ASSESSMENT OF CONSTRAINTS IN THE ADOPTION OF ORGANIC COTTON PRODUCTION PRACTICES IN MEATU DISTRICT, TANZANIA

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ABSTRACT

Despite 19 years of its existence, organic cotton production (OCP) system has not been adopted as envisioned. This study therefore sought to identify and assess constraints to its adoption and consequent diffusion, both in temporal and spatial dimensions. A survey study was conducted using almost equal number of both organic and conventional farmers. The key methodological features involved interviewing 59 organic and 60 conventional cotton farmers using structured questionnaire. Other instruments included key informants and Focus Group Discussion (FDG) checklists. Quantitative data were analysed using Statistical Package for Social Sciences (SPSS) software and results were presented as frequencies and percentages. Cross tabulation and Chi square test was used to to determine association between socio-economic variables and adoption of OCP. Qualitative data were analysed using content analysis procedure. Findings of the study show that major constraints limiting the rate of adoption and diffusion of OCP were low price of organic seed cotton, stringent rules associated with organic agriculture and little involvement of political leaders and other district officials in promoting it. Other constraints included high minimum quality standards before certification of organic fields and organic seed cotton thereof, high labour requirements, lack of marketing competition and large crop losses due to pest infestation. Some predetermined constraints were not considered as limiting the adoption of OCP. They include lack of transparency in organic seed cotton pricing, lack of information on pesticide-inflicted health and environmental hazards and lack of strong organic farmers' association. Some socio-economic variables were found to statistically significantly influence adoption of OCP system ($p < 0.05$ i.e. 95 % level of confidence). They include age, education, average annual income, land size, amount of family labour and land tenure. Variables that were found to have no influence in the adoption of OCP include marital status, gender and type of off-farm activities farmers performed apart from crop production. Finally, recommendations were given in order to facilitate adoption of OCP within and beyond the study area. They include more research on OA, improved public-private partnerships in OA and to enlighten farmers on public and environmental hazards associated with heavy usage of synthetic insecticides. Others are provision of financial and technical assistance to farmers so as to help them manage hurdles in the initial stages of the conversion process, to facilitate organic certification process and scouting for reliable organic cotton market opportunities. Finally, it is suggested that more quantitative studies be conducted to find out important empirical facts towards improving farm-level economics of OCP, while ensuring delivery of social and environmental public goods.

DECLARATION

I, Mshana Dhahir Hamis do declare to neither the Senate of Sokoine University of Agriculture that this dissertation is my original work done within the period of registration and has not been submitted nor being concurrently submitted for degree award in any other institution.

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The above declaration is confirmed

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DEDICATION

This valuable work is dedicated to my beloved wife, Rizati Badi Msuya. She has been of an unequalled and unparalleled help all along my academic endeavors. Her willingness and ability to ably and successfully manage family issues and my parents' social affairs in my absence laid the foundation on which both this academic and professional achievement is firmly anchored.

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LIST OF ACRONYMS AND ABBREVIATIONS

AMCOS	Agriculture Marketing Cooperative Society
BEOs	BioRe Extension Officers
CAGs	Codex *alimentarius* guidelines
CAN	Calcium-Ammonium-Nitrogen (inorganic fertilizer)
CF	Contract Farming
COA	Certified Organic Cotton
COF	Certified Organic Farming
COPs	Certified Organic Products
COSC	Certified organic seed cotton
CSC	Conventional seed cotton
DC	District commissioner
DCEOs	District Council Extension Officers
DED	District Executive Director
EIL	Economic Injury Level
EPOPA	Export Promotion of Organic Products from Africa
ET	Economic Threshold
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
ICAC	International Cotton Advisory Committee
ICS	Internal Control System
IFOAM	International Federation of Organic Agriculture Movements
ILO	International Labour Organization
ITC	International Trade Centre
IYNF	International Year of Natural Fibres
Kg	Kilogram
KIHATA	Kilimo Hai Tanzania

KIIs	Key Informant Interviews
MOCP	Meatu organic cotton project
NAP	National Agriculture Policy
NPK	Nitrogen-Phosphorus-Potassium (inorganic fertilizer)
OA	Organic agriculture
OCF	Organic cotton farming
OCP	Organic cotton production
OPP	Organic Premium Price
SPSS	Statistical Package for Social Sciences
SRSD	Simple random sampling design
SSA	Sub-Saharan Africa
SUA	Sokoine University of Agriculture
TanCert	Tanzania Organic Certification Association
TCB	Tanzania Cotton Board
TOAM	Tanzania Organic Agriculture Movement
Tshs	Tanzanian shillings
VAEOs	Village Agriculture Extension Officers
VEOs	Village Executive Officers
WCGA	Western Cotton Growing Area. The area mainly includes regions of Shinyanga, Geita, Mwanza, Simiyu and Mara.
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Cotton is the most important natural fibre crop in the world, grown in tropical and subtropical regions of more than 80 countries (Eyhorn *et al.*, 2005; Pushpa and Raveendran, 2010). The plant belongs to the genus *Gossypium* in the family malvacea. There are four commercially important cotton species grown worldwide. The species and their relative proportions in the world market are *Gossypium hirsutum L. (upland cotton-90%), Gossypium barbadense L.* (extra-long staple cotton-8%), *Gossypium arboreum L.* (tree cotton <2%) and *Gossypium herbaceum* – Levant[1] cotton < 2% (Pushpa and Raveendran, 2010).

