzania Journal Agriculture Science* 8(2): 161 – 172.

- Ministry of Agriculture Food Security and Cooperatives (2013). *National Agriculture Policy*. United Republic of Tanzania. Dar es Salaam. 51pp.
- Mwangi, M. and Kariuki, S. (2015). Factors determining adoption of new agricultural technology by smallholder farmers in developing countries. *Journal of Economics and Sustainable Development* 6(5): 208 – 216.
- Oyekale, K. O. (2014). Growing an effective seed management system: A Case Study of Nigeria. *Journal of Agriculture and Environmental Sciences* 3(2): 345 – 354.
- Rogers E. M. (1983). *Diffusion of Innovations*. (3<sup>rd</sup> Ed.), Macmillan Publishing Co. New York. 236pp.
- Sai, D., Patel, B.B. and Verma, L. (2013). Knowledge and extent of adoption of farmers regarding recommended agricultural technologies transmitted. *Agriculture Update* 8(2): 156 – 159.
- Singh, P., Choudhary, M. and Lakhera, J. P. (2014). Knowledge and attitude farmers towards improved wheat production technology. *Indian Research Journal of Extension Education* 14(2): 54 – 59.
- Singh, S. and Hensel, O. (2014). Impact of Extension education on improving knowledge of sustainable technical agricultural practices. *Agricultural Engineering International: CIGR Journal* 16(1): 198 – 206.
- Star, J. R. and Stylianides, G. J. (2013). Procedural and conceptual knowledge: Exploring the gap between knowledge type and knowledge quality. *Canadian Journal of Science, Mathematics, and Technology Education* 13(2): 169 – 181.
- Technical Centre for Agricultural and Rural Cooperation (2014). Seed systems, science and policy in East and Central Africa. [[https://cgspace.cgiar.org/bitstream/handle/10568/81086/1832\\_PDF.pdf?sequence=1&isAllowed=y](https://cgspace.cgiar.org/bitstream/handle/10568/81086/1832_PDF.pdf?sequence=1&isAllowed=y)] site visited 30/07/2019.

Uriarte F. A. Jr. (2008). *Introduction to Knowledge Management: A Brief Introduction to the Basic Elements of Knowledge Management for Non-Practitioners Interested in Understanding the Subject*. ASEAN Foundation, Jakarta, Indonesia. 179pp.

## CHAPTER FIVE

### 5.0 Smallholder Farmers' Attitude Toward Quality Seed of Improved Common Bean Varieties in Tanzania

Joshua S. Kidudu\*<sup>1</sup>, Dismas L. Mwaseba<sup>2</sup> and Susan Nchimbi-Msolla<sup>3</sup>

<sup>1</sup>Department of Agricultural Extension and Community Development, College of Agriculture, Sokoine University of Agriculture, P.O Box 3002, Morogoro, Tanzania.

Email: kidudujoshua@yahoo.com

<sup>2</sup>Department of Agricultural Extension and Community Development, College of Agriculture, Sokoine University of Agriculture, P.O Box 3002, Morogoro, Tanzania.

Email: dilmwase@yahoo.com

<sup>3</sup>Department of Crop Science and Horticulture, College of Agriculture, Sokoine University of Agriculture, P.O Box 3005, Morogoro, Tanzania.

Email: smsolla@yahoo.com

\*Correspondence Author: [kidudu@sua.ac.tz](mailto:kidudu@sua.ac.tz)

---

To be submitted to *Journal of Agriculture, Forestry and the Social Sciences*

#### 5.1 Abstract

Using cross-sectional research design, a survey was conducted in major regions producing common beans to determine smallholder farmers' attitude towards quality seed of improved common bean varieties. Generally, smallholder farmers have very weak positive attitude (0.9957) toward quality seed of improved common bean varieties. This emanates from the fact the farmers considered quality seed of improved common bean varieties as beneficial (2.0616). However, they had moderate positive attitude

towards qualities (1.4705) and accessibility (1.4598) of quality seed of improved common bean varieties. Furthermore, they had very weak positive attitude toward availability (0.3068), promotion (0.3432) and marketability (0.3326) of their produce. The findings indicate further that benefits ( $\beta = 0.333$ ;  $p \leq 0.001$ ), qualities ( $\beta = 0.144$ ;  $p \leq 0.05$ ) and marketability ( $\beta = -0.131$ ;  $p \leq 0.05$ ) significantly influenced farmers' attitude towards using the quality seeds. These findings suggest that the efforts of promoting quality seed use have to focus on ensuring good quality of the claimed to be quality seeds and availability of market outlets for the produce from these varieties.

**Key words**-quality seed, attitude, accessibility, promotion, marketability, availability

---

## 5.2 Introduction

Common bean is the most important food legume in the world. Globally 36,458,895 ha were allocated to common beans in 2017 and yielded 31,405,912 tonnes of dry common beans (FAOSTAT, 2019). Global production statistics indicate that India, Brazil, Myanmar and China are the world largest producers of common beans while Tanzania, Uganda and Kenya are the leading common beans producers in Africa. Common bean is the leading among leguminous crops accounting for 78 percent of the cultivated land under legumes with per capita consumption of 19.3kg, contributing to 16.9 percent of protein, 7.3 percent of calorie, and 71 percent of leguminous protein in human diets (Binagwa *et al.*, 2018).

Common bean is the second most important crop after maize in the common beans producing villages in Tanzania. However, despite its importance common beans productivity has remained low among many smallholder farmers for years. The reason behind low productivity among others is predominant use of grains as seed in production. Using quality seed of improved common bean varieties provide the opportunity of

increasing productivity. In this study, quality seed means certified seed of improved common bean varieties.

The contribution of quality seed of improved varieties in increasing productivity is well documented. For example, Oyekale (2014) indicates that when quality seed of improved variety is used in production yield increases by 10 to 15 percent. Similarly, Birachi *et al.* (2011) reported an increase of 22 percent when quality seed of improved common bean varieties are used in production.

Nevertheless, despite these trends the demand for quality seed of improved varieties among smallholder farmers' has remained low for years. Various studies (ASARECA/KIT, 2014; CTA, 2014; Etwire *et al.*, 2013; MAFC, 2013 Adetumbi *et al.*, 2010; Lazaro and Muywanga, 2008) cited low levels of use of quality seed of improved varieties as a cause of low crop productivity, which may in turn lead to food and nutrition insecurity as well as low family income.

Despite low use of quality seed of improved common bean varieties among smallholder farmers', information of the causes of this trend is scanty. Previous studies have broadly identified technological, economic, institutional and human specific factors as major determinants of adoption (Mwangi and Kariuki, 2015). However, these studies paid little attention on the influence of smallholder farmers' attitude towards decision of using quality seed of improved common bean varieties. Therefore, this study aims at filling the knowledge gap by determining smallholder farmers' attitude toward quality seed of improved common bean varieties.

Common variables considered in the adoption models as factors influencing the adoption decisions include extension, education, age, family size/labour, credit and income ignoring attitude of the adopters towards a given technology (Yirga and Alemu, 2016). This study adds knowledge to the existing literature by investigating smallholder farmers' attitude towards quality seed of improved common bean varieties.

Attitude refers to a tendency revealed through varying degrees of favourable or unfavourable judgments (Sivaraj *et al.*, 2017). Determining whether smallholder farmers have favourable or unfavourable attitude towards quality seed of improved common bean varieties is necessary before accusing farmers of not using quality seeds. For instance, Ogunsumi (2011) found the level of adoption and positive attitude were higher among the sustained users than among the non users of the technology

When addressing attitude, Chandra and Kumar (2007) used the words favourable or unfavourable, desirable or undesirable, good or bad, likes or dislikes, pleasing or displeasing, and behavioural readiness associated with it. As we address smallholder farmers' attitude toward quality seed of improved common bean varieties, we need to establish whether farmers consider them to be favourable or unfavourable, desirable or undesirable, good or bad, pleasing or displeasing, and their behavioural readiness associated with using them.

### **5.3 Methodology**

Using cross-sectional research design, a survey of smallholder farmers in four regions was conducted. A multistage sampling technique was used to obtain a representative sample of smallholder farmers for the household survey. In the first stage, the main regions producing common beans were randomly selected from the major common beans

producing zones including Eastern, Lake/western, Northern, and, southern highlands. For the eastern zone, main common beans producing regions included Morogoro and Tanga. In the Lake/western zone, the main common beans producing regions include Geita, Kagera, and Kigoma. For the northern zone, the main common beans producing regions include Arusha, Kilimanjaro and Manyara. The southern zone comprises Iringa, Katavi, Mbeya, Njombe, Rukwa, Ruvuma, and Songwe.

In the first stage, therefore Kigoma, Manyara, Mbeya and Morogoro regions were randomly selected to represent major common beans producing zones. In the second stage, one representative district was randomly selected from each representative region. In this respect, Babati, Kasulu, Mbeya, and Mvomero districts were selected. In the third stage, study villages were randomly selected from representative districts. Finally, in the fourth stage systematic random sampling technique was used to select 320 respondents. However, during data collection 311 smallholder farmers participated in the study because nine farmers who were selected had other responsibilities.

To gain entry to the study sites and access participants, permits were obtained from Sokoine University of Agriculture and from the Local Government Authorities. Informed consent was obtained from the participants with the assistance of local government officials and agricultural extension workers before data collection. During the survey, selected villages were randomly assigned to a questionnaire or focus group discussion group checklist. Questionnaire was used to collect data in Dudiye, Endanoga, Gallapo and Tsaayo villages from Babati District. In Kasulu District, the questionnaire was administered to farmers in Heru Juu, Kanazi, Kigondo and Ruhita villages. For Mbeya District, the questionnaire was used in Idiga, Itimu, Iwindi, Mshewe and Songwe



Viwandani villages. In Mvomero District, the questionnaire was used to collect data in Ndole and Magunga villages.

In addition to the questionnaire, data were collected using focus group discussions in Belmi, Orngadadi, Tsamani, and Seloto villages in Babati District. In Kasulu District, focus group discussions were conducted in Murufiti, Mganza, Nyumbigwa and Ruhita villages while in Mbeya a similar tool was used to collect data from Mapogolo and Itimba villages.

To measure smallholder farmers' attitude toward quality seed of improved common bean varieties, quality seed availability, benefits, accessibility, qualities, promotion and marketability were determined. Positive and negative statements were generated and used to measure smallholder farmers' attitude towards quality seeds of improved common bean varieties. The statements were arranged on a seven point Likert scale ranging from Strongly agree = 3, Moderately agree = 2, Slightly agree = 1, Neutral = 0, Slightly disagree = -1, Moderately disagree = -2 to Strongly disagree = -3. Based on each of the theme's attributes, the average score was computed. Furthermore, the influence of each attribute on smallholder farmers' attitude towards using quality seed of improved common bean varieties was determined using linear regression analysis.

#### **5.4 Results**

The main themes that influence smallholder farmers' attitude toward quality seed of improved common bean varieties included seed availability, benefits of quality seeds, accessibility of quality seeds, qualities of quality seeds, promotion of quality seeds and marketability of common bean produces from improved varieties (Table 5.1). Mean values for each theme was computed and the findings are presented in Table 5.1.

**Table 5.1: Mean score per theme influencing smallholder farmers attitude towards quality seed of improved common bean varieties**

Theme	n	Minimum	Maximum	Mean	Std. Deviation
Benefits of quality seed	311	-2.00	3.00	2.0616	.91041
Qualities of quality seed	311	-3.00	3.00	1.4705	.97405
Accessibility of quality seed	311	-3.00	3.00	1.4598	1.49158
Promotion of Quality seed	311	-2.88	3.00	.3432	1.27734
Marketability of Quality seed produce	311	-3.00	3.00	.3326	1.50274
Quality seed availability	311	-3.00	3.00	.3068	1.50934
Overall attitude	311	-2.00	3.00	.9957	.78769

The findings in Table 5.1 indicate that, generally, smallholder farmers consider quality seed of improved common bean varieties as beneficial because they have moderate to strong positive attitude (2.0616). However, they have very weak positive attitude toward availability (0.3068) as well as marketability (0.3326) of their produce and promotion (0.3432). Furthermore, smallholder farmers have weak to moderate positive attitude towards qualities (1.4705) and accessibility to quality seed of improved common bean varieties (1.4598).

The extent to which each of the theme influences smallholder farmers' attitude towards quality seed of improved common bean varieties is presented in Table 5.2. The findings indicate that benefits of quality seed, seed quality attributes and marketability of common bean produces from quality seed have a significant influence on smallholder farmers attitude towards quality seed of improved common bean varieties.

**Table 5.2: The influence of various themes on smallholder farmers' attitude towards quality seed of improved common bean varieties**

Theme influencing attitude	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	4.785	.108		44.313	.000**
Benefits of quality seed	.291	.052	.333	5.560	.000**
Qualities of quality seed	.118	.050	.144	2.365	.019*
Marketability of Quality seed produce	-.069	.030	-.131	-2.308	.022*
Accessibility of quality seed	.044	.030	.083	1.458	.146
Quality seed availability	-.036	.030	-.068	-1.206	.229
Promotion of Quality seed	.002	.035	.003	.059	.953

\*\* Significant at the 0.001 level

\*Significant at the 0.05 level

The findings in Table 5.3 indicate that although all quality seed benefits related attributes have influence on smallholder farmers' attitude towards quality seed of improved common bean varieties, profit and seed quality assurance have significant influence on smallholder farmers' attitude towards quality seed of improved common bean varieties.

**Table 5.3: The influence of benefits attributes on smallholder farmers' attitude towards quality seed of improved common bean varieties**

Benefits attribute	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	6.146	.098		62.483	.000**
Using quality seed of improved common bean varieties assures one quality <u>strongly agree</u>	-.136	.045	-.206	-3.028	.003**
When you use quality seed of improved common varieties in production you get high profit hence improved livelihood <u>strongly agree</u>	-.073	.037	-.115	-1.974	.049*
Using quality seed of improved common bean varieties improves farmer's income <u>strongly agree</u>	-.071	.038	-.118	-1.872	.062
Using quality seed of improved common bean varieties will improve my expertise in common bean production <u>strongly agree</u>	-.061	.036	-.107	-1.687	.093
Using quality seed of improved common bean varieties assures ones' body nutritional requirement <u>agree</u>	-.023	.024	-.054	-.973	.331
Using quality seed of improved common bean varieties loses local landraces <u>agree</u>	.013	.017	.040	.782	.435
Using quality seed of improved common bean varieties assures ones' seed security <u>strongly agree</u>	-.026	.035	-.047	-.737	.461

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

\* . Correlation is significant at the 0.05 level (2-tailed).

The findings in Table 5.4 indicate that although all quality seed related attributes had an influence on smallholder farmers' attitude towards quality seed of improved common bean varieties, it was high germination capacity, suitability to microclimate condition and quality seeds' high yielding ability, which had significant influence on smallholder farmers' attitude towards using quality seed of improved common bean varieties.

**Table 5.4: The influence of qualities of quality seed on smallholder farmers' attitude toward quality seed of improved common bean varieties**

Quality Seed attribute	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	5.949	.126		47.077	.000**
Common beans produced using quality seed of improved common bean varieties have higher yield <u>strongly agree</u>	-.145	.047	-.213	-3.070	.002**
Quality seed of improved varieties are suitable at our microclimate condition <u>neutral</u>	.046	.018	.136	2.521	.012*
Quality seed of improved common bean varieties have high germination capacity <u>strongly agree</u>	-.087	.039	-.144	-2.244	.026*
Weather variability influences use of quality seed of improved common bean varieties <u>agree</u>	-.032	.020	-.090	-1.644	.101
common beans produced from quality seed of improved common bean varieties are tolerant to diseases <u>agree</u>	-.029	.021	-.077	-1.370	.172
Common beans sown with quality seed of improved varieties are tolerant to drought <u>moderately agree</u>	-.027	.023	-.069	-1.172	.242
Quality seed of improved common bean varieties mature early <u>moderately agree</u>	.016	.025	.039	.653	.515
Prevalence of fake seed claimed to be quality seed affects use of quality seed of improved common bean varieties <u>moderately agree</u>	-.011	.022	-.028	-.502	.616

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Common beans produced using quality seed of improved common bean varieties are uniform <u>moderately agree</u>	.004	.024	.010	.175	.861

\*\*Significant at the 0.01 level;  
\*Significant at the 0.05 level

The findings in Table 5.5 indicate that all marketability related attributes have influence on smallholder farmers' attitude toward quality seed of improved common bean varieties. However, there are some difficulties, which are encountered in selling common bean produce from quality seed of improved varieties. In particular, consumers' not preferring common beans produced from quality seed of improved common bean varieties, uniformity of produce from quality seed of improved varieties, and the fact that common bean produced from quality seed of improved common beans varieties are not tasty have significant negative influence on smallholder farmers attitude towards quality seed of improved common bean varieties.

**Table 5.5: The influence of marketability of produce from quality seed of improved common bean varieties on smallholder farmers' attitude**

Marketability attribute	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	5.581	.126		44.183	.000**
Many common buyers prefer local varieties more than improved varieties <u>agree</u>	-.020	.020	-.063	-.988	.324
It is difficult to sell produce from quality seed of improved common beans in our village <u>neutral</u>	.060	.022	.192	2.704	.007*
Market for selling produce from quality seed of improved varieties is difficulty <u>agree</u>	-.026	.022	-.085	-1.168	.244
Most consumers do not prefer common beans produced from quality seed of improved common bean varieties <u>agree</u>	-.059	.022	-.187	-2.689	.008*

	Unstandardized Coefficients		Standardized Coefficients		
Lack of markets for selling common beans produce from quality seed of improved varieties <u>agree</u>	.026	.021	.087	1.277	.203
Common bean produced from quality seed of improved common bean varieties are uniform hence good for business <u>strongly agree</u>	-.096	.026	-.206	-3.732	.000**
Common bean produced from quality seed of improved common beans varieties are not taste <u>neutral</u>	.053	.020	.162	2.638	.009*

\*Significant at the 0.01 level

\*\*Significant at the 0.001 level

### 5.5 Results from Focus Group Discussion

Smallholder farmers' attitude toward quality seed of improved common bean varieties was also examined in focus group discussion. Citing examples of improved varieties, one of the participants said, *"If you decide to grow improved varieties you will cry because you will never get customers, no one who is seeking to buy these varieties"*. Explaining about improved varieties, which were once introduced and then disappeared in their village and district, participants, had this to say, *"Some improved varieties shortly disappear after being introduced to smallholder farmers because they have no market"*.

From another focus group discussion, participants indicated that if one intends to introduce new varieties then *"Varieties brought must have place to sell them, you should not bring varieties which one fail to sell when a child is sick, wife will strongly blame you why did you bring these varieties which have no market"*. This implies that smallholder farmers' decision of using quality seed of improved common bean varieties would be enhanced if the released varieties target consumers' preferences, assures smallholder farmers that there is a possibility of selling the produce from these varieties. The same would eliminate what participants in another focus group discussion raised about what a farmer group experienced after producing improved varieties in a farmer field school.

They reported that “*the group doesn’t sell because nobody seeks this variety, it is like a duck, it is never sought*”.

## **5.6 Discussion**

The study examined smallholder farmers’ attitude towards quality seed of improved common bean varieties. Generally, smallholder farmers have very weak positive attitude towards quality seed of improved common bean varieties. This very weak positive attitude emanated from the fact that smallholder farmers are discouraged by availability and marketability of the produce from quality seed of improved common bean varieties. Furthermore, smallholder farmers are discouraged by the current low promotion of quality seed of improved common bean varieties.

Smallholder farmers’ attitude towards quality seed of improved common bean varieties is significantly influenced by benefits accrued from using the seed, qualities of the seed and marketability of the produces from quality seed of improved common bean varieties. Seed quality attributes are a key in using quality seed of improved common bean varieties. There are cases where farmers buy seeds, which are claimed to be quality seed, but whose performance discourages the users. Complaints about fake, adulterated or counterfeit seeds are frequent among farmers.

According to ESAFF (2013), there are problems of adulterated materials, which undermine farmers’ trust in agro-dealers and in the use of agro-inputs. A similar situation was reported by ASARECA/KIT (2014). In an attempt of establishing trust among stakeholders in the seed sector, they found farmers to have perceived seed companies and agro dealers as providers of fake and too expensive seed. This makes it difficult for farmers to use quality seed of improved varieties unless the seeds are used for demonstration in farmers’ field conditions before popularization. Mneney *et al.* (2016)



reported the prevalence of counterfeit seeds in Tanzania. This puts farmers at risk of procuring unintended seed and hence losing confidence with quality seed of improved varieties. Adetumbi *et al.* (2010) investigated seed quality problem in South Western Nigeria and found that private individuals handling the seed cannot afford the provision of conducive storage environment hence the seed quality deteriorates faster than usual in their hands.

The fact that new improved varieties face marketing challenges was also found by Letaa *et al.* (2015). In their study Letaa *et al.* (ibid) found continued use of new improved common bean varieties as a challenge. Instead, farmers continued to use old improved varieties because they had market outlet. In a situation where there is low market potential for the produce, its commercialization becomes difficult, if not impossible. Basically, the attitude of the study respondents reflects what De Luque and Creamer (2014) found to be a principal constraint in common beans commercialization. In their study, the authors cited market constraints as a key constraint in the commercialization of common beans.

Agricultural experts continue to advice farmers to use quality seed of improved common bean varieties, which lead to high yield but face the marketing challenge. A similar trend is reported by Katungi *et al.* (2015) who reveal that consumption and postharvest attributes outweighed production traits. In focus group discussions, it was reported that when new varieties are introduced in the farming communities they disappear shortly afterwards because they lack market. This implies that if a variety is to last long, it must have a market outlet. This is a lesson to be considered by breeders before introducing new

varieties to the farming communities. There is a need to establish consumer preferences before releasing new common bean varieties. This is what made Sichilima *et al.* (2016) to recommend for the involvement of traders and consumers as important actors in breeding. Involving common beans vendors, traders and consumers who play a significant role in distribution and marketing is very important for the sustainability and adoption of improved common beans among smallholder farmers.

### **5.7 Conclusions and Recommendations**

Generally, smallholder farmers' attitude towards quality seed of improved common bean varieties is significantly influenced by benefits accrued from quality seed of improved common bean varieties. Adding to quality seeds' benefits, smallholder farmers' attitude is also influenced by qualities of the seeds. Furthermore, marketability of the produce from the quality seed of improved common bean varieties has a significant influence on smallholder farmers' attitude towards using quality seed of improved common bean varieties.

Very weak positive attitude among farmers towards quality seed of improved common bean varieties means that there is a need of boosting smallholder farmers' attitude. Therefore, attempts of promoting the use of quality seed of improved common bean varieties have to strengthen availability, promotion, and targeting marketable varieties. Moreover, enabling smallholder farmers to receive genuine quality seed as well as addressing accessibility is likely to promote the use of quality seed among farming communities. This calls for effective and efficient seed certification system as well as monitoring seed distribution and marketing. Therefore, TOSCI has to strengthen seed certification and inspection to ensure seed quality. It also calls for breeders to focus on improving market led varieties. Furthermore, there is a need for ASA and seed companies

to expand their multiplication activities and distribution networks targeting the demanded varieties.

### 5.8 References

- Adetumbi J. A., Saka J. O. and Fato B. F. (2010). Seed handling system and its implications on seed quality in South Western Nigeria. *Journal of Agricultural Extension and Rural Development* 2(6): 133 – 140.
- Association for Agriculture Research in East and Central Africa/Tropical Royal Institute (2014). *Tanzania Seed Sector Assessment: A Participatory National Seed Sector Assessment for the Development of an Integrated Seed Sector Development. Programme in Tanzania*. Entebbe, Uganda.183pp.
- Binagwa, P. H., Magdalena, W., Michael, K., Zakayo, E., Mbiu, J., Msaky, J., Mdachi, M., Kasubiri, F., Kisamo, A., Nestory, S. M. and Rubyogo, J. C. (2018). *Selian Agricultural Research Institute Released Seven (7) Improved Common Bean (Phaseolus vulgaris) Varieties*. Selian Agricultural Research Institute, Arusha. 5pp/
- Birachi, E. A., Ochieng, J., Wozemba, D., Ruraduma, C., Niyuhire, M.C. and Ochieng, D. (2011). Factors influencing smallholder farmers' bean production and supply to market in Burundi. *African Crop Science Journal* 19(4): 335 – 342.

- Chandra, N. and Kumar, S. (2007). A scale to measure farmer's attitude towards improved agricultural practices. *Indian Research Journal of Extension Education* 7(3): 30 – 31.
- De Luque, J. J. R. and Creamer, B. (2014). Major Constraints and trends for common bean production and commercialization; establishing priorities for future research. *Agronomia Columbiana* 32(3): 423 – 431.
- Eastern and Southern Africa Small Scale Farmers' Forum (2013). A scoping study report on seeds and agriculture research process in Tanzania: The Case of Small scale farmers' participation in setting research agenda. [[http://esaff.org/images/insard\\_seeds\\_and\\_agriculture\\_research\\_processes\\_in\\_tanzania.pdf](http://esaff.org/images/insard_seeds_and_agriculture_research_processes_in_tanzania.pdf)] site visited 16/9/2015.
- Etwire, P. M., Atokple, I. D. K., Buah, S. S. J., Abdulai, A. L., Karikari, A. S. and Asungre, P. (2013). Analysis of the seed system in Ghana. *International Journal of Advance Agricultural Research* 1: 7 – 13.
- FAO (2019). FAOSTAT data on production/yield quantities of beans, dry in world + total 1994 – 2017. [<http://www.fao.org/faostat/en/#data/QC/visualize>] site visited on 14/11/2019
- Katungi, E., Kikulwe, E. and Emongor, R. (2015). Analysis of farmers' valuation of common bean attributes and preference heterogeneity under environmental stresses of Kenya. *African Journal of Agricultural Research* 10(30): 2889 – 2901.
- Lazaro, E. A. and Muywanga, D. M. (2008). Seed production and poverty reduction: Case of Dodoma Rural District. *Tanzania Journal Agriculture Science* 8(2): 161 – 172.

- Letaa, E., Kabungo, C., Katungi, E., Ojara, M. and Ndunguru, A. (2015). Farm Level Adoption and Spatial Diffusion of Improved Common Bean Varieties in Southern Highlands of Tanzania. *African Crop Science Journal* 23(3): 261 – 277.
- Ministry of Agriculture Food Security and Cooperatives (2013). *National Agriculture Policy*. United Republic of Tanzania, Dar es Salaam. 51pp.
- Mneney, E., Mashindano, O. and Nagarajan, L. (2016). *Tanzania Early Generation Seed Study*. United State Agency for International Development, USA. 97pp.
- Mwangi, M. and Kariuki, S. (2015). Factors Determining adoption of new agricultural technology by smallholder farmers in developing countries. *Journal of Economics and Sustainable Development* 6(5): 208 – 216.
- Ogunsumi, L. O. (2011). Attitude of farmers towards improved agricultural technologies in south-west Nigeria. *African Journal of Biotechnology* 10(50): 10108 – 10115.
- Oyekale, K. O. (2014). Growing an effective seed management system: A Case Study of Nigeria. *Journal of Agriculture and Environmental Sciences* 3(2): 345-354.
- Sichilima, T., Mapemba, L. and Tembo, G. (2016). Drivers of Dry common beans trade in Lusaka, Zambia: A Traders Perspective. *Sustainable Agriculture Research* 5(2): 15 – 26.
- Sivaraj, P., Philip, H., Sriram, N. and Pirabu, J. V. (2017). A scale to measure attitude of agricultural professionals towards social media in Tamil Nadu. *Journal of Pharmacognosy and Phytochemistry* 6(6): 365 – 369.
- Technical Centre for Agricultural and Rural Cooperation (2014). Seed Systems, Science and Policy in East and Central Africa. [<https://cgspace.cgiar.org/bitstream/>

handle/105\_68/81086/1832\_PDF.pdf?sequence=1&isAllowed=y] site visited  
30/07/2019.

Yirga, C. and Alemu, D. (2016). *Adoption of Crop Technologies among Smallholder Farmers in Ethiopia: Implications for Research and Development*, Ethiopia. 16pp.

## CHAPTER SIX

### **6.0 Smallholder Farmers' Intention to Use Quality Seed of Improved Common Bean Varieties in Tanzania**

Joshua S. Kidudu

Department of Agricultural Extension and Community Development, College of Agriculture, Sokoine University of Agriculture, P.O Box 3002, Morogoro, Tanzania.

Email:kidudujoshua@yahoo.com

**To be submitted to *Journal of Agricultural Extension***

#### **6.1 Abstract**

The study was conducted to determine smallholder farmers' intention to use quality seed of improved common bean varieties. Using serial cross-sectional research design, the study involved carrying out an elicitation study and survey. Using the Theory of Planned Behaviour the study sought to determine the beliefs, attitude, subjective norm, perceived behavioural control, intention and actual use of quality seed of improved common bean varieties. Findings indicate that smallholder farmers are in favour of using quality seed of improved common bean varieties. However, they experience moderate social pressure to use quality seed of improved common bean varieties. Moreover, they have very weak control to use quality seed of improved common bean varieties. Findings also indicate that behavioural, normative, and control beliefs had significant influence on smallholder farmers attitude, subjective norm and perceived behavioural control respectively toward quality seed of improved common bean varieties. Findings further indicate that attitude, subjective norm and perceived behavioural control significantly influence smallholder farmers' intention to use quality seed of improved common bean varieties. Finally, results indicate that perceived behavioural control has significant influence on smallholder

farmers' actual use of quality seed of improved common bean varieties. The findings suggest that efforts to increase smallholder farmers' use of quality seed of improved common bean varieties have to pay attention to social-psychological factors.