In the aftermath of increasing international awareness on public health concerns, environmental pollution and climate change caused by industrial processes, natural fibres are progressively superseding synthetic fibres. To stress the stance, the United Nations Food and Agriculture Organization (FAO) declared 2009 the international year of natural fibres (IYNF). The measure was meant in part to increase global recognition of the importance of natural fibre production in terms of household and national economies around the world, as well as to bring attention to the need of improving efficiency and sustainability of its production (FAO, 2008 cited by Franz *et al.*, 2010).

Cotton has been grown in Tanzania for more than 120 years, having been introduced by German colonialists in the late 19th century. The crop is one of the major traditional cash crops alongside others like coffee, tea, tobacco, cashew nuts, and sisal. Cotton is a source

[1] An old name for the area of land at the eastern end of the Mediterranean Sea, including Syria, Lebanon, Israel, and parts of Turkey

of employment and livelihood to about 40% of the national population (TCB, 2010). It is estimated that 350 000 to 500 000 smallholder farmers are directly engaged in cotton production in the country (TCB, 2010).

Organic cotton production is part of the government initiative which seeks to enable and facilitate farmers' access to lucrative market niche for organic products in the world market. In Tanzania, organic cotton is almost exclusively produced in Meatu District in Simiyu Region. The organic cotton farming system was started in 1994. In Meatu context, organic cotton involves part of cotton crop that is not sprayed with synthetic pesticides and raised from chemical-free seed while conventional cotton is the crop that is raised from chemically treated seed and sprayed with a variety of synthetic pesticides. In order to maintain its identity, organic cotton is sold, stored and ginned separately.

The crop is vulnerable to pests, especially when grown as a monoculture. Large quantities of acutely toxic pesticides are therefore used in its production, often leading to severe and fatal poisoning of humans and livestock in developing countries. It is estimated that cotton uses 19-25 % of all pesticides released worldwide (de Blécourt, 2010; EJF, 2007; Allan, 1995; PAN UK, 2001; Sanfilippo and Perschau, 2008).

Concerned by the gravity of fatalities associated with production of conventional cotton, many scientists have laboured to collect dreadful statistics in this regard. For example, it is argued least 20 000 people in developing countries die every year from poisoning by agricultural pesticides and three million suffer acute reproductive after effects. It has been noted that about 200,000 people commit suicide using pesticides each year (Artukoglu *et al*., 2009, Ferrigno *et al*., 2005).

1.1.1 Status of organic cotton production in Tanzania

Tanzania is the largest organic cotton producer in Africa, followed by Uganda (Elepu and Ekere (2011). According to Pattni (2010), organic cotton production was started as a project in 1994 in Meatu District Simiyu region (then Shinyanga) by the Swiss textile trading company- Remei AG. Initially, the project started with only 45 farmers at Ng'hoboko village and later on more farmers joined in.

In order to facilitate project management, Remei AG founded a locally operating company, the BioRe Tanzania Ltd (Pattni, 2010). The latter is a local agent that currently manages and buys organic cotton from about 2 000 organic cotton growers for Remei AG (Pattni, 2010). Currently organic cotton production covers 15, out of 96 villages that grow cotton in the district. Therefore its share in the total district production is still very small compared to conventional cotton.

1.1.2 Economic contribution of organic cotton in the district

Certified organic seed cotton (COSC) is sold at a premium price that is higher than that of conventional seed cotton (CSC) in the open market. However, contribution of organic cotton to the overall cotton farmers' economy and District Council's revenues is still comparably small. For instance, in the cotton buying season 2013/2014 CSC brought farmers Tshs. 25.41 billion (36 303 000 kg x Tshs 700) compared to Tshs. 6.06 billion (7 213 000 kg x Tshs 840) from COSC (DED, 2014). About 29 250 farmers are engaged in conventional cotton production and an average of 2000 farmers are registered for organic cotton production in the district. These statistics indicate that both farm-level and aggregate adoption of organic cotton farming practices are still patchy, in the background of conventional cotton production system.

1.2 Problem Statement

Conventional cotton has received much attention worldwide since it uses more agrochemical than most other crops. It is argued that cotton uses large quantities of potentially hazardous agrochemicals than any other single crop in the world (EJF, 2007; Singh *et al.* 2013; Niggli *et al*., 2007; Lotter, 2003; Chantre and Cardona, 2014).

In response to the above facts, organic cotton production projects were initiated in many countries. In sub Saharan Africa certified cotton production started in 1990s (Ferrigno *et al*., 2005). Apart from its potential in mitigation of public health impacts and negative environmental externalities, organic cotton production has emerged to be one of the most lucrative agribusiness enterprises due to the existence of niche markets in the developed countries. The crop is traded with an organic premium price (OPP) all along the whole supply chain from farmers to textile operators.

In Tanzania, organic cotton was introduced in Meatu District in 1994. The new model of cotton production was thought to cover all farmers in the district and thence to other areas, particularly the Western Cotton Growing Area (WCGA).