**Key words:** Common beans, quality seed, theory of planned behaviour, beliefs, attitude, subjective norm, perceived behavioural control, intention

## 6.2 Introduction

Common bean is the most important food legume in the world. Globally 36 458 895 ha were allocated to common beans in 2017 and yielded 31 405 912 tonnes of dry common beans (FAOSTAT, 2019). Global production statistics indicate that India, Brazil, Myanmar and China are the world largest producers of common beans while Tanzania, Uganda and Kenya are the leading common beans producers in Africa. Common bean is the leading among leguminous crops accounting for 78 percent of the cultivated land under legumes with per capita consumption of 19.3 kg, contributing to 16.9 percent of protein, 7.3 percent of calorie, and 71 percent of leguminous protein in human diets (Binagwa *et al.*, 2018). Generally, common beans provide 20 percent protein, 32 percent energy, generous amounts of micro-nutrients especially iron and zinc, as well as vitamins A and B complex to over 50 million resource poor rural and urban consumers in eastern Africa (Karanja *et al.*, 2011).

Common bean is the second most important crop after maize in the common beans producing villages in Tanzania. However, common beans productivity has remained low to many smallholder farmers for years. Predominant use and recycling of grains as seed in production is among the reasons behind low productivity. Using quality seed of improved common bean varieties provides an opportunity for increasing its productivity. In this study, quality seed means certified seed of improved common bean varieties.



The contribution of quality seed of improved varieties to increased productivity is well documented. For example, Oyekale (2014) indicates that when quality seed of improved variety is used in production yield increases by 10 to 15 percent. Another study has reported an increase in yield by 22 percent (Birachi *et al.*, 2011) when quality seed of improved common bean varieties is used in production. Despite these attributes, the demand for quality seed of improved varieties among smallholder farmers has remained low over the years (ASARECA/KIT, 2014; CTA, 2014; Etwire *et al.*, 2013; MAFC, 2013; Adetumbi *et al.*, 2010; Lazaro and Muywanga, 2008). This trend has led to low crop productivity, which may in turn lead to food and nutrition insecurity as well as low family income.

Despite the low use of quality seed of improved common bean varieties among smallholder farmers, information regarding this trend is scanty. Previous studies have broadly identified technological, economic, institutional and human specific factors as the major determinants of the adoption of improved agricultural technology (Mwangi and Kariuki, 2015) and paid little attention to social-psychological factors influencing smallholder farmers' decision of using these varieties. This study adds knowledge to the existing empirical literature by investigating social-psychological factors influencing smallholder farmers' intention of using quality seed of improved common bean varieties.

Intention refers to motivational factors, which influence behaviour (Ajzen, 1991). These are the factors that influence the desire of using these improved common bean varieties. In this study, particular attention is paid to what smallholder farmers prefer in common beans, the benefits associated with the use of quality seed of improved common bean varieties. This is contrasted to landraces including yield, tolerance to a/biotic constraints, taste, nutritive value, cooking time, colour, grain size, quality seed price,

grain price, and consumer preferences. Others include whether the common bean is produced for consumption or for sale.

Studies (e.g., Hasbullah *et al.*, 2014; Herath, 2013) which based on the Theory of Planned Behaviour have established that behavioural beliefs, attitudes, normative beliefs, subjective norms, control beliefs, perceived behavioural control influence farmers' intention of using a given technology. A study on agricultural information utilization by Ahmed *et al.* (2015) found behavioural beliefs, attitudes, normative beliefs, subjective norms, control beliefs, perceived behavioural control to have influenced farmers' intention of using agricultural information. Furthermore, Borges *et al.* (2015) in their study on the adoption of innovations found behavioural beliefs, attitudes, normative beliefs, subjective norms, control beliefs, perceived behavioural control to have influenced farmers' intention of adopting innovations. Other studies such as Kühne *et al.* (2014) on networks, Sharifzadeh *et al.* (2012) on agricultural climate information and Lee *et al.* (2010) on the use of educational technologies have also found behavioural beliefs, attitudes, normative beliefs, subjective norms, control beliefs, perceived behavioural control to have influenced the respondents' intention.

However, the literature on studies employing the Theory of Planned Behaviour to predict smallholder farmers' intention of using quality seed of improved common bean varieties particularly in Tanzania is scanty. Therefore, this study used the Theory of Planned Behaviour to determine smallholder farmers' intention of using quality seed of improved common bean varieties in Tanzania. The motivation for this study emanated from the fact that despite the importance of the crop in Tanzania, the use of quality seed of improved common bean varieties is still extremely low as indicated earlier; this is notwithstanding the several initiatives of boosting productivity to ensure food security.

### **6.3 Methodology**

Drawing on Pandis (2014), this study employed serial cross-sectional research design involving the collection of both quantitative and qualitative data in two different phases. In the first phase, an elicitation study was conducted as recommended by Francis *et al.* (2004) to identify smallholder farmers' salient beliefs regarding the use of quality seed of improved common bean varieties. The study was conducted in Iringa, Kigoma, Kilimanjaro, Mbeya, Morogoro and Njombe regions. The sampled regions represented major common beans producing regions in Western/Great Lakes, Northern, Southern and Eastern Zones. From these regions, one district was randomly selected from each region, and the exercise ended up with the selection of Kasulu, Kilolo, Mbeya, Moshi, Mvomero, Siha and Wanging'ombe districts as indicated in Figure 6.1. Then data for the study were collected from a randomly selected village in each district.

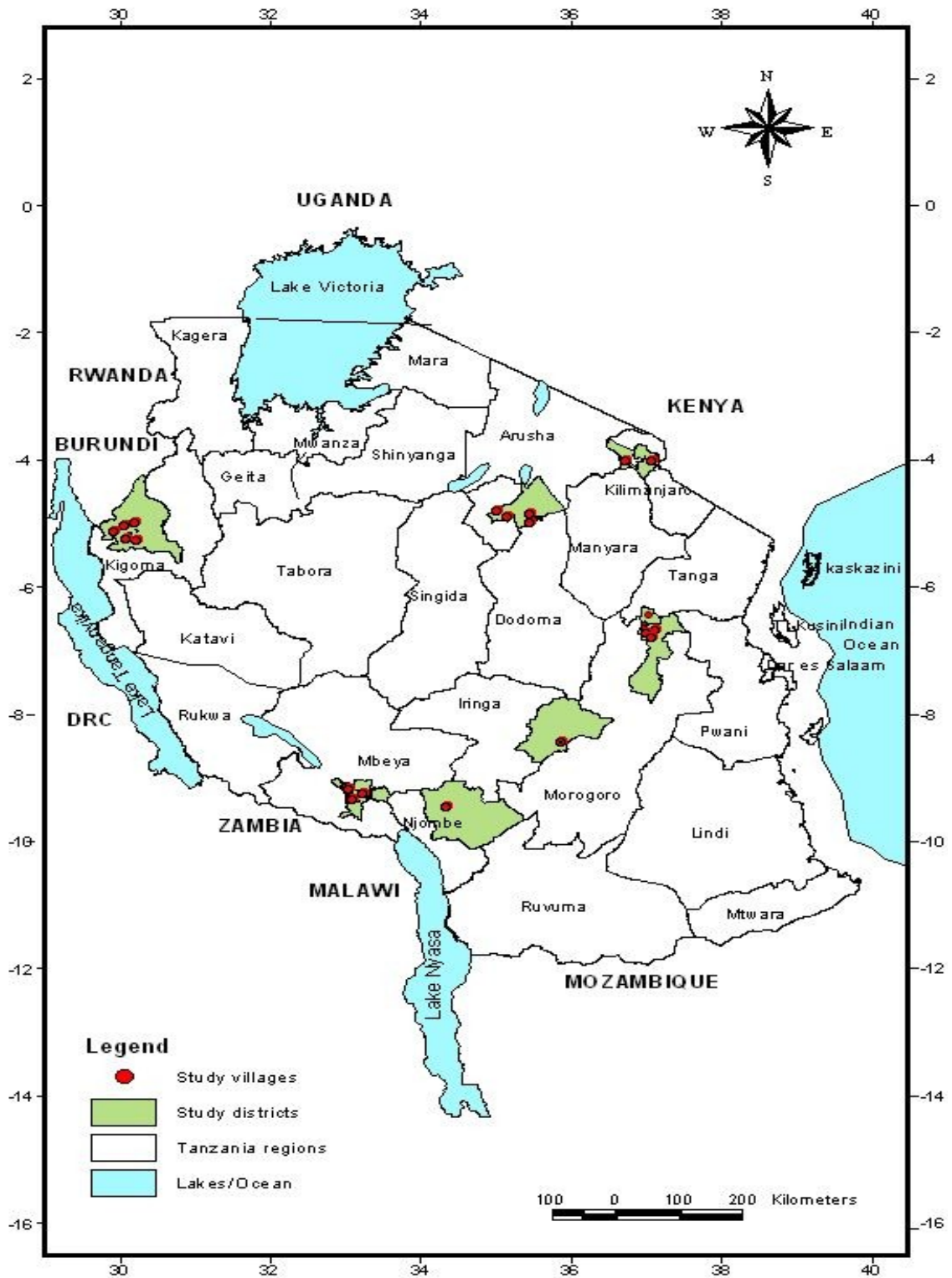


Figure 6.1: Map showing study areas

Using systematic random sampling technique 107 respondents were selected to participate in the elicitation study. The results from 107 respondents who participated in the elicitation study were used to develop measures of behavioural, normative, and control beliefs, which are the indirect determinants of behavioural intention. These beliefs together with attitude, subjective norm and perceived behavioural control, which are the direct determinants of behavioural intention, were studied in the second phase that involved the survey of smallholder farmers in four randomly selected regions.

Data obtained during elicitation study were used to develop a questionnaire to be used during the second phase. The questionnaire was pretested to smallholder farmers from Njelenje Village in Gairo District. Reliability for direct measures of intention i.e. attitudes, subjective norm and perceived behavioural control was established using an index of internal consistency while test-retest reliability was used for indirect determinants of intention i.e. behavioural, normative and control beliefs as recommended by Francis *et al.* (2004).

A representative sample of smallholder farmers, who participated in the survey, was obtained using a multistage sampling technique. In the first stage, the major regions producing common beans were randomly selected from the major common beans producing zones. The main zones included Eastern, Lake/western, Northern, and, southern highlands. For the eastern zone, the regions producing common beans are Morogoro and Tanga. In the Lake/western zone, the major common beans producing regions included Geita, Kagera, and Kigoma. For the northern zone, the major common beans producing regions included Arusha, Kilimanjaro and Manyara. The southern zone comprised of Iringa, Katavi, Mbeya, Njombe, Rukwa, Ruvuma, and Songwe. In the first stage, therefore Kigoma, Manyara, Mbeya and Morogoro regions were randomly selected

to represent major common beans producing zones. In the second stage, one representative district was randomly selected from each representative region. The selected districts are Babati, Kasulu, Mbeya and Mvomero. In the third stage, the study villages were randomly selected from the representative districts.

The study villages included Belmi, Orngadadi, Tsamani, Seloto, Dudiye, Gallapo, Endanoga and Tsaayo for Babati district. From Kasulu, the sampled villages were Murufiti, Mganza, Nyumbigwa, Heru juu, Kanazi, Kigondo, and Ruhita. Villages from Mbeya were Mapogolo, Itimba, Idiga, Itimu, Iwindi, Mshewe and Songwe Viwandani. While the sampled villages from Mvomero were Ndole and Magunga. In the fourth stage, systematic random sampling technique was used to select 320 smallholder farmers who represented other farmers producing common beans in Tanzania. However, during data collection nine earlier selected famers had other obligations hence data were collected from 311 respondents.

A questionnaire as recommended by Ajzen (2006) was used to collect data from 311 smallholder farmers to determine smallholder farmers' attitude, subjective norm, perceived behavioural control, intention towards and the actual use of quality seed of improved common bean varieties. In addition, observations were also used focusing on varieties and landraces, which are actually grown by farmers, the varieties and landraces that are actually sold in village markets, shops and those, which are actually bought, by vendors and middlemen. Furthermore, observations were made on varieties, which are actually traded in the district and regional markets. Observations were also made to agro input shops to see whether or not quality seed of improved common bean varieties were sold.

To determine smallholder farmers' attitude, subjective norm, perceived behavioural control, intention towards and the actual use of quality seed of improved common bean varieties, the survey was conducted. During the survey, selected villages were randomly assigned to a questionnaire or focus group discussion checklist. A questionnaire was used to collect data in Dudiye, Endanoga, Gallapo and Tsaayo villages from Babati District. From Kasulu District, data were collected in Heru Juu, Kanazi, Kigondo and Ruhita villages. For Mbeya District, data were collected in Idiga, Itimu, Iwindi, Mshewe and Songwe Viwandani villages. For Mvomero District, data were collected in Ndole and Magunga villages.

Adding to a questionnaire, focus group discussions were conducted in Belmi, Orngadadi, Tsamani, and Seloto villages from Babati District. From Kasulu District, focus group discussions were conducted in Murufiti, Mganza, Nyumbigwa and Ruhita villages. Villages from Mbeya were Mapogolo and Itimba. Apart from questionnaire and focus group discussions, observations were also used. Observations focused on the varieties and landraces, which are actually grown by farmers, the varieties and landraces, which are actually sold in village markets, shops and those, which are actually bought, by vendors and middlemen. Furthermore, observations were made on varieties, which are actually traded in the district and regional markets. Observations were also made in agro input shops to see whether or not the quality seed of improved common bean varieties are sold.

To determine smallholder farmers' intention of using quality seed of improved common bean varieties, the direct determinants of intention were first computed from their associated weighted beliefs. The direct determinants of intention include attitude, subjective norm and perceived behavioural control. These were determined as follows-

To determine attitude from its associated beliefs, behavioural beliefs and outcome evaluation were scored. Weighted attitude from behavioural beliefs and their associated outcome evaluations were calculated using the formula  $A = \sum (Be \times Oe)/N$ . Where A=Total attitude score, Be=Behavioural beliefs, Oe=Outcome evaluation, and N=Total number of respondents. If A, that is, the overall attitude is positive then the smallholder farmers are in favour of quality seed of improved common bean varieties. If A, that is, the overall attitude is negative then the smallholder farmers are not in favour of quality seed of improved common bean varieties.

To determine subjective norm from its associated beliefs, normative beliefs and motivation to comply were scored. Subjective norm was then determined using the formula  $Sn = \sum (No_{be} \times Mo_{co})/N$ . Where Sn =Total subjective norm score,  $No_{be}$ = Normative beliefs,  $Mo_{co}$ = Motivation to comply was used and N=Number of respondents. By this formula, a positive (+) Sn score means that, overall, the participant experiences social pressure of using quality seed of improved common bean varieties. On the other hand, a negative (-) score means that, overall, the participant experiences social pressure of not using quality seed of improved common bean varieties.