However, adoption of the novel cotton production system has not been impressive despite the reliable market and an OPP over conventional seed cotton (CSC). General observation shows that some farmers who adopted earlier have dropped the practice (disenchantment discontinuance), other farmers have not tried the model at all while there are very few new entrants registered annually. Furthermore, review of the BioRe annual progress reports indicated that every year 6% to 10% of farmers default. To its worst, in season 2013/2014 almost 20% of registered farmers did not adhere to organic cotton rules (BioRe, 2014).

Building on similar situations, some scientists point out that once organic cotton farming is adopted, the farmer may reverse the decision if he/she senses some risk factors (Adanacioglu and Olgun, 2010; Oladele, 2005; Akudugu, 2012). However, the reasons why farmers abandon organic farming have received less attention and may provide further insights towards understanding the slow uptake of organic farming (Pant, 2014; Läpple and Donnellan, 2009; Kulindwa *et al*., 2009). In support of this observation, reasons for this phenomenon have not been explored in the study area.

Literature on the adoption of organic cotton production elsewhere indicates a mixture of both success and failure stories (Eyhorn *et al*., 2005; Adanacioglu and Olgun, 2010; Olgun *et al*., 2008; Adebayo and Oladele, 2013). Unlike more uniform conventional farming systems, organic systems are more variable due to reliance on local ecological features. Thus, conclusions made in geographical regions that are relatively far apart are normally of little external validity. It is further asserted by Ferrigno and Lizarraga (2009) that “organic cotton is a complex system that is still being analyzed, understood and codified following the past two decades of experimentation and development”. Based on the foregoing, this situation presents a knowledge gap that this study is trying to address.

Therefore this study aimed at identification of real hindrances in a social system where the program is operating (Meatu District). Appreciably, the study built on suggestions by Adanacioglu and Olgun (2010) that location specific studies would enable formulation of contextualised plans geared to effectively and efficiently promoting organic cotton production within relatively more uniform national or supranational geographical regions.

1.3 Study Justification

This study aimed at assessing constraints to the adoption of organic cotton in the study area. As stated above, organic cotton has triple benefits, namely improvement of farmers’ incomes, mitigation of agrochemicals-inflicted public health hazards and mitigation of negative environmental externalities (Appendices 3 and 4). Given the length of time that our environment has been exposed to pollution by synthetic chemicals from conventional cotton systems and considering geographical area covered with cotton production in the country, organic cotton production seems to be indispensable.

Correct identification of constraints to its adoption will contribute to formulation of policy statements and strategic plans geared to fostering development of organic cotton industry in the study area in particular and the whole country in general. The prospering organic cotton industry in Meatu District will also act as a model from which others can learn in the national endeavours to expand the organic base in the whole agricultural sector.

1.4 Objectives

1.4.1 Overall objective

To establish constraints in the adoption of organic cotton production in Meatu District.

1.4.2 Specific objectives

i. To assess socio-economic characteristics of the study respondents in Meatu District.
ii. To examine the extent of adoption of organic cotton production practices in Meatu District.
iii. To assess availability of market for organic cotton in Meatu District.
iv. To assess agronomic practices for organic cotton production in Meatu District.
v. To identify main factors limiting adoption of organic cotton practices in Meatu District.

1.5 Research Questions

i. Which socio-economic characteristics influence adoption of organic cotton production?

ii. What is the extent of adoption of organic cotton production practices in the district?

iii. To what extent is the market for organic cotton available in the district?

iv. What are specific agronomic practices for organic cotton production?

v. What are the main factors limiting adoption of organic cotton production in the district?

1.6 Conceptual Framework

The slow pace at which agricultural innovations are adopted by farmers has since long been one of the main preoccupations by public and private agricultural extension agencies. With large amount of funds in the agricultural budget devoted to extension services delivery, it is important to know to what extent these financial and human resources have translated into innovation adoption by smallholder farmers and consequent benefits to the latter.

Literature on agriculture highlights two major drivers of successful aggregate agricultural innovations adoption in developing countries: (i) the availability and affordability of technologies; and (ii) farmers' expectations that adoption will remain profitable as opposed to the status quo, both which determine the extent to which farmers are risk averse (Foster and Rosenzweig, 2010; Carletto *et al*, 2007).

Evidence from empirical studies on Africa confirm that Sub-Saharan Africa (SSA) farmers face a host of constraints, ranging from infrastructure, incentives, and liquidity, which impede farmer's adoption and retention of agricultural technology (Kijima *et al.*, 2011; Marenya and Barrett, 2009; Bezu and Holden, 2008; Poulton *et al.*, 2006; and Jayne *et al.*, 2003). Nonetheless, there are many more constraints hindering agricultural innovations adoption as well. Based on the complex nature of innovation adoption process, there are other complementary, supplementary and facilitative factors apart from those mentioned without which sustained adoption of agricultural innovations cannot certainly be ensured.

Based on the above argument, reasons for adoption or dis-adoption of innovations at farm level may widely vary over space and time. The conceptual framework presented here (Fig.1) highlights the various pathways through which different factors influence household decisions to adopt organic cotton farming (OCF).

In this study, constraints to adoption of OCF was assessed under political, social, economic, technical and informational factors as explained in similar studies (Tovignan and Nuppenau, 2004; Artukoglu *et al*., 2009; Akudugu *et al*., 2012). Different variables related to adoption behaviour of farmers were explored. Major groups of variables included socio-economic characteristics, personality variables and communication behaviour of farmers (Rogers, 2003). Institutional and political influence is also assessed.

Some of the important independent variables included income differentials, land holding differentials, labour availability, level education, age, gender, availability of extension services, availability of inputs, availability of market, degree of awareness of industrial pesticides-inflicted health hazards, degree of advocacy on OCF and farmers' attitudes towards organic cotton as an agribusiness. The conceptual framework related to factors influencing adoption of OCF in Meatu District is summarised in the model presented in Fig. 1.

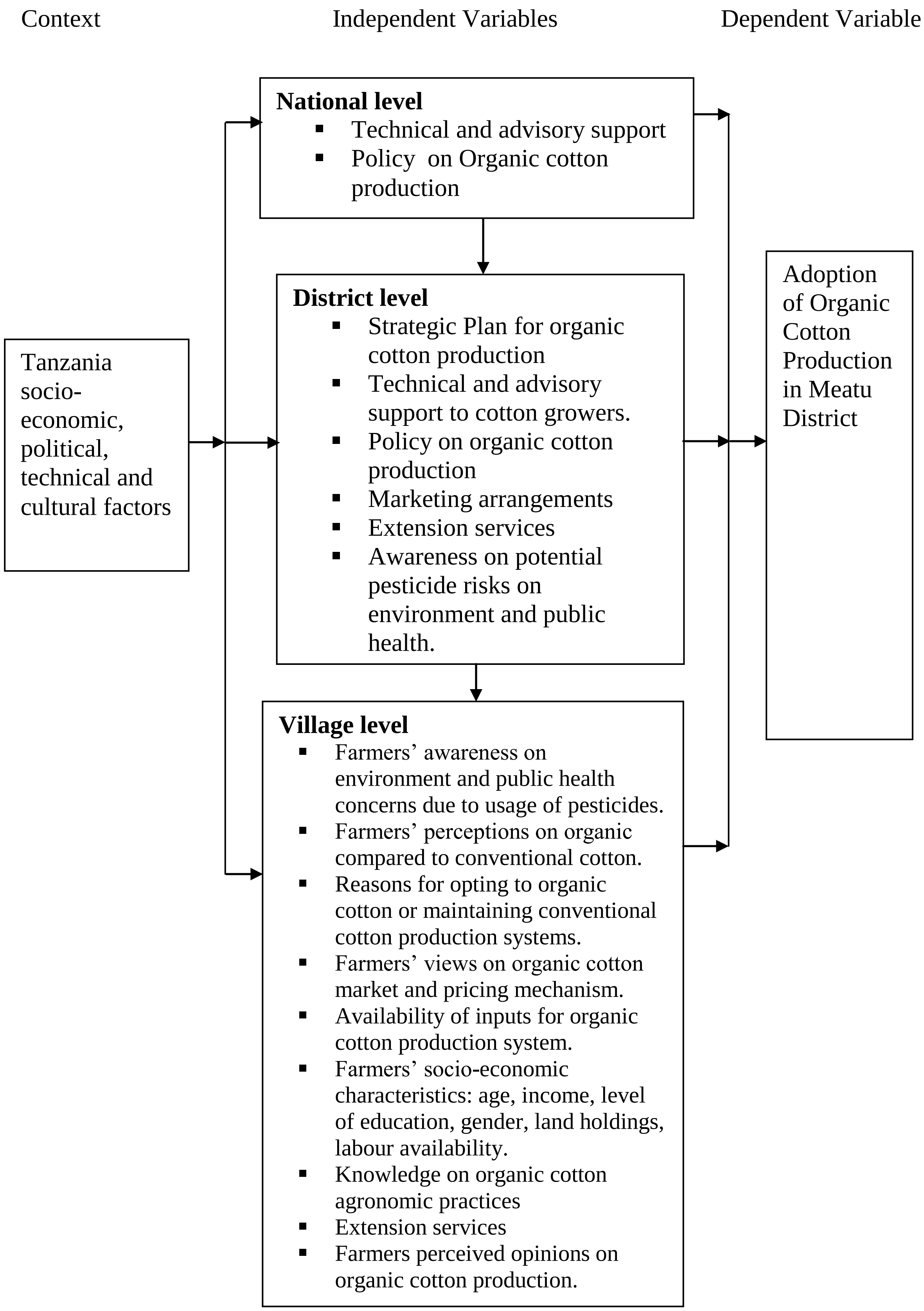

Figure 1: Conceptual framework model

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Evolution of certified organic agriculture in the world

Although organic agriculture (OA) has been defined variously depending on professional affiliations, it is basically the production of crops and farm animals without using any synthetic inputs. Based on this fact, one may argue that the farming practice predates history.

For example Bellwood (2005) asserts that agriculture has been practiced for more than 10 000 years and for most of that period there were no synthetic fertilizers or pesticides. Connecting to the observation, Prasad (2007) point out that on the basis of the definition for OA, traditional agriculture that has been in practice for centuries qualifies to be referred to as ‘organic’ inasmuch as the use of synthetic inputs is a recent development in the historical timeline. Before 19th century most food in the world was organically produced using organic manures, human and animal power. On the basis of the principles of OA, the ‘ancient’ type of OA was termed ‘organic by default’ or *de facto* OA in order to differentiate it from the contemporary certified OA (Mella *et al.*, 2007; John and Biernbaum, 2003; Bellwood, 2005; Scialabba, 2000).