To determine perceived behavioural control from its associated beliefs, control beliefs and control belief power were scored. Perceived behavioural control was then computed by the formula  $PBC = \sum (Co_{be} \times Co_{bepo})/N$ ; Where PBC=Total Power Belief Control score,  $Co_{be}$ = Control beliefs,  $Co_{bepo}$  = Control belief power and N=Number of respondents. By this formula, a positive (+) PBC score means that, overall, the participant feels to have control over the use of quality seed of improved common bean varieties. On the



other hand a negative (-) score means that, overall, the participant does not feel to have control over the use of quality seed of improved common bean varieties.

Linear regression analysis was then conducted to determine the influence of beliefs on direct determinants of intention. On the one hand, weighted behavioural beliefs were regressed with attitude to determine their influence on quality seed use. On the other hand, weighted normative beliefs were regressed with subjective norm. Finally, weighted control beliefs were regressed with perceived behavioural control.

The direct determinants of intention, which included attitude, subjective norm and perceived behavioural control were then measured directly. To determine smallholder farmers' attitude towards quality seed of improved common bean varieties, the average attitude score was computed. To determine smallholder farmers' subjective norm towards quality seed of improved common bean varieties, the average subjective norm score was computed. To determine smallholder farmers' perceived behavioural control towards quality seed of improved common bean varieties, the average perceived behavioural score was computed. To determine smallholder farmers' intention of using quality seed of improved common bean varieties, the average intention score was computed.

To determine the influence of attitude, subjective norm, perceived behavioural control and the intention of smallholder farmers' decision of using quality seed of improved common bean varieties, multiple linear regression analysis was conducted. The independent variables attitude, subjective norm and perceived behavioural control were regressed against the dependent variable intention.

To determine the influence of perceived behavioural control and the intention on the actual use of quality seed, multiple linear regression analysis was performed. The independent variables, the perceived behavioural control and the intention were

regressed against the dependent variable, the actual use of quality seed of improved common bean varieties.

## **6.4 Results**

### **6.4.1 Attitude resulting from Behavioural Beliefs**

Using the formula  $A = \sum (Be \times Oe)$ ,  $A = +4198.618$ . Where  $A$ =Total attitude score,  $Be$ =Behavioural beliefs,  $Oe$ =Outcome evaluation, the overall attitude is positive suggesting that smallholder farmers are in favour of quality seed of improved common bean varieties. Possible score could be  $[7x+/-3] \times 311 = 6531$ , where  $[7x+/-3]$  is possible score that is, the scores ranged from -3 to +3, 311 indicating the number of the respondents. Therefore, the possible range could be -6531 to + 6531 indicating that smallholder farmers have weak to moderate positive attitude towards using quality seed of improved common bean varieties.

The overall attitude of smallholder farmers toward using quality seed of improved varieties is the mean value obtained by using the formula  $[A = \sum (Be \times Oe)/N = +4198.618/311 = 13.5004]$ . The maximum score range is -21 to +21. The average score is 13.5004, which indicates that smallholder farmers have weak to moderate positive attitude toward quality seed of improved common bean varieties. Besides, this indicates that generally smallholder farmers are in favour of using quality seed of improved common bean varieties.

### **6.4.2 The influence of behavioural beliefs on attitude**

Linear regression analysis was conducted to determine the influence of smallholder farmers' behavioural beliefs on attitude towards quality seed of improved common bean varieties. The results in Table 6.1 indicate that behavioural beliefs have a significant

influence on smallholder farmers' attitude towards quality seed of improved common bean varieties.

**Table 6.1: The influence of behavioural beliefs on smallholder farmers' attitude towards quality seed**

Factor	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	4.389	.102		43.104	.000**
Weighted attitude <sup>1</sup>	.089	.007	.583	12.629	.000**

<sup>1</sup>Attitude being a product of behavioural beliefs and outcome evaluation

\*\* . Significant at the 0.001 level

#### 6.4.3 Subjective norm resulting from normative beliefs

The formula  $S_n = \sum (N_{o_{be}} \times M_{o_{co}}) = +3786.813$ . Where  $S_n$  = Total subjective norm score,  $N_{o_{be}}$  = Normative beliefs,  $M_{o_{co}}$  = Motivation to comply was used. By this formula, a positive (+)  $S_n$  score [+3786.813] means that, overall, the participant experiences social pressure of using quality seed of improved common bean varieties. The possible score could be  $[7x+/-3] \times 311$  where  $[7x+/-3]$  is possible score range that is, the score ranged from -3 to +3, while 311 is the number of the respondents indicating that the variable has been scored 311 times. The possible range is -6531 to +6531. Compared with the actual score obtained, the findings indicate that smallholder farmers experience moderate social pressure of using quality seed of improved common bean varieties.

The overall subjective norm possessed by smallholder farmers toward quality seed of improved varieties is the average calculated by the formula  $[S_n = \sum (N_{o_{be}} \times M_{o_{co}})/N = +3786.13/311=12.1762]$ . The maximum score range is -21 to

+21. The average score 12.1762 indicates that smallholder farmers experience a weak to moderate social pressure of using quality seed of improved common bean varieties.

#### 6.4.4 The influence of normative beliefs on subjective norm

Linear regression analysis was conducted to determine the influence of smallholder farmers' normative beliefs on subjective norm towards quality seed of improved common bean varieties. The findings in Table 6.2 indicate that normative beliefs have a significant influence on smallholder farmers' subjective norm towards quality seed of improved common bean varieties.

**Table 6.2: The influence of normative beliefs on subjective norm**

Factor	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	4.954	.096			
Subjective norm <sup>1</sup>	.014	.007	.121	2.141	.033*

<sup>1</sup>Resulting from the product of normative beliefs and motivation to comply

\* Significant at the 0.05 level

#### 6.4.5 Perceived Behavioural control resulting from Control beliefs

Perceived Behavioural control is weighted score computed by the formula  $PBC = \sum (C_{be} \times C_{bepo}) = +601.084$ ; Where PBC=Total Perceived Behavioural Control score,  $C_{be}$ = Control beliefs,  $C_{bepo}$  = Control belief power. Based on this formula, a positive (+) PBC= +601.084 score means that, overall, the participant feels to have control over the use of quality seed of improved common bean varieties. Possible score could be  $[7x+/-3] \times 311$  where  $[7x+/-3]$  indicates the possible score range hat is, from -3 to +3, while 311 represents the number of the respondents indicating the number of times a variable is answered. The possible range could have therefore been -6531 to +6531,

which indicates that smallholder farmers had neutral to weak feeling of having control over the use of quality seed of improved common bean varieties.

The overall Perceived Behavioural Control possessed by smallholder farmers toward quality seed of improved varieties is the average score which is determined by the formula  $[PBC = \sum (C_{obe} \times C_{obepo})/N = +601.084/311=1.9327]$ . The maximum score range is -21 to +21. The average score, which is 1.9327, indicates that smallholder farmers feel to lack or have very weak control over the use of quality seed of improved common bean varieties.

#### **6.4.6 The influence of control beliefs on Perceived Behavioural Control**

Linear regression analysis was conducted to determine the influence of smallholder farmers' control beliefs on the perceived behavioural control towards quality seed of improved common bean varieties. Results in Table 6.3 indicate that control beliefs have a significant influence on smallholder farmers' perceived behavioural control towards quality seed of improved common bean varieties.

**Table 6.3: The influence of control beliefs on perceived behavioural control**

Factor	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	5.605	.068		82.606	.000
Perceived behavioural control <sup>1</sup>	-.023	.009	-.141	-2.510	.013*

<sup>1</sup>Perceived behavioural control resulting from control beliefs and power of control factors \*Significant at the 0.05 level

### 6.4.7 The influence of direct determinants on intention

Multiple linear regression analysis was conducted to determine the influence of attitude, subjective norm, and perceived behavioural control on smallholder farmers' intention to use quality seed of improved common bean varieties. The independent variables, namely attitude, subjective norm and perceived behavioural were regressed against the dependent variable intention and results are presented in Table 6.4.

**Table 6.4: The influence of direct determinants on intention to use quality seed**

Determinant of intention	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	2.494	.345		7.238	.000**
Attitude	.504	.059	.448	8.527	.000**
Perceived behavioural control	.126	.039	.164	3.229	.001**
Subjective norm	.104	.046	.110	2.263	.024*

\*\*Significant at the 0.001 level

Significant at the 0.05 level

\*

The findings indicate that attitude, subjective norm and perceived behavioural control have a positive significant influence on smallholder farmers' intention of using quality seed of improved common bean varieties. Detailed analysis of how each of the direct determinant influences intention is indicated in Tables 6.5 to Table 6.7.

**Table 6.5: Attitudinal factors influencing intention to use quality seed**

Determinant	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	7.412	.088		83.781	.000**
To me producing common beans using quality seed of improved common bean varieties as main seed <u>is Very bad</u>	-.154	.039	-.207	-3.891	.000**

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
To me producing common beans using quality seed of improved common bean varieties as main seed <u>is not good at all</u>	-.191	.049	-.214	-3.906	.000**
To me producing common beans using quality seed of improved common bean varieties <u>has no value at all</u>	-.132	.049	-.146	-2.704	.007*

\*\*Significant at the 0.001 level      \*Significant at 0.01 level

**Table 6.6: Subjective norm features influencing intention to use quality seed**

Feature	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	6.720	.169		39.656	.000**
It is expected of me that when I produce common beans I should use quality seed of improved common bean varieties <u>no</u>	-.175	.031	-.298	-5.585	.000**
Nearly all people who are important to me think that <u>I'm not supposed to</u> use quality seed of improved common bean varieties as main seed	-.088	.029	-.163	-3.071	.002**
Nearly all people whose opinion I value could have been impressed by my producing common beans using quality seed of improved common bean varieties <u>agree</u>	.063	.021	.161	2.997	.003**
Many common bean consumers prefer local varieties more than improved ones <u>disagree</u>	.026	.019	.074	1.372	.171
Many common bean buyers prefer improved common bean varieties more than local ones <u>disagree</u>	-.020	.021	-.050	-.943	.346

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Most farmers in this village whom I know very well produce common beans using quality seed of improved common bean varieties <u>neutral</u>	-.015	.018	-.042	-.812	.417
If I produce common beans using quality seed of improved common bean varieties my fellow farmers will be surprised <u>disagree to neutral</u>	-.010	.018	-.032	-.594	.553

\*\*Significant at the 0.001 level; \*Significant at the 0.01 level;

**Table 6.7: Perceived behavioural control factors influencing intention to use quality seed**

Factor	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	6.755	.138		49.018	.000**
I'm confident if I wanted to use quality seed of improved common bean varieties as main seed in production I could manage <u>disagree</u>	-.317	.039	-.419	-8.148	.000**
To me producing common beans using quality seed of improved common beans is <u>neither difficult nor simple</u>	.041	.018	.117	2.266	.024*
It is my own decision to produce common beans using or not using quality seed of improved common bean varieties <u>disagree</u>	-.052	.023	-.116	-2.240	.026*



	Unstandardized		Standardized		
	Coefficients		Coefficients		
To me producing common beans using quality seed of improved common bean varieties as main seed is slightly possible	.036	.019	.098	1.916	.056

\*\*Significant at the 0.001 level      \*Significant at the 0.05 level

#### 6.4.8 Influence of intention and perceived behavioural control on actual seed use

To determine the influence of intention and perceived behavioural control on the actual use of quality seed, the independent variables, that is, perceived behavioural control, and intention were regressed against the dependent variable the actual use of quality seed of improved common bean varieties and the results are presented in Table 6.8. Although both perceived behavioural control and the intention influence the actual use of quality seed, the findings indicate that perceived behavioural control has significant ( $\beta = 0.157$ ;  $p \leq 0.01$ ) influence on smallholder farmers' actual use of quality seed of improved common bean varieties.

**Table 6.8: Influence of intention and perceived behavioural control on use of quality seed of improved common bean varieties**

Factor	Unstandardized		Standardized		
	B	Std. Error	Beta	t	Sig.
Constant	-9.080	8.901		-1.020	.308
Perceived behavioural control	2.754	1.055	.157	2.610	.010**
Smallholder farmers' intention to use quality seed of improved common bean varieties	.072	1.374	.003	.053	.958

\*\*Significant at the 0.01 level

Detailed analysis of the perceived behavioural control based factors influencing intention in Table 6.9 indicates that on average, smallholder farmers consider producing common beans using quality seed of improved common bean

varieties as neither difficult nor simple. This inability of telling whether it is simple or difficult to produce common beans using quality seed of improved common bean varieties has a significant ( $\beta = 0.130$ ;  $p \leq 0.05$ ) influence on smallholder farmers' actual use of quality seed of improved common bean varieties.

**Table 6.9: Perceived behavioural control factors influencing quality seed use**

Factor	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
Constant	-.511	3.561		-.143	.886
To me producing common beans using quality seed of improved common beans is <u>neither difficult nor simple</u>	1.041	.468	.130	2.227	.027*
To me producing common beans using quality seed of improved common bean varieties as main seed is <u>slightly possible</u>	.710	.490	.084	1.449	.148
I'm confident if I wanted to use quality seed of improved common bean varieties as main seed in production I could manage <u>disagree</u>	-.766	1.006	-.044	-.761	.447
It is my own decision to produce common beans using or not using quality seed of improved common bean varieties <u>disagree</u>	-.027	.598	-.003	-.045	.964

\*\*Significant at the 0.05 level

Tracing socioeconomic factors influencing smallholder farmers' actual use of quality seed of improved common bean varieties, the results in Table 6.10 show that smallholder farmers' sex ( $\beta = 0.199$ ;  $p \leq 0.001$ ), marital status ( $\beta = 0.128$ ;  $p \leq 0.01$ ), number of household members ( $\beta = -0.125$ ;  $p \leq 0.05$ ), size of common beans farm ( $\beta = 0.219$ ;  $p \leq 0.001$ ) and knowledge ( $\beta = 0.444$ ;  $p \leq 0.001$ ) significantly influence smallholder farmers actual quality seed use practices.

**Table 6.10: Socioeconomic factors influencing quality seed use**

Factor	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
(Constant)	-35.488	8.052		-4.407	.000
Respondent's age in years	.822	.843	.050	.975	.330
Respondent's sex	8.232	1.927	.199	4.273	.000
Respondent's Education level	-.087	2.169	-.002	-.040	.968
Respondent's marital status	3.571	1.344	.128	2.658	.008

	Unstandardized Coefficients		Standardized Coefficients		
Number of household members	-3.122	1.324	-.125	-2.357	.019
Number of household members involved in agricultural activities	-1.475	1.838	-.042	-.803	.423
Size of farms grown common beans	3.780	.806	.219	4.690	.000
Smallholder farmer's knowledge	13.014	1.364	.444	9.540	.000
Number of years spent in common beans farming	.233	.822	.014	.283	.777

\*\*Significant at the 0.05 level

## 6.5 Discussion

The objective of this study was to determine smallholder farmers' intention of using quality seed of improved common bean varieties. To achieve this, the study used the Theory of Planned Behaviour to establish whether there are any beliefs possessed by smallholder farmers, which indirectly influence their intention of using quality seed of improved common bean varieties. Moreover, the study aimed at seeing whether the possessed beliefs influence smallholder farmers' attitude, subjective norm, and perceived behavioural control of acquiring and using quality seed of improved common bean varieties. Furthermore, the study examined whether smallholder farmers' attitude, subjective norm and perceived behavioural control influence their intention of using quality seed of improved common bean varieties. Finally, the study examined if smallholder farmers' intention and perceived behavioural control have any influence on actual quality seed usage practices.