As a new concept and ideal, OA began in the early part of the twentieth century, primarily in Europe, but also in the United States (Kuepper, 2010). The main aim then was to counteract negative environmental and public health concerns due to heavy use of agrochemicals in most agricultural systems.

Increasing worldwide demand for organic products led to the formation of The International Federation of OA Movements (IFOAM). The organ has been responsible for management and certification of OA through its basic standards since 1980 to date (Gould, 2013). The IFOAM basic standards are regulated by the *Codex Alimentarius* guidelines (CAGs).

The basis for certification is to guarantee consumer confidence and trust on the organic status of products in the market. Therefore, unless products are certified by the approved institutions based on the standards of IFOAM, they will not accepted in the market as 'organic' irrespective of the mere fact that they are produced purely without chemicals (Ton, 2007). As pointed out by Biondo (2014), certification is also a means to filter out dishonest businesses which mimic organic products through industrial process and sell the same at organic premium prices.

2.2 Evolution of Certified OA in Tanzania

In Tanzania, about 80 % of farmers are practicing low input agriculture, otherwise known as *traditional farming* which tends towards organic principles (Mella *et al.*, 2007). This kind of farming is famously referred to as '*organic by default'* or *'de facto organic'* as described in the preceding sub section because it is practiced by small scale farmers who usually cannot afford to buy expensive synthetic inputs.

As landmark development in the official organic sector, the first organic garden in Tanzania was started in 1898 in Peramiho, Songea District of Ruvuma Region. But it was not until the 1990s that the Tanzanian government launched a campaign that aimed at promoting certified organic agriculture (COA) and related services. This campaign stimulated donors' support and encouraged various initiatives from NGOs and other organizations. These initiatives included among others, the Meatu Organic Cotton Project (MOCP), Kilimo Hai Tanzania (KIHATA), Natural crop protection in Mgeta-Morogoro District and Export Promotion of Organic Products from Africa (EPOPA).

Gradually, COA gained foothold with the passage of time mainly as project-based initiatives. Currently crops under certified organic farming (COF) include cotton, coffee, black tea, cocoa, spices, fruits and vegetables.

Based on the above description, organic cotton in Meatu District is produced under COA principles with regards to IFOAM basic standards, which are in turn guided by the CAGs. This enables the crop to be certified as organic on the basis of international minimum organic standards and hence qualify for organic premium price (OPP). Although some conventional farmers are unable to purchase synthetic pesticides and fertilizers, their crop is not regarded as organic due to lack of certification tag and is therefore channeled to CSC open markets.

2.3 Status of Certified OA in Tanzania

In Tanzania, OA is still at its infancy and hence poorly coordinated. For that reason it is difficult to establish with certainty area under certified OA and number of smallholder farmers engaged in it. Nonetheless, the government has facilitated the formation of Institutions at the national level in attempts to foster the program. The institutions are the Tanzania Organic Certification Association (TanCert) launched in 2004 and Tanzania OA Movement (TOAM). TanCert was responsible for provision of certification services to facilitate the market competitiveness of organic products. The TOAM was launched in 2005 as an umbrella organization for various stakeholders' initiatives. It aims at providing leadership and coordination in developing and promoting the organic sector in Tanzania.

2.4 Status of Certified Organic Agriculture in Meatu District

In consonant with the overall status of Tanzanian organic sector, panoramic view of the district's COA shows that the sector is also in its infancy and thus a fledgling model of farming despite its introduction 19 years ago. Apart from a mix of purely conventional and *de facto* organic products that are traditionally consumed, traded and exchanged in the district, there is still no internal demand and consequently market for certified organic products (COPs). This scenario is mainly due to lack of awareness and insensitivity towards possible public health and environmental negative externalities associated with agrochemicals. Therefore, the rate of conversion to certified organic systems depend on external availability of lucrative market spots for COPs outside the district. Availability of the latter would have certainly spurred drastic and dramatic expansion of the district OA base, other factors remaining favourable.

Of all the on-farm enterprises (crops and livestock alike) in the district, cotton production is presently the only project that is covered by COA rules.

2.5 Evolution of Certified Organic Cotton

Just like other crops, organic cotton production as a system has by default been in progress for ages. It is for instance argued that, although *de facto* organic cotton production took place for many centuries, it was not until 1989 when it was officially certified by Turkey and then by US in 1990 (ICAC, 2003, Ton, 2007). This move was the result of consumers in developed countries becoming increasingly more ecologically concerned and health conscious in the late 1980s (Funtanilla *et al*, 2009; Lakhal *et al.*, 2008; Ton, 2007). Other common names used for organic cotton, particularly at the beginning of production, are green cotton, biological cotton and environment-friendly cotton (ICAC, 2003).

From Turkey, officially certified organic cotton production system has since spread to many countries around the world in response to increased demand for organic lint and awareness of public and environmental concerns. Major world organic cotton producers are India, Turkey and Syria which contribute about 87 % of total world organic cotton share (Ton, 2007; Ferrigno and Lizarranga, 2009). Currently, the place for Syria in this regard may have perhaps changed following protracted civil war.

Continent-wise, Africa's contribution to global production is still small. It is estimated that the continent contributes about 4.5 % of total global production (Elepu and Ekere, 2011). Driven by economic, social, and environmental motives, a number of private multinational initiatives have emerged to promote organic cotton production in SSA region. Consequently, in 1990s there were deliberate efforts by some multinational companies to introduce organic cotton production to some African countries in form of special projects. Such projects included those initiated in Tanzania, Uganda, Egypt, Zambia, Zimbabwe, Mozambique, Senegal, Burkina Faso, Mali, and Benin (Ferrigno and Lizarranga, 2005). To date, such projects are still in progress, with varying degrees of success among countries.

2.6 Current Policy Environment for OA in Tanzania

Generally, a policy is a principle or protocol to guide important decisions so as to achieve rational outcomes. In essence, it is a statement of intent that is formulated and implemented as a procedure or protocol in a given organization in its endeavours to achieving broader objectives. It is in this background that most important sectoral issues are policy-embraced in order to ensure focused and strategic implementation. This reality constitutes the basis on which OA policy statement is actually premised.

The previous version of the Agriculture and Livestock Policy of 1997 that was subjected to review since 2006 scantly recognized the importance of OA. Nonetheless, the current National Agriculture Policy 2013 version has relatively comprehensively covered OA as one of its important features (NAP, 2013, Mibavu, 2013).

Main policy statements are:

i) Registration and availability of organic inputs to farmers shall be facilitated;

ii) The Government shall facilitate accreditation of organic products in order to reduce certification costs;

iii) Initiatives for regulation and certification of organic products shall be promoted; and

iv) In collaboration with the private sector, effective coordination among stakeholders shall be enhanced.

2.7 Contract Farming

Contract farming (CF) is a form of vertical coordination largely aimed at correcting the market failure associated with spot markets that arise due to imperfect information. Cotton is heavily characterized by spot marketing with multiple buyers within small localities. Of late there have been initiatives by private international development stakeholders to promote and foster CF in developing countries.

The CF has globally been defined variously by agricultural economists and other professional scientists as evidenced in the existing body of literature. In principle however, contract farming presents a formal or non-formal environment which ensures reliable supply of goods or services to the buyer while guaranteeing reliable reasonable price to the seller. Eaton and Shepherd (2001) define contract farming as an agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under forward agreements, frequently at predetermined prices.

The CF is a form of vertical coordination largely aimed at correcting the market failure associated with spot markets that arise due to imperfect information on the marketing opportunities. It is also thought that CF system provides assurance to farmers on reliable markets.

This model is therefore highly suitable for high value products with high cost of production like organic products. However there is still no consensus in the literature on the impact of contract farming on the welfare of smallholder farmers in through both crop and livestock enterprises. For example Wainaina *et al*. (2012) point out that while some studies have argued that contact farming improves access to ready markets by smallholder farmers, other studies have suggested that contract farming lowers the incomes of smallholder farmers because the contractors wield greater market power over the farmers.

Case studies in developing countries have shown mixed messages in the performance of CF in cotton farming systems. While some studies have shown that a non-contracted farmer realises better returns than a contracted farmer due to savings made from procurement of interest-free and cheaper inputs (Mugwagwa, 2005; Mujeyi, 2013) while other report positive revenue effects from participation in the CF scheme (Munongo, 2012; Kumwenda and Madola, 2005). The observed poor performance in the organic cotton sector in study area could in part, signal ineffectiveness of the CF system.

Classically, CF binds the purchaser in providing a degree of production support through, for example, the supply of inputs, credits and the provision of technical advice. On the other hand a farmer is required to commit himself/herself to provide a specific commodity in quantities and at quality standards determined by the purchaser (Poole and Frece, 2010; Eaton and Shepherd, 2001).

This arrangement prevails also in Meatu District where BioRe Co. Ltd has been providing its organic cotton famers with inputs, micro credits and technical advice since 1994. In

Tanzania the model is currently being piloted in conventional cotton farmers too. It is however too early to judge on its relative worth considering short time it has been operational, particularly in WCGA.

2.8 Agronomy of Organic Cotton

Unlike conventional farming, organic farming requires organic agronomic practices from sowing to harvesting, starting with chemical-free seed materials. Organic cotton production scientists have prepared guides and training manuals that are relevant to organic cotton production for trainers and farmers (Ton, 2007; Eyhorn *et al*., 2005; Nicolay and Ssebunya, 2011). The manuals could also be used for other crops with some minor modifications. Below is an excerpt from the manuals on some important agronomic aspects.