The results indicated that smallholder farmers hold various beliefs about quality seed of improved common bean varieties and these beliefs significantly influenced their attitude, subjective norm, and perceived behavioural control at ( $\beta = 0.583$ ;  $p \leq 0.001$ ), ( $\beta = 0.121$ ;  $p \leq 0.05$ ) and ( $\beta = -0.141$ ;  $p \leq 0.001$ ) respectively. Additionally, the results indicate that smallholder farmers' attitude, subjective norm, and perceived behavioural control significantly influenced their intention of using quality seed at ( $\beta = 0.448$ ;  $p \leq 0.001$ ),

( $\beta = 0.110$ ;  $p \leq 0.05$ ) and ( $\beta = 0.164$ ;  $p \leq 0.001$ ) respectively. Furthermore, the results indicate that smallholder farmers' perceived behavioural control toward quality seed of improved common bean varieties significantly influenced their actual seed usage practices.

These findings are consistent with the findings in other studies based on the Theory of Planned Behaviour which found beliefs, attitude, subjective norm, and perceived behavioural control to have significantly influenced respondents' intentions. For instance, when determining smallholder farmers' behavioural intentions towards sustainable agricultural practices, Zeweld *et al.* (2017) found attitudes, subjective norm, and perceived behavioural control to influence smallholder farmers' intentions positively and significantly toward sustainable agriculture. Focusing on durum wheat producers, Menozzi *et al.* (2015) found attitude and perceived behavioural control to influence significantly their motivation of adopting sustainable agricultural practices.

Using the theory of planned behaviour, previous studies and the current study have shown that attitude, subjective norm, and perceived behavioural control significantly influence intentions among respondents. Studies that investigated entrepreneurial intentions among university students have also indicated that attitude, subjective norm, and perceived behavioural control influenced significantly students' intentions. For instance Negash and Amentie (2013) investigated higher education student's entrepreneurial intention in Ethiopian Universities, found their intention to have been influenced significantly by their attitude, subjective norm, and perceived behavioural control. Additionally, Utami (2017) studying entrepreneurial intention among University Students in Indonesia found attitude, subjective norm, and perceived behavioural control among others to have influenced their intention positively and significantly. Moreover, Cruz *et al.* (2015) when

determining the effect of applications of the theory of planned behaviour in entrepreneurship intentions, found attitude, subjective norm, and perceived behavioural control to influence intention significantly. Furthermore, studying intentions among the General U.S. Population Martinez and Lewis (2016) found attitude, subjective norm, and perceived behavioural control to be responsible factors influencing intention.

### **6.6 Conclusions and Recommendations**

The findings suggest that smallholder farmers are slightly in favour of using quality seed of improved common bean varieties. Additionally, they experience only a moderate social pressure of using quality seed of improved common bean varieties. Furthermore, smallholder farmers have very weak control over the use of quality seed of improved common bean varieties. Therefore, to improve smallholder farmers' use of quality seed of improved common bean varieties attention should be given to socio-psychological issues. This could improve common beans productivity and enhance smallholder farmers' livelihoods.

There is need of strengthening smallholder farmers' attitude in favour of using quality seed of improved common bean varieties. Moreover, there is a need of improving smallholder farmers' subjective norm by increasing pressure that is more social of using quality seed of improved common bean varieties. Furthermore, it is necessary to empower smallholder farmers for them to have the ability of acquiring and confidence of using quality seed of improved common bean varieties.

These findings imply that seed and other agro input dealers should build trust with the farming community who are the main users of inputs. This would enable farmers to have favourable attitudes toward quality seed of improved common bean varieties. Moreover, these findings imply that seed stakeholders should pay attention on the effect of social

influences. There is a need for seed stakeholder such as TOSCI, ASA, breeders, seed companies, stockists and extension services providers to participate actively in guiding smallholder farmers well and encouraging them to use quality seed of improved common bean varieties.

Furthermore, the Ministry of Agriculture is expected to pay attention on high input costs to design a subsidy program targeting common beans, which can boost smallholder farmers' intention to use quality seed of improved common bean varieties. This will enhance smallholder farmers' confidence to acquire and use quality seed of improved common bean varieties.

## 6.7 References

- Adetumbi, J. A., Saka, J. O. and Fato, B. F. (2010). Seed handling system and its implications on seed quality in South Western Nigeria. *Journal of Agricultural Extension and Rural Development* 2(6): 133 – 140.
- Ahmed, H. U., Muhammad A. and Musa, H. U. (2015). Exploring theory of planned behaviour for understanding agricultural information utilization by rural farmers in Katsina State. *Journal of Humanities and Social Science* 20(6): 27 – 32.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50: 179 – 211.
- Ajzen, I. (2006). Constructing a TPB questionnaire: conceptual and methodological considerations.[<http://www.unibielefeld.de/ikg/zick/ajzen%20construction%20a%20tpb%20questionnaire.pdf>] site visited on 06/04/2016.
- Association for Agriculture Research in East and Central Africa/Tropical Royal Institute (2014). *Tanzania Seed Sector Assessment: A Participatory National Seed Sector Assessment for the Development of an Integrated Seed Sector Development. Programme in Tanzania*. Entebbe, Uganda.183pp.
- Binagwa, P. H., Magdalena, W., Michael, K., Zakayo, E., Mbiu, J., Msaky, J., Mdachi, M., Kasubiri, F., Kisamo, A., Nestory, S. M. and Rubyogo, J. C. (2018). *Selian Agricultural Research Institute Released Seven (7) Improved Common Bean (Phaseolus vulgaris) Varieties*. Selian Agricultural Research Institute, Arusha 5pp.
- Birachi, E. A., Ochieng, J., Wozemba, D., Ruraduma, C., Niyuhire, M. C. and Ochieng, D. (2011). Factors influencing smallholder farmers' bean



- production and supply to market in Burundi. *African Crop Science Journal* 19(4): 335 – 342.
- Borges, J. A. R., Foletto, L. and Xavier, V. T. (2015). An interdisciplinary framework to study farmers' decisions on adoption of innovation: Insights from expected utility theory and theory of planned Behavior. *African Journal of Agricultural Research* 10(29): 2814 – 2825.
- Cruz, L., Suprapti, W. S. and Yasa, N. K. (2015). Aplikasi *Theory of Planned Behavior* Dalam Membangkitkan niat berwirausaha bagi mahasiswa fakultas ekonomi unpaz, dili timor leste. *e-Jurnal Ekonomi dan Bisnis Universitas Udayana* 4(12) : 895 – 920.
- Etwire, P. M., Atokple, I. D. K., Buah, S. S. J., Abdulai, A. L., Karikari, A. S. and Asungre, P. (2013). Analysis of the seed system in Ghana. *International Journal of Advance Agricultural Research* 1: 7 – 13.
- FAO (2019). FAOSTAT data on production/yield quantities of beans, dry in world + total 1994 – 2017. [<http://www.fao.org/faostat/en/#data/QC/visualize>] site visited on 14/11/2019.
- Francis, J. J., Eccles, M. P., Johnston, M., Walker, A., Grimshaw, J., Foy R., Kaner, E. F. S., Smith, L. and Bonetti, D. (2004). Constructing questionnaires based on the theory of planned behaviour: A manual for health services researchers. [<http://web.fmk.edu.rs/files/blogs/2010-11/Psihologija/Socijalna/TPB.pdf>]site visited on 8/04/2016.
- Hasbullah, N., Mahajar, A. J. and Salleh, M. I. (2014). Extending the theory of planned behavior: evidence of the arguments of its sufficiency. *International Journal of Humanities and Social Science* 4(14): 101 – 105.
- Herath, C. S. (2013) . Scientific information: Does intention lead to behaviour? A case study of the Czech Republic farmers *Agricultural Economics* 59(3): 143–148

- Karanja, D., Endire, S., Ruraduma, C., Kimani, P., Kweka, S. and Louis, B. (2011). *Value Added Bean Technologies for Enhancing Food Security, Nutrition, to cope with Climate Change Income and Resilience and Variability Challenges in Eastern Africa*. International Livestock Research Institute, Nairobi Kenya. 43pp.
- Kühne, B., Lambrecht, E., Vanhonacker, F., Pieniak, Z. and Gellynck, X. (2014). Factors underlying farmers' decisions to participate in networks. *International Journal on Food System Dynamics* 4(3): 198 - 213.
- Lazaro, E. A. and Muywanga, D. M. (2008). Seed production and poverty reduction: Case of Dodoma Rural District. *Tanzania Journal Agriculture Science* 8(2): 161 - 17.
- Lee, J., Cerreto, F. A., & Lee, J. (2010). Theory of Planned Behavior and Teachers' Decisions Regarding Use of Educational Technology. *Educational Technology & Society* 13 (1): 152–164.
- Martinez, L. S. and Lewis, N. (2016). The Moderated Influence of Perceived Behavioral Control on Intentions among the General U.S. Population: Implications for Public Communication Campaigns. *Journal of Health Communication* 21(9): 1006–1015.
- Menzio, D., Fioravanti, M. and Donati, M. (2015). Farmer's motivation to adopt sustainable agricultural practices. *Bio-based and Applied Economics* 4(2): 125 – 147.
- Ministry of Agriculture Food Security and Cooperatives (2013). *National Agriculture Policy*. United Republic of Tanzania, Dar es Salaam. 51pp.
- Mwangi, M. and Kariuki, S. (2015). Factors Determining Adoption of New Agricultural Technology by Smallholder Farmers in Developing Countries. *Journal of Economics and Sustainable Development* 6(5): 208-216.

- Negash, E. and Amentie, C. (2013). An investigation of higher education student's entrepreneurial intention in Ethiopian Universities: Technology and business fields in focus *Basic Research Journal of Business Management and Accounts* 2(2): 30 – 35.
- Oyekale, K. O. (2014). Growing an Effective Seed Management System: A Case Study of Nigeria. *Journal of Agriculture and Environmental Sciences* 3(2): 345 – 354.
- Pandis, N. (2014). Statistics and research design: Cross-sectional studies. *American Journal of Orthodontics and Dentofacial Orthopedics* 146(1): 127 – 129.
- Sharifzadeh, M., Zamani G. H., Khalili, D. and Karami, E. (2012). Agricultural climate information use: An application of the planned behaviour theory. *Journal of Agricultural Science and Technology* 14: 479 – 492.
- Technical Centre for Agricultural and Rural Cooperation (2014). Seed systems, science and policy in East and Central Africa. [[https://cgspace.cgiar.org/bitstream/handle/10568/81086/1832\\_PDF.pdf?sequence=1&isAllowed=y](https://cgspace.cgiar.org/bitstream/handle/10568/81086/1832_PDF.pdf?sequence=1&isAllowed=y)] site visited 30/07/2019
- Utami, C. W. (2017). Attitude, subjective norms, perceived behavior, entrepreneurship education and self-efficacy toward entrepreneurial intention university student in Indonesia. *European Research Studies Journal* 20(2): 475 – 495.
- [Zeweld, W.](#), [Van, H. G.](#), [Tesfay, G.](#) and [Speelman, S.](#) (2017). Smallholder farmers' behavioural intentions towards sustainable agricultural practices. [Journal of Environmental Management](#) 187(1): 71 – 81.

## CHAPTER SEVEN

### 7.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### 7.1 Summary of Major Results and Conclusions

This study assessed factors influencing smallholder farmers' decision to use quality seed of improved common bean varieties in Tanzania. In this study, quality seed means certified seed of improved common bean varieties. The study was done in Iringa, Kigoma, Kilimanjaro, Manyara, Mbeya, Morogoro and Njombe regions which represented major common beans producing regions in Western/Great lakes, Northern, Southern and Eastern Zones. The aim was to provide seed stakeholders including the ministry responsible for agriculture, researchers, policy makers, breeders, ASA, TOSCI, Seed companies, extension workers, and QDS producers up to date information on factors influencing smallholder farmers' decision to use quality seed of improved common bean varieties.

This information is aimed at facilitating formulation of appropriate seed dissemination policy and extension strategy as well as designing mechanisms for enhancing smallholder farmers' demand for quality seed of improved common bean varieties. Specifically, the study intended to: (1) Determine smallholder farmers' beliefs about quality seed of improved common bean varieties. (2) Determine attributes preferred by smallholder farmers in improved common bean varieties. (3) Investigate smallholder farmers' knowledge about quality seed of improved common bean varieties. (4) Evaluate smallholder farmers' attitude towards quality seed of improved common bean varieties and (5) Determine smallholder farmers' intention to use quality seed of improved common bean varieties.

### **7.1.1 Smallholder farmers' beliefs about quality seed of improved common bean varieties**

The results on smallholder farmers' beliefs on quality seed of improved common bean varieties are discussed in Chapter two, which is based on objective one. Using content and thematic analysis, the results showed that farmers' have various behavioural, normative and control beliefs. Based on behavioural beliefs smallholder farmers have weak to moderate positive attitude toward quality seed of improved common bean varieties. On normative beliefs, smallholder farmers experience a weak to moderate social pressure of using quality seed of improved common bean varieties. As for control beliefs, smallholder farmers feel to lack or have very weak control over the use of quality seed of improved common bean varieties.

These beliefs emanated from quality seed unavailability, low family income, low market potential for produces from improved varieties, inadequate extension services, and high costs of associated inputs, among others. Furthermore, linear regression analysis indicated that these behavioural, normative and control beliefs significantly influenced smallholder farmers' attitude ( $\beta = 0.583$ ;  $p \leq 0.001$ ), subjective norm ( $\beta = 0.121$ ;  $p \leq 0.05$ ), and perceived behavioural control ( $\beta = -0.141$ ;  $p \leq 0.05$ ) respectively. Based on the findings, it is concluded that there is a need of improving smallholder farmers' behavioural and normative beliefs while minimizing control beliefs. This can be achieved by breeding, multiplying and promoting market led varieties as well as empowering farmers through loans and credit schemes to build their ability of acquiring and confidence of using quality seed of improved common bean varieties.

### **7.1.2 Attributes preferred by smallholder farmers in improved common bean varieties**

Chapter three is based on the second objective. In this chapter, comparative analysis of attributes preferred by smallholder farmers in landraces and improved common bean varieties was carried out. The analysis focused on common bean value chain where preproduction and postproduction preferred attributes were determined, at flowering, maturity, harvesting, and marketing and consumption stages. In addition, this chapter determined the influence of these attributes on actual use of quality seed.