2.8.1 Soil fertility management

Recommended materials are decomposed biomas, crop rotation, natural mineral fertilizers, and liquid fertilizer, intercropping and bio-fertilizer.

i. Decomposed biomas

This category includes compost manure, farmyard manure and green manure. Farmers undergo on-field training on how to make and apply each category.

ii. Crop rotation

It involves growing of different types of crops in a sequence over several years. In organic cotton production principles, a field cropped with cotton should not be repeated with cotton in the next season. Another principle is that legumes must be included in the rotation. Also at some point the field should left without any crop (i.e. fallowing).

iii. Natural mineral fertilizers

To a limited extent these material are allowed. They include *muriate* of potash, rock phosphate (e.g. *minjingu rock phosphate* in Tanzania), gypsum, and lime). They are applied as concentrated sources of some specific plant nutrients when soil test results exhibit severe deficiency.

iv. Intercropping

It involves planting cotton together with other crops on the same field in the same season. Mostly used intercrops include legumes varieties such as mug bean, chickpea, cowpeas green gram and groundnuts

v. Liquid fertilizer

These materials are applied by sprinkling on the soil, applied together with irrigation water or applied as foliar fertilizer. They include cattle urine, biogas slurry and fermented manure. They have the advantage that the nutrients are almost instantly available to the plant.

vi. Bio-fertilizers

These are preparations containing some bacteria species that increase availability of some basic nutrients in the soil. They include *Rhizobium spp, Azotobacter spp, Azospirillum spp* and phosphorus solubilizing bacteria.

2.8.2 Pest management strategies

Under organic settings, the principle of pest management is to use several methods in combination since there is no single strategy that is completely efficacious (Pujari *et al*., 2013).

Strategies are divided into two groups, namely prevention and direct control

i. Prevention techniques

They involve measures aimed at preventing insect pest population from reaching economic threshold. Specific measure include promotion of natural enemies, trap crops, pheromones and removing crop residues from the field after harvesting.

ii. Direct control

They are applied when preventive measures are not effective in controlling pest populations within safe boundaries. Specific measures include biological control, botanical insecticides and mass trapping.

2.8.3 Disease management

In most of the semi-arid tropical regions, diseases are no a major problem in cotton production. However few diseases are known to sporadically occur. They are bacterial blight, root and boll rot and *fusarium* wilt. Specific measures include crop rotation, spraying with cattle urine, avoidance of infected seed, use of tolerant varieties, removal of cotton stalks after harvesting and application of well decomposed compost.

2.8.4 Weed management

Weeds are often a major threat in organic farming (OF) and it seems as a key bottleneck for promotion of sustainable organic agriculture. Globally, about 34% of potential crop yield is reduced by weeds (Oerke, 2006 cited by Nikolich *et al*., 2011). However this seems to be particularly a thereat in some regions of the world where climatic conditions favour rich vegetative cover and where therefore enormous quantities of herbicides must be used. In Meatu District weed is not that much of a threat when organic and conventional systems are compared.

Strategies in weed management involve changing from herbicides to mechanical and cultural practices. Specific measures involve mechanical weeding, hand pulling, crop rotation and mulching. Other techniques involve leaving weed population in place when it is established that they cannot effectively compete with cotton crop. It is also argued that conservation agriculture is compatible with OA since the system is highly efficient in tremendously keeping down the weed population. This is achieved through smothering effect and building of conducive environment for development of weeds and pests predators (Baral, 2012).

2.9 Conventional Agriculture

Conventional agriculture is a farming practice that uses synthetic chemicals, genetically modified organisms, and sewage sludge. It is thus an inputs and energy-intensive farming system aimed at higher productivities (Kassie *et al*., 2008; Pimentel *et al*., 2005).

Therefore best practice in conventional agriculture is to apply recommended levels of various inputs such as pesticides, fertilizers, herbicides depending on the crop type and soil chemical and physical properties (Page and Ritchie, 2009). Use or non-use of these materials constitute major dichotomy between conventional and organic farming systems. This system of farming is strongly associated with global food security and increased farmers' incomes on both developed and developing countries.

Currently this farming paradigm is under attack by as many opponents as it is supported by many proponents too. Critics argue that it is responsible for widespread public health concerns and negative environmental externalities. For example Sarker and Itohara (2010) maintain that many scientists are of the view that when smallholders adopt organic farming as a means of livelihood their chance of attaining household food security might be more risky due to relatively lower yield performance of organic farming. Moreover, while some proponents acknowledge that some of conventional agriculture criticisms are valid, they argue that there is a tendency today to overstate the problems and to ignore the counterfactual situation. For instance they ask what would have been the magnitude of hunger and poverty without the yield increases of the Green Revolution and with the same population growth? (IFPRI, 2002).

2.10 Conventional Cotton Production

Cotton plant with its green leaves, many large open flowers and nectaries on every leaf and flower and large number of flowers seem to especially attract the insect pests under natural condition (Mallah *et al*., 2001; Ferrigno *et al*., 2005; Eyhorn *et al*., 2005). Different types of insects with chewing and sucking habits attack the crop causing serious damage, which can result in partial or total failure of the crop (Mallah *et al.*, 2001). They do not only lower the yield but also impair the quality of the fibre. In view of this fact, large quantities of acutely toxic pesticides are used in its production, often leading to severe and fatal poisoning of humans, livestock and wildlife.

According to Organic Cotton Crop Guide by Eyhorn *et al.* (2005), the most notorious pest include *Helicoverpa armigera* (American bollworm), *Pectinephora gossypiella* (pink bollworm), *Earias insulana* (spiny bollworm), *Earias vittella* (spotted bollworm), *Agrostis spp* (cutworm), *Dysdercus spp* (cotton stainer).

Although official statistics on global and by-country utilization of active ingredients in conventional cotton are not available to make an objective assessment of the new use levels, it is estimated that about 19-25 % of total global pesticides are used in cotton alone annually (de Blécourt, 2010; EJF, 2007; Allan, 1995; PAN UK, 2001). In Meatu District for example, about 98 % of total pesticides introduced annually for agricultural purposes are used in conventional cotton production (DED, 2013).

Research has indicated that extensive use of agrochemicals has caused significant public health concerns to the community members through direct chemical effects and contaminated food and water sources (Murugesh and Selvadass, 2013; Khan *et al*., 2011;

Hussain *et al*, 2011; Turgut and Erdogan; 2005). Effects have also been extended to other unintended organisms including aquatic life through chemical drift, runoff and food chain (Turgut and Erdogan, 2005; Murugesh and Selvadass, 2013).

Such negative externalities are also feared in Meatu District where major ephemeral rivers that yield water for domestic and livestock uses collect large amount of runoff from cotton fields under conventional agriculture. The rivers include Semu, Minyanda, Simiyu, Sibiti, Itembe and Sanga. Furthermore, the aquatic ecology of Lake Kitangiri which form the common border between Meatu, Iramba, Kishapu and Igunga districts is also likely to be polluted since the lake forms a sink to the mentioned rivers. Therefore the wholesomeness of fish from this water body which are consumed in large quantities by Meatu residents and safety of natural vegetation surrounding the lake which form part of livestock pasture are all questionable.

Furthermore, it is observed that the brunt of chemical load is borne by smallholder farmers most of whom live in African countries and parts of Asia (Khan *et al.*, 2011; Tovignan *et al*., 2001; Sanfilippo and Perschau, 2008). Page and Ritchie 2009 point out that matters are compounded by the fact that although farmers in developing countries are advised to wear protective clothing (like overalls, boots, gloves and respirators) to prevent poisoning, most of them do not pay heed for failure to afford costs, short supply of the gears and sometimes sheer negligence.

According to PAN UK (2001) and Tovignan *et al*. (2001) most of the chemicals in studies conducted in Bénin, Sénégal, Uganda, Tanzania and Zimbabwe are classified by the World Health Organization (WHO) as Class II (moderately hazardous) for acute mammalian toxicity and WHO Class Ib—highly hazardous. The Food and Agriculture

Organization (FAO) recommends that WHO Ia and Ib pesticides should not be used in developing countries, and if possible Class II pesticides should also be avoided.

Focusing on cotton production, Sanfilippo and Perschau (2008) claim pesticide poisonings are a fact in cotton producers lives and are often taken for granted by pesticide users in developing countries. Presenting some alarming statistics, the World Health Organization (WHO) reports that there are approximately three million cases a year, resulting in 20 000 unintentional deaths. Moreover, the International Labour Organisation (ILO) estimates between two to five million occupational cases of pesticide poisonings a year with 40,000 fatalities (Tiraieyari *et al.*, 2014; Sanfilippo and Perschau, 2008).

Research studies show that pests, particularly insects, have developed great capacity to resistance. Today, world-wide, more than 700 species of insects are resistant to insecticides while plant pathogens resistant to fungicides are widespread and weed resistance to herbicides is becoming common (Kaur and Kaur, 2014; Kennedy *et al.*, 2000). Depopulation of organisms that prey on crop pests have further complicated pest management programs.

To cite a specific example, the study conducted in India attested that *Helicoverpa armigera*, the most dangerous among agricultural pests of both tropical and temperate countries of the world was no longer killed by most chemical pesticides used in many parts of the world as was the case before (Duraimurugan and Regupathy, 2005; Sarker and Itohara, 2008; Kennedy *et al.*, 2000). In Tanzania, cases whereby some cotton farmers constantly express doubt over the efficacy of pesticides distributed by TCB could be partly explained by this phenomenon. In view of the foregoing, public health and environmental consequences associated with worldwide intensive use of pesticides in cotton production constitute a firm ground on which advocacy campaigns by organic cotton activists are premised.

Despite acknowledging negative environmental impacts engendered by agrochemicals, some scientists seem not to express zero tolerance to pesticides use on the basis of studies conducted in various places. For instance Kennedy *et al.* (2000) and Kühne (2008) observe that non-chemical techniques in cotton industry such as sanitation, cultivation, crop rotation, resistant cultivars, and biological control are not efficient in adequately controlling many pests alone without some chemical use.

2.11 Principles of Organic Agriculture

Organic farming is regulated internationally by Codex Alimentarius Guidelines (CAGs). The CAGs were established by The United Nations' Food and Agriculture Organization (FAO) and the World Health Organization (WHO) in collaboration with the International Federation of Organic Agriculture Movements (IFOAM) Basic Standards (Tuomisto *et al*., 2012). The CAGs and IFOAM Basic Standards provide a minimum baseline for national and regional standards worldwide.

There are globally agreed principles of organic agriculture on the basis of which local and international standards for agricultural products are defined. The IFOAM, which is the representative body for OA worldwide, defines 'organic agriculture' according to four principles (Ton, 2007; IFOAM, 2008; Tuomisto *et al*., 2012).

i. The principle of health

Organic agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.

ii. **The principle of ecology