Using Analysis of Variance (ANOVA), the results showed that smallholder farmers' preferences varied considerably among improved varieties and landraces at each node in the chain. At flowering stage germination ( $\beta = 0.130$ ;  $p \leq 0.001$ ), growth vigour ( $\beta = 0.209$ ;  $p \leq 0.001$ ) and flowering intensity ( $\beta = 0.290$ ;  $p \leq 0.001$ ) influenced preference. At maturity stage, high yield ( $\beta = 0.354$ ;  $p \leq 0.001$ ), growth vigour ( $\beta = 0.191$ ;  $p \leq 0.001$ ), and tolerance against a/biotic stress ( $\beta = 0.271$ ;  $p \leq 0.001$ ) influenced preferences. At marketing stage, common beans grain colour ( $\beta = 0.079$ ;  $p \leq 0.001$ ), grain size ( $\beta = 0.116$ ;  $p \leq 0.001$ ), price ( $\beta = 0.146$ ;  $p \leq 0.001$ ), market availability ( $\beta = 0.201$ ;  $p \leq 0.001$ ), and consumers availability ( $\beta = 0.420$ ;  $p \leq 0.001$ ) influenced preferences. This preference ( $\beta = 0.593$ ;  $p \leq 0.001$ ) in turn influenced actual quality seed usage practices.

The results indicated further that improved varieties are superior in production stages namely flowering, maturity, and harvesting. However, they were perceived to be inferior at postproduction stage namely marketing and consumption stages. Nevertheless, during cooking, they were found to be delicious contrary to smallholder farmers' expectations. Despite being delicious, improved common bean varieties are hardly sold in the village

and district markets. Furthermore, vendors, middlemen, and common beans buyers do not go at smallholders' homes to seek for improved common bean varieties. To a smallholder farmer common beans, which are not sold at home or village market are considered as non-marketable varieties.

Based on these findings, it can be concluded that there is a great variation in attributes preferred by smallholder farmers in common beans. Rarely addressed attributes by breeders are postproduction traits mainly market and consumption traits. Since preferences influence actual quality seed use, there is a need for breeding, multiplication, promotion and distribution to focus on market led attributes.

### **7.1.3 Smallholder farmers' knowledge about quality seed of improved common bean varieties**

Chapter four, which is based on objective three, examine if smallholder farmers have knowledge about quality seed of improved common bean varieties. Furthermore, the study examined if smallholder farmers' knowledge has influence on their actual quality seed usage practices. Overall, the results show that surveyed smallholder farmers had considerable variation in knowledge level. The findings indicate that 37, 50.8, 10.6, and 1.6 percent of the smallholder farmers had no knowledge, had low knowledge, had moderate knowledge and had high knowledge respectively about quality seed of improved common bean varieties. Furthermore, the results indicated that smallholder farmers' knowledge ( $\beta = 0.530$ ;  $p \leq 0.001$ ) had significant influence on their decision of using quality seed of improved common bean varieties. The findings suggest that efforts of promoting the use of quality seed of improved common bean varieties have to focus on creating awareness and knowledge among smallholder farmers about quality seed of improved common bean varieties.

#### **7.1.4 Smallholder farmers' attitude towards quality seed of improved common bean varieties**

Chapter five covered the fourth objective of the thesis. The chapter evaluated smallholder farmers' attitude towards quality seed of improved common bean varieties. The study used a seven point Likert scale which ranged from Strongly agree = 3, Moderately agree = 2, Slightly agree = 1, Neutral = 0, Slightly disagree = -1, Moderately disagree = -2 to Strongly disagree = -3. Based on theme's attributes the average score was computed. Generally, smallholder farmers have very weak positive attitude as indicated by a mean value of 0.9957. This emanated from the fact that they considered quality seed of improved common bean varieties as beneficial as they have moderate to strong positive attitude (2.0616). However, they have neutral to very weak positive attitude toward availability (0.3068) as well as marketability (0.3326) of their produce and promotion (0.3432).

Furthermore, smallholder farmers have weak to moderate positive attitude towards qualities (1.4705) and accessibility to quality seed of improved common bean varieties (1.4598). The findings indicated further that benefits ( $\beta = 0.333$ ;  $p \leq 0.001$ ), qualities ( $\beta = -0.144$ ;  $p \leq 0.05$ ), and marketability ( $\beta = -0.131$ ;  $p \leq 0.05$ ) influenced their attitude significantly. These findings suggest that efforts of promoting quality seed use have to focus on ensuring quality of claimed to be quality seeds and market outlets for the produce from quality seed of improved common bean varieties. This calls for effective and efficient seed certification system as well as monitoring seed distribution and marketing. Therefore, TOSCI has to strengthen seed certification and inspection to ensure seed quality. It also calls for breeders to focus on improving market led varieties.



### **7.1.5 Smallholder farmers' intention to use quality seed of improved common bean varieties in Tanzania**

Chapter six covered the fifth objective of the thesis. The chapter evaluated smallholder farmers' intention of using quality seed of improved common bean varieties in Tanzania. The results indicated that smallholder farmers' beliefs significantly influenced their attitude, subjective norm and perceived behavioural control at ( $\beta = 0.583$ ;  $p \leq 0.001$ ), ( $\beta = 0.121$ ;  $p \leq 0.05$ ) and ( $\beta = -0.141$ ;  $p \leq 0.001$ ) respectively. Additionally, the results indicated that smallholder farmers' attitude, subjective norm, and perceived behavioural control influenced significantly their intention of using quality seed at ( $\beta = 0.448$ ;  $p \leq 0.001$ ), ( $\beta = 0.110$ ;  $p \leq 0.05$ ) and ( $\beta = 0.164$ ;  $p \leq 0.001$ ) respectively.

The influence of attitude stems from the fact that on average smallholder farmers regard producing common beans using quality seed of improved common bean varieties as the main seed to be bad which significantly ( $\beta = -0.207$ ;  $p \leq 0.001$ ) influences their intention. Moreover, smallholder farmers consider producing common beans using quality seed of improved common bean varieties as not adding any value and this significantly ( $\beta = -0.146$ ;  $p \leq 0.01$ ) influences their intention of using quality seed of improved common bean varieties. Furthermore, smallholder farmers consider producing common beans using quality seed of improved common bean varieties as the main seed not to be good at all, and this has a significant influence ( $\beta = -0.214$ ;  $p \leq 0.001$ ) on their intention of using quality seed of improved common bean varieties.

The influence of subjective norm arises from the fact that on average, smallholder farmers view that nearly all the people who are important to them think that they are not supposed to use quality seed of improved common bean varieties. This has a significant ( $\beta = -0.163$ ;  $p \leq 0.01$ ) influence on their intention of using quality seed of improved

common bean varieties. Smallholder farmers also have a view that it is not expected of them to produce common beans using quality seed of improved common bean varieties and this significantly ( $\beta = -0.298$ ;  $p \leq 0.001$ ) influences their intention of using quality seed of improved common bean varieties. However, smallholder farmers agree that nearly all people whose opinion they value could have been impressed by their producing common beans using quality seed of improved common bean varieties. This has a significant ( $\beta = 0.161$ ;  $p \leq 0.01$ ) influence on their intention to use quality seed of improved common bean varieties.

The influence of perceived behavioural control emanates from the fact that on average, smallholder farmers consider producing common beans using quality seed of improved common bean varieties as neither difficult nor simple and this has a significant ( $\beta = 0.117$ ;  $p \leq 0.05$ ) influence on their intention to use quality seed of improved common bean varieties. Smallholder farmers consider producing common beans using quality seed of improved common bean varieties as not one of their own decisions and this has a significant ( $\beta = -0.116$ ;  $p \leq 0.05$ ) influence on their intention to use quality seed of improved common bean varieties. Furthermore, smallholder farmers are not confident as to whether they would manage to use quality seed of improved common bean varieties as the main seed in production. This significantly ( $\beta = -0.419$ ;  $p \leq 0.001$ ) influences their intention to use quality seed of improved common bean varieties.

On the actual quality seed usage, the results show that perceived behavioural control has significant ( $\beta = -0.131$ ;  $p \leq 0.01$ ) influence on smallholder farmers' actual use of quality seed of improved common bean varieties. This stems from the fact that smallholder farmers are not able to tell whether it is simple or difficult to use quality seed. Tracing from control beliefs, the reasons behind this inability are low family income, high costs of

associated inputs, unavailability of quality seed, inadequate extension services, and weather variability. This inability has a significant ( $\beta = 0.130$ ;  $p \leq 0.05$ ) influence on smallholder farmers' actual use of quality seed of improved common bean varieties.

Furthermore, the results show that smallholder farmers' sex ( $\beta = 0.199$ ;  $p \leq 0.001$ ), marital status ( $\beta = 0.128$ ;  $p \leq 0.01$ ), number of household members ( $\beta = -0.125$ ;  $p \leq 0.05$ ), number of common beans acres ( $\beta = 0.219$ ;  $p \leq 0.001$ ) and knowledge ( $\beta = 0.444$ ;  $p \leq 0.001$ ) significantly influence smallholder farmers actual quality seed use practices. These results suggest that the efforts of common bean stakeholders of increasing quality seed use have to address smallholder farmers' socioeconomic factors, preferred attributes, beliefs, attitude, subjective norm, perceived behavioural control and intention.

## 7.2 Theoretical Reflections

Theoretical triangulation approach was deemed necessary, as there is no single comprehensive theory that can be used to establish exhaustively the factors influencing smallholder farmers' decision of using quality seed of improved common bean varieties. Studies on agricultural technology diffusion and adoption frequently use four theories which explain how new practices, ideas, methods and technologies reach farmers. These theories include innovation-diffusion model, the economic constraints model, the technology characteristics users' model (Adesina and Zinnah, 1993; Kormawa *et al.*, 2004), and the expected utility theory (Borges *et al.*, 2015).

The four theories have been and are widely used to explain how agricultural innovations diffuse and been adopted by farmers. However, they rarely address social psychological based factors influencing smallholder farmers' decision of using quality seed of improved common bean varieties. Therefore, adding to the four theories cited here, the theory of

planned behaviour was used to determine the influence of beliefs, attitudes, subjective norm, perceived behavioural, and the intention of smallholder farmers on decision to use quality seed of improved common bean varieties. Studies based on the Theory of Planned Behaviour have established that behavioural beliefs, attitudes, normative beliefs, subjective norms, control beliefs, perceived behavioural control, and behavioural intention predict farmers' decision of using technologies (Ahmed *et al.*, 2015; Kühne *et al.*, 2014; Herath, 2013; Sharifzadeh *et al.*, 2012).

On the one hand, the innovation-diffusion model considers transfer of new practices, ideas, methods and technologies from the source, which is from research to the end users who are smallholder farmers through extension system. Based on this model, analysis focussed on research, extension and the characteristics of the person who is expected to adopt the technology under consideration. Using this model, quality seed of improved common bean varieties were traced from breeding through extension to smallholder farmers. Based on this model, it was found that variety breeding, seed multiplication, certification, promotion and distribution mechanisms are not adequately done for common beans.

On the other hand, the economic constraints model pays attention on resources owned by the person expected to adopt a given technology. This model categorizes adopters in terms of how one is endowed with the resources, which facilitate ones' decision of using a given technology. Based on this model, to gain a thorough understanding of factors influencing smallholder farmers' decision to use quality seed of improved common bean varieties, the study paid attention on acreage and the ability to manage farm operations. Based on this model, it was found that smallholder farmers have low family income. However, quality

seeds and associated inputs are sold at high prices, which isolate smallholder farmers, as they are not able to afford these costs.

On the contrary, the technology characteristics users' model focuses on the characteristics of the technology under consideration. The model acknowledges adopters' perception of the characteristics of the technology in question. In this respect, Rogers (1983) indicated that the factors that influence the adoption include how innovation is perceived to be economically and socially profitable, and how it is perceived to be consistent with previous values, experiences, beliefs and needs. Others include how it is perceived to be relatively difficult or ease to understand and use, how it is perceived to be experimented on limited basis, and how the benefits are perceived to be visible to others. The model also focuses on socio-economic and institutional contexts in which adopters live. The model was proved to be useful as socio-economic and institutional factors were found to significantly influence actual quality seed use practices.

As for the utility theory, the English dictionary defines utility as a state or condition of being useful. It is the ability of a commodity to satisfy the needs or wants. The satisfaction experienced by the consumer of the given commodity was addressed by paying attention on what smallholder farmers prefer in common beans. Their preferences in common beans were compared with what is available in quality seed of improved common bean varieties. This enabled the study to establish whether or not quality seed of improved common bean varieties satisfy smallholder farmers' needs in common beans production, marketing and consumption.

The theory of planned behaviour has enabled the study to establish that smallholder farmers possess various beliefs, which later influenced their attitude, subjective norm, and

perceived behavioural control toward quality seed of improved common bean varieties. Additionally, using this theory, smallholder farmers' attitude, subjective norm and perceived behavioural control influenced their intention to use quality seed of improved common bean varieties were established. Furthermore, the theory assisted in establishing that it is perceived behavioural control, which influences the actual use of quality seed.

Therefore, as result of theoretical triangulation it has been established that smallholder farmers' decision of using quality seed of improved common bean varieties is mainly influenced by socioeconomic, preferences, and social psychological factors as they significantly influenced the actual use of quality seed.

### **7.3 Recommendations**

#### **7.3.1 Smallholder farmers' beliefs about quality seed of improved common bean varieties**

To address smallholder farmers' beliefs about quality seed of improved common bean varieties there is a need for stakeholders to play their roles actively. The study has shown that smallholder farmers have weak to moderate positive attitude toward quality seed of improved common bean varieties. Moreover, smallholder farmers experience weak to moderate social pressure to using quality seed of improved common bean varieties. Furthermore, smallholder farmers lack or have very weak control over the use of quality seed of improved common bean varieties. These are mainly due to unavailability of quality seed of improved common bean varieties, low family income, low market potential of produce from improved common bean varieties, high costs of associated inputs, and inadequate extension services.

Since quality seed of improved common bean varieties are not easily available to the farming community, efforts to make them available and accessible have to consider distribution channels which come closer to the farming community mainly smallholder farmers. There is some evidence that seed dealers are not interested in trading quality seed of improved common bean varieties due to seed recycling hence unavailability. There is a need for the Ministry of Agriculture, ASA, TOSCI, local government authorities to develop alternative seed delivery system for common beans.

Since produces from quality seed of improved common bean varieties experience low marketing potential, there is a need of strengthening breeding activities which target market led varieties. Several varieties have been released but not easily adopted due to lack of market outlet for these varieties. Smallholder farmers sell their products to common bean vendors and/or common bean businessmen who know where to take the produces. Involving common beans vendors, traders and consumers who play a significant role in distribution and marketing is very important for improved common beans to be used by smallholder farmers.

In a situation where there is inadequate extension services improving access to extension services is important. There is a need of strengthening extension services, which focus on the quality seed of improved common bean varieties. There is a need of improving the quantity and quality of extension services. This would increase the chances for smallholder farmers to use quality seed of improved common bean varieties. Evidence indicated that even vendors, common beans buyers and consumers are not aware of most of these released varieties. Therefore, strengthening extension services will not only benefit farmers but also other common beans stakeholders.

In a situation where there is high cost of associated inputs coupled with low family income, credits are considered paramount. There is a need of having a scheme targeting credits to common beans producers. The main initiative targeting seed is National Agriculture Input Voucher Scheme; however, this scheme does not pay attention to quality seed of improved common bean varieties. There is a need of having a special scheme targeting on increased access to quality seed of improved common bean varieties.

### **7.3.2 Attributes preferred by smallholder farmers in improved common bean varieties**

To address smallholder farmer preferences there is a need for interventions, which focus specifically on smallholder farmers, vendors, buyers and consumers preferred attributes in common beans. Smallholder farmers' preferences are crucial in any attempt of increasing the use of quality seed of improved common bean varieties. Smallholder farmers produce common beans for their own consumption and for sell to vendors who later sell the produce to consumers. Thus, focusing on what they prefer in common beans consumption, as well as what vendors prefer to buy is very crucial. There is a need for breeders to balance between agronomic and postproduction traits. Common practice has been to focus on increased yield ignoring where the product goes hence shelving newly released improved varieties as they lack market outlets and therefore are not easily demanded by the farming community. Although there are some convergences between farmers and breeders on what are considered as the best qualities of seed, divergences also exist. To farmers, consumption and marketability or market potential of produce from the variety are the key determinants. These findings imply that breeding and multiplication of common beans should pay attention on market led varieties.



### **7.3.3 Smallholder farmers' knowledge about quality seed of improved common bean varieties**

Knowledge of quality seed of improved common bean varieties plays an important role in smallholder farmers' decision to use quality seed. However, smallholder farmers were found to have varying knowledge levels, with only very few having adequate knowledge to be able use quality seeds of improved common bean varieties. Majority lacked sufficient knowledge to be able to use quality seed of improved common bean varieties. Furthermore, smallholder farmers' knowledge of quality seed of improved common bean varieties was found to influence significantly their seed use practices.

For farmers to be able to decide to use quality seed of improved common bean varieties, there is a need of assisting them to improve their knowledge level on quality seed. Once they have acquired sufficient knowledge about quality seed of improved common bean varieties, they will use them. This is possible because those who had adequate knowledge to be able to use quality seed of improved common bean varieties are the ones who worked with researchers. This calls for extension services providers and seed dealers to play their role actively. There is need to promote these improved varieties through demonstrations, farmer field schools, seed fairs, agricultural shows as well other information and communication media.

### **7.3.4 Smallholder farmers' attitude towards quality seed of improved common bean varieties**

To address smallholder farmers' attitude toward quality seed of improved common bean varieties, requires concerted efforts from seed stakeholders. Smallholder farmers consider quality seed of improved common bean varieties as beneficial. However, they have neutral to very weak positive attitude toward availability, promotion and marketability of

their produce. Furthermore, they have weak to moderate positive attitude towards qualities and accessibility of quality seed of improved common bean varieties. Therefore, attempts to increase use of quality seed of improved common bean varieties have to strengthen availability, promotion and target marketable varieties. Moreover, assuring smallholder farmers on the quality of claimed to be quality seed as well as addressing accessibility stand better chances of increasing quality seed use. This calls for effective and efficient seed certification system as well as monitoring seed distribution and marketing. Therefore, TOSCI has to strengthen seed certification and inspection to ensure seed quality. It also calls for breeders, ASA, seed companies and stockists to focus on improving and distributing market led varieties.

### **7.3.5 Smallholder farmers' intention to use quality seed of improved common bean varieties in Tanzania**

To address smallholder farmers' intention to use quality seed of improved common bean varieties in Tanzania, seed stakeholders' efforts to increase quality seed use have to address smallholder farmers' beliefs, attitude, subjective norm, and perceived behavioural control. This is because results indicated that smallholder farmers' beliefs significantly influenced their attitude, subjective norm and perceived behavioural control. Additionally, results indicated that smallholder farmers' attitude, subjective norm and perceived behavioural control significantly influenced their intention to use quality seed. Moreover, results indicate that smallholder farmers' perceived behavioural control significantly influenced their actual quality seed use. Furthermore, results indicate that sex, marital status, number of household members, number of acres used to grow common beans and knowledge significantly influenced smallholder farmers' actual seed use. It has been shown that smallholder farmers' decision to use quality seed of improved common bean varieties is influenced by socioeconomic, preferences, and social psychological factors.

Therefore, the Ministry of Agriculture, ASA, TOSCI, breeders, researchers, local government authorities, seed companies, extension services providers should focus more on market led varieties as well as searching markets for already released varieties. Additionally, they should all put more emphasis on using quality seed of improved common bean varieties as for quality seed of improved maize varieties.

#### **7.4 Areas for Further Research**

This study mainly focused in major common beans producing zones where representative regions, districts, stockists, common beans vendors and sellers, extension workers and smallholder farmers were involved. Evidence have shown that local landraces are the mainly preferred by vendors, buyers, sellers and consumers hence minimal use of quality seed of improved common bean varieties as they lack market outlets. Future similar studies are recommended to pay attention on common beans markets at both local, national and cross border trade. These would come up with improved common bean varieties preferred in specific countries to enable breeders, seed companies, ASA and producers to produce while they know where to sale the particular variety. Additionally, future studies should pay attention on market information flow among producers, vendors and common beans businessmen. Moreover, future studies are recommended to establish mechanisms, which would link agro dealers, stockists and producers so that farmers could acquire inputs at affordable prices. Furthermore, future studies need to focus on mechanisms which could assist smallholder farmers to raise their family incomes.

## 7.5 References

- Adesina A. A. and Zinnah M. M. (1993). Technology characteristics, farmers' perceptions and adoption decisions: A Tobit model application in Sierra Leone. *Agricultural Economics* 9: 297 – 311.
- Ahmed, H.U., Muhammad A. and Musa, H. U. (2015). Exploring theory of planned behaviour for understanding agricultural information utilization by rural farmers in Katsina State. *Journal of Humanities and Social Science* 20(6): 27 – 32.
- Borges, J. A. R., Foletto, L. and Xavier, V. T. (2015). An interdisciplinary framework to study farmers' decisions on adoption of innovation: Insights from expected utility theory and theory of planned behavior. *African Journal of Agricultural Research* 10(29): 2814 – 2825.
- Herath, C. S. (2013). Scientific information: Does intention lead to behaviour? A case study of the Czech Republic farmers. *Agricultural Economics* 59(3): 143–148.
- Kormawa, P. M., Ezedinma, C. I. and Singh B. B. (2004). Factors influencing farmer-to-farmer transfer of an improved cowpea variety in Kano State, Nigeria. *Journal of Agriculture and Rural Development in the Tropics and Subtropics* 105(1): 1–13.
- Kühne, B., Lambrecht, E., Vanhonacker, F., Pieniak, Z., and Gellynck, X. (2014). Factors underlying farmers' decisions to participate in networks. *International Journal on Food System Dynamics* 4(3): 198 - 213.
- Rogers E. M. (1983). *Diffusion of Innovations*. (3<sup>rd</sup> Ed.), Macmillan Publishing Co., New York. 236pp.
- Sharifzadeh, M., Zamani, G. H., Khalili, D. and Karami, E. (2012). Agricultural climate information use: An application of the planned behaviour theory. *Journal of Agricultural Science and Technology* 14: 479 – 492.

## **APPENDICES**

### **Appendix 1: Questionnaire for Eliciting Smallholder Farmers' Beliefs about Quality Seed of Improved Common Bean Varieties in Tanzania**

#### **Respondent's information**

1. Age in years
2. Education level a) No formal education b) Primary education c) Secondary education d) College education e) University education f) Other [specify]
3. Marital status a) Single b) Married c) Separated d) Divorced e) Widow/er
4. Number of household members
5. Number of household members involved in agricultural activities

#### **Information on common beans production**

1. Number of years spent in common bean production.
2. Number of acres you own
3. Number of acres you actually cultivate
4. Number of acres you grow common beans
5. Please list three main crops which your household depends on most
6. For each of the three key crops in your household please list three main sources of seed for each crop
7. Please list three main preferred common beans in your village
8. Please list the sources of seed for each of the three main preferred common beans in your village
9. Please list attributes which attract you in each of the preferred common beans in your village

10. For the first time you planted common beans using quality seed of improved common bean varieties in which year?
11. Where did you get these quality seed of improved common bean varieties?
12. Number of acres you grow common beans using quality seed of improved common bean varieties
13. What attracts you in using quality seed of improved common bean varieties as main seed in your common bean production?
14. What discourages you in using quality seed of improved common bean varieties as main seed in your common beans production?
15. What do you believe to be the advantages of using quality seed of improved common bean varieties in common beans production?
16. What do you believe to be the disadvantages or challenges of using quality seed of improved common bean varieties in common beans production?
17. Is there anything else you associate with your views about using quality seed of improved common bean varieties in common beans production?
18. Please list individuals, people or groups of people who would be impressed by your use or think you are supposed to use quality seed of improved common bean varieties in your common beans production.
19. Please list individuals, people or groups of people who would not be impressed by your use or think you are not supposed to use quality seed of improved common bean varieties in your common beans production.
20. Are there any other individuals, people or groups of people who come to your mind when you think about using quality seed of improved common bean varieties?
21. Is there anything else you associate with your views or other people's views about using quality seed of improved common bean varieties in common beans production?

22. Please list things, situations, reasons, or environments which may simplify or facilitate your use of quality seed of improved common bean varieties in common beans production.
23. Please list things, situations, reasons, or environments which may make it difficult or impossible for you to use quality seed of improved common bean varieties in common beans production.
24. Are there any other things, situations, reasons, or environments which come to your mind when you think about difficulties in using quality seed of improved common bean varieties as main seed in the next common beans production seasons?

**Appendix 2: Questionnaire for Smallholder Farmers' Knowledge about Quality Seed  
of Improved Common Bean Varieties**

**Respondent's information**

1. Education level a) No formal education b) Primary education c) Secondary education  
d) College education e) University education f) Other [specify]
2. Marital status a) Single b) Married c) Separated d) Divorced e) Widow/er
3. Number of household members
4. Number of household members involved in agricultural activities
5. Number of years spent in common bean production

**Information on common bean production**

1. How many common bean production seasons do you have in your village?
2. Which common bean production season is better than the other?
3. Better common bean production season starts in which month?
4. What are the differences between these seasons?
5. You produce common bean for which purpose/s?
6. You use large proportion of common bean produces for what purpose?
7. List common beans produced in this village
8. Out of these which are local common bean varieties [landraces]?
9. Out of these which common bean varieties were introduced recently?
10. These common bean varieties introduced recently who brought them?
11. What are the differences between local varieties and those introduced recently?
12. Where do you get seed to use in common bean production?
13. Which criteria do you use to identify common bean which are good for sowing as seed?
14. When sowing common bean which distance do you use between rows?



15. When sowing common bean which distance do you use between plants?
16. For the first time you planted common bean using quality seed of improved common bean varieties in which year?
17. Where did you get these quality seed of improved common bean varieties?
18. Which common bean variety was that?
19. What are the differences between quality seed of improved common bean varieties and common beans grains used as seed?
20. When you need quality seed of improved common bean varieties where do you get them?
21. What are the advantages of using quality seed of improved common bean varieties?
22. What are the qualities of quality seed of improved common bean varieties?
23. Which type of fertilizer do you use when sowing common beans?
24. Which type of fertilizer do you use to boost common beans?
25. Which type of pesticide do you use to control pests in your common bean farm?
26. Which type of pesticide do you use to control diseases in your common bean farm?
27. Which type of herbicide do you use to control weeds in your common bean farm?
28. Number of acres you planted common beans
29. Number of acres you planted common beans using quality seed of improved common bean varieties
30. Which improved common bean variety/ies have you planted?

**Appendix 3: Questionnaire for smallholder farmers' Attitude towards Quality Seed of Improved Common Bean Varieties**

Please answer each of the following questions by circling the number that best describes your opinion.

Please read each question carefully

**Availability of quality seed of improved common bean varieties**

1. Quality seeds of improved varieties are not sold in agro input shops  
Strongly disagree :\_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree
2. Quality seeds of improved common bean varieties are not available  
Strongly disagree :\_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree
3. Planting quality seed of improved common bean varieties implies late sowing due to late delivery  
Strongly disagree :\_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree
4. Quality seeds of improved common bean varieties are not included in National Agriculture Input Voucher Scheme  
Strongly disagree :\_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree
5. Many seed companies do not sale quality seed of improved common bean varieties  
Strongly disagree :\_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree

**Benefits of using quality seeds of improved common bean varieties**

1. Using quality seeds of improved common bean varieties improves one's livelihood  
Strongly disagree :\_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree
2. Using quality seeds of improved common bean varieties leads to loss of your traditional varieties  
Strongly disagree :\_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree

3. Using quality seeds of improved common bean varieties improves one's expertise in common bean production

Strongly disagree :\_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree

4. Using quality seeds of improved common bean varieties leads to seed quality

assurance Strongly disagree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ :

strongly agree

5. Using quality seeds of improved common bean varieties improves one's income

Strongly disagree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree

6. Using quality seeds of improved common bean varieties assures one's food security

Strongly disagree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree

7. Using quality seeds of improved common bean varieties assures one's body

nutritional needs Strongly disagree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ :

strongly agree

### **Accessibility of Quality seeds of improved common bean varieties**

1. Quality seeds of improved varieties are sold at high price

Strongly disagree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree

2. Using quality seeds of improved common bean varieties requires other inputs with high costs

Strongly disagree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree

3. Farm management costs associated with using quality seeds of improved common bean varieties hinder their use

Strongly disagree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree

**Agronomic traits of common beans grown using quality seed of improved common bean varieties**

1. Quality seeds of improved common bean varieties have high germination rate  
Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree
2. Quality seeds of improved common bean varieties mature early  
Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree
3. Quality seeds of improved common bean varieties are not suitable to microclimate conditions  
Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree
4. Quality seeds of improved common bean varieties are tolerant to drought  
Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree
5. Prevalence of fake seed of claimed quality seeds of improved common bean varieties erode farmers' confidence in improved varieties  
Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree
6. Quality seeds of improved common bean varieties have good growth uniformity  
Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree
7. Quality seeds of improved common bean varieties are high yielding  
Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree
8. Quality seeds of improved common bean varieties are resistant to diseases  
Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree
9. Weather variability limits use of quality seeds of improved common bean varieties  
Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree

**Promotion of quality seed of improved common bean varieties**

1. Many farmers in this village have participated in farmer field schools which involved quality seeds of improved common bean varieties

Strongly disagree :\_\_1\_\_: \_\_2\_\_: \_\_3\_\_: \_\_4\_\_: \_\_5\_\_: \_\_6\_\_: \_\_7\_\_: strongly agree

2. There is minimal education on quality seeds of improved common bean varieties

Strongly disagree :\_\_1\_\_: \_\_2\_\_: \_\_3\_\_: \_\_4\_\_: \_\_5\_\_: \_\_6\_\_: \_\_7\_\_: strongly agree

3. There is a demonstration plot where quality seeds of improved common bean varieties are grown in this village

Strongly disagree :\_\_1\_\_: \_\_2\_\_: \_\_3\_\_: \_\_4\_\_: \_\_5\_\_: \_\_6\_\_: \_\_7\_\_: strongly agree

4. Inadequate extension services limits use of quality seeds of improved common bean varieties

Strongly disagree :\_\_1\_\_: \_\_2\_\_: \_\_3\_\_: \_\_4\_\_: \_\_5\_\_: \_\_6\_\_: \_\_7\_\_: strongly agree

5. Village leaders promote use of quality seeds of improved common bean varieties

Strongly disagree :\_\_1\_\_: \_\_2\_\_: \_\_3\_\_: \_\_4\_\_: \_\_5\_\_: \_\_6\_\_: \_\_7\_\_: strongly agree

6. There is very minimal advertisement about quality seeds of improved common bean varieties

Strongly disagree :\_\_1\_\_: \_\_2\_\_: \_\_3\_\_: \_\_4\_\_: \_\_5\_\_: \_\_6\_\_: \_\_7\_\_: strongly agree

7. Seed companies do not promote quality seeds of improved common bean varieties

Strongly disagree :\_\_1\_\_: \_\_2\_\_: \_\_3\_\_: \_\_4\_\_: \_\_5\_\_: \_\_6\_\_: \_\_7\_\_: strongly agree

8. Quality seed of improved common bean varieties are not promoted during Nane Nane Agricultural shows

Strongly disagree :\_\_1\_\_: \_\_2\_\_: \_\_3\_\_: \_\_4\_\_: \_\_5\_\_: \_\_6\_\_: \_\_7\_\_: strongly agree

**Marketability of produce from quality seed of improved varieties**

1. Many common bean buyers prefer local landraces to improved common bean varieties

Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree

2. Common beans produced from quality seeds of improved common bean varieties are hardly sold in our village

Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree

3. Produces from quality seeds of improved common bean varieties are not easily marketable

Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree

4. Many common beans consumers do not prefer produce from quality seeds of improved common bean varieties

Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree

5. Lack of markets for produce from improved varieties limits use of quality seeds of improved varieties

Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree

6. Produce from quality seeds of improved common bean varieties are uniform hence good for business

Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree

7. Produces from quality seeds of improved common bean varieties are not tasty

Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree

**Appendix 4: Questionnaire for smallholder farmers' intention to use quality seed of improved common bean varieties**

Please answer each of the following questions by circling the number that best describes your opinion. Some of the questions may appear to be similar, but they do address somewhat different issues.

Please read each question carefully.

**Outcome Evaluations**

1. For me to gain a better understanding of quality seed of improved common bean varieties is

Extremely good : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely bad

2. For me to use quality seed of improved common bean varieties and get a high yield is

Extremely good : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely bad

3. For me to have an opportunity to interact with agricultural experts and other farmers producing common beans is

Extremely good : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely bad

4. For me to miss local common bean varieties seed is

Extremely good : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely bad

5. My being subjected to common bean varieties with high market potential and high attractive cooking traits is

Extremely good : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely bad

6. My decision to use quality seed of improved common bean varieties seed is

Extremely good :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: extremely bad

7. For me to keep up with common beans production for improving livelihood is

Extremely good :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: extremely bad

8. For me to develop good farming habits, self-seed sufficiency, and a feeling of self-seed  
reliant is

Extremely good :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: extremely bad

9. My decision to use local common bean varieties seed is

Extremely good :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: extremely bad

10. For me getting information and explanations regarding quality seed of improved  
common bean varieties is

Extremely good :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: extremely bad

11. My being subjected to high yielding, early maturing and drought, disease tolerant  
common bean varieties is

Extremely good :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: extremely bad

### **Past Behavior: Self-Report**

During the past 5 years, what percentage of your farms have you planted using quality seed of improved common bean varieties?

During the past 5 years, I have planted about \_\_\_\_ % of the common bean farms with quality seed of improved common bean varieties.



**Direct Measures of Perceived Behavioral Control, Subjective Norm, Attitude, and Intention**

1. For me to produce common beans using quality seed of improved common bean varieties as the main seed is

Extremely difficult : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely easy

2. Most people who are important to me think that

I should : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : I should not use quality seed of improved common bean varieties as the main seed

3. For me to produce common beans using quality seed of improved common bean varieties as the main seed is

Extremely good : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely bad

4. I plan to produce common beans using quality seed of improved common bean varieties as the main seed

Extremely likely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely unlikely

5. Whether or not I produce common beans using quality seed of improved common bean varieties as the main seed is completely up to me

Strongly disagree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly agree

6. Most of the farmers in this village with whom I am acquainted produce common beans using quality seed of improved common bean varieties as the main seed

Definitely true : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : definitely false

7. For me to produce common beans using quality seed of improved common bean varieties as the main seed

Extremely valuable : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely worthless

8. I am confident that if I wanted to I could produce common beans using quality seed of improved common bean varieties as the main seed

Definitely true :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: definitely false

9. It is expected of me that I produce common beans using quality seed of improved common bean varieties as the main seed

Definitely true :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: definitely false

10. For me to produce common beans using quality seed of improved common bean varieties as the main seed is

Extremely pleasant :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: extremely unpleasant

11. I will make an effort to produce common beans using quality seed of improved common bean varieties as the main seed

I definitely will :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: I definitely will not

12. For me to produce common beans using quality seed of improved common bean varieties as the main seed is

Impossible :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: possible

13. Most people whose opinions I value would approve of my producing common beans using quality seed of improved common bean varieties as the main seed

Strongly disagree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly agree

14. For me to produce common beans using quality seed of improved common bean varieties as the main seed is

Interesting :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: boring

15. I intend to produce common beans using quality seed of improved common bean varieties as the main seed

Strongly agree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly disagree

**Motivation to Comply**

1. Generally speaking, how much do you care what the agricultural expert thinks you should do?

Not at all : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very much

2. Generally speaking, how much do you care what your relatives think you should do?

Not at all : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very much

3. Generally speaking, how much do you care what your close friends think you should do?

Not at all : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very much

4. Generally speaking, how much do you care what your farmer group members think you should do?

Not at all : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very much

5. Generally speaking, how much do you care what common bean buyers think you should do?

Not at all : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very much

6. Generally speaking, how much do you care what older people think you should do?

Not at all : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very much

7. Generally speaking, how much do you care what your fellow farmers think you should do?

Not at all : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very much

**Behavioral Beliefs**

1. Producing common beans using quality seed of improved common bean varieties as the main seed will help me to gain a better understanding of improved common bean production practices

Extremely unlikely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely likely

2. Producing common beans using quality seed of improved common bean varieties as the main seed will help me to improve production practices and get a high yield  
Extremely unlikely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely likely
  
3. Producing common beans using quality seed of improved common bean varieties as the main seed will give me an opportunity to interact with agricultural experts and other farmers producing common beans  
Extremely unlikely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely likely
  
4. Producing common beans using quality seed of improved common bean varieties as the main seed will cause me to miss local common bean varieties  
Extremely unlikely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely likely
  
5. Producing common beans using quality seed of improved common bean varieties as the main seed will subject me to common bean varieties with high market potential and high attractive cooking traits  
Extremely unlikely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely likely
  
6. Producing common beans using quality seed of improved common bean varieties as the main seed will help me to keep up with common bean production for improved livelihood  
Extremely unlikely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely likely

7. Producing common beans using quality seed of improved common bean varieties as the main seed will help me to develop good farming habits, self-seed sufficiency, and a feeling of self-seed reliant

Extremely unlikely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely likely

8. Producing common beans using quality seed of improved common bean varieties as the main seed will make me miss out local bean varieties

Extremely unlikely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely likely

9. Producing common beans using quality seed of improved common bean varieties as the main seed will help me to get information and explanations regarding quality seed of improved varieties

Extremely unlikely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely likely

10. Producing common beans using quality seed of improved common bean varieties as the main seed will subject me to high yielding, early maturing and drought, disease tolerant common bean varieties

Extremely unlikely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely likely

### **Control Beliefs**

1. How often do you encounter unanticipated events that place demands on your decision to use quality seed of improved common bean varieties as main seed in production?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

2. How often do you face unavailability of quality seed of improved common bean varieties?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

3. How often do family obligations place unanticipated demands on your decision to use quality seed of improved common bean varieties as main seed in production?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

4. How often does weather variability places unanticipated demands on your decision to use quality seed of improved common bean varieties as main seed in production?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

5. How often do high costs of inputs associated with common bean production place heavy demands on your decision to use quality seed of improved common bean varieties as main seed in production?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

6. How often does low market potential of improved common bean varieties products places heavy demands on your decision to use quality seed of improved common bean varieties as main seed in production?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

7. How often do inadequate extension services place heavy demands on your decision to use quality seed of improved common bean varieties as main seed in production?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

8. How often does lack of education on improved seed place heavy demands on your decision to use quality seed of improved common bean varieties as main seed in production?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

9. How often does lack of agricultural land places heavy demands on your decision to use quality seed of improved common bean varieties as main seed in production?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

10. How often does incidence of pests and diseases places heavy demands on your decision to use quality seed of improved common bean varieties as main seed in production?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

11. How often do farm management or operation costs place heavy demands on your decision to use quality seed of improved common bean varieties as main seed in production?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

12. How often do seed recycling practices place heavy demands on your decision to use quality seed of improved common bean varieties as main seed in production?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

13. How often do you fail to do common bean farm operations on time?

Very rarely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : very frequently

### **Power of Control Factors**

1. If I encountered unanticipated events that placed demands on my decision to use quality seed of improved common bean varieties as main seed in production, it would make it more difficult for me to use quality seed of improved varieties as main seed in production

Strongly agree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly disagree

2. If I faced unavailability of quality seed of improved common bean varieties, it would make it more difficult for me to use quality seed of improved varieties as main seed in production
- Strongly agree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly disagree
3. If I had family obligations that placed unanticipated demands on my decision to use quality seed of improved common bean varieties as main seed in production, it would make it more difficult for me to use quality seed of improved varieties as main seed in production
- Strongly agree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly disagree
4. If weather variability placed unanticipated demands on my decision to use quality seed of improved common bean varieties as main seed in production, it would make it more difficult for me to use quality seed of improved varieties as main seed in production
- Strongly agree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly disagree
5. If high costs of inputs associated with common bean production placed heavy demands on my decision to use quality seed of improved common bean varieties as main seed in production, it would make it more difficult for me to use quality seed of improved varieties as main seed in production
- Strongly agree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly disagree
6. If low market potential of improved common bean varieties products placed heavy demands on my decision to use quality seed of improved common bean varieties as main seed in production, it would make it more difficult for me to use quality seed of improved varieties as main seed in production
- Strongly agree :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: strongly disagree



7. If inadequate extension services placed heavy demands on my decision to use quality seed of improved common bean varieties as main seed in production, it would make it more difficult for me to use quality seed of improved varieties as main seed in production
- Strongly agree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly disagree
8. If lack of education on improved seed placed heavy demands on my decision to use quality seed of improved common bean varieties as main seed in production, it would make it more difficult for me to use quality seed of improved varieties as main seed in production
- Strongly agree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly disagree
9. If lack of agricultural land placed heavy demands on my decision to use quality seed of improved common bean varieties as main seed in production, it would make it more difficult for me to use quality seed of improved varieties as main seed in production
- Strongly agree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly disagree
10. If incidence of pests and diseases placed heavy demands on my decision to use quality seed of improved common bean varieties as main seed in production, it would make it more difficult for me to use quality seed of improved varieties as main seed in production
- Strongly agree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly disagree
11. If farm management or operation costs placed heavy demands on my decision to use quality seed of improved common bean varieties as main seed in production, it would make it more difficult for me to use quality seed of improved varieties as main seed in production
- Strongly agree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly disagree

12. If seed recycling practices placed heavy demands on my decision to use quality seed of improved common bean varieties as main seed in production, it would make it more difficult for me to use quality seed of improved varieties as main seed in production

Strongly agree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly disagree

13. If I failed to do common bean farm operations on time, it would make it more difficult for me to use quality seed of improved varieties as main seed in production

Strongly agree : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : strongly disagree

### **Normative Beliefs**

1. Agricultural experts think that I should use quality seed of improved common bean varieties as main seed in common bean production

Extremely likely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely unlikely

2. My relatives think that I should use quality seed of improved common bean varieties as main seed in common bean production

Extremely likely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely unlikely

3. My close friends think that I should use quality seed of improved common bean varieties as main seed in common bean production

Extremely likely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely unlikely

4. My farmer group members think that I should use quality seed of improved common bean varieties as main seed in common bean production

Extremely likely : \_\_1\_\_ : \_\_2\_\_ : \_\_3\_\_ : \_\_4\_\_ : \_\_5\_\_ : \_\_6\_\_ : \_\_7\_\_ : extremely unlikely

5. Common bean buyers think that I should use quality seed of improved common bean varieties as main seed in common bean production

Extremely likely :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: extremely unlikely

6. Older people think that I should use quality seed of improved common bean varieties as main seed in common bean production

Extremely likely :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: extremely unlikely

7. My fellow farmers think that I should use quality seed of improved common bean varieties as main seed in common bean production

Extremely likely :\_\_1\_\_:\_\_2\_\_:\_\_3\_\_:\_\_4\_\_:\_\_5\_\_:\_\_6\_\_:\_\_7\_\_: extremely unlikely

**[Behavior: Observed]**

Percentage of farms actually planted with quality seed of improved common bean varieties.

**Appendix 5: Checklist at flowering stage**

1. Respondent name
2. Respondent's mobile number
3. Name of the plot where common beans were grown
4. Planting date
5. Common bean variety evaluated
6. Seed class of the variety planted
7. Evaluation date
8. Number of days from planting
9. Germination percent
10. Growth percent
11. Number of leaves per variety at evaluation day
12. Height of the variety above the ground
13. Common bean variety flowering percent
14. Overall variety score for a particular common bean variety

**Appendix 6: Checklist at Maturity stage**

1. Respondent's Name
2. Respondent's Mobile Number
3. Plot name
4. Plot's planting Date
5. Common bean variety evaluated
6. Variety's overall score
7. First attractive feature which influenced a particular score
8. Second attractive feature which influenced a particular score
9. Third attractive feature which influenced a particular score

**Appendix 7: Checklist at marketing stage**

1. Respondents name
2. Common bean Variety evaluated
3. Percent assigned to common bean variety colour
4. Percent assigned to common bean grain size
5. Percent assigned to price of the common bean variety
6. Percent assigned to availability of market for a particular common bean variety
7. Percent assigned to availability of consumers for a particular common bean variety
8. Overall variety score for a particular common bean variety
9. Common bean variety diffusion

**Appendix 8: Checklist at taste preferences test during cooking**

1. Respondent's name
2. Respondent's mobile number
3. Common bean variety tasted
4. Tasted common bean variety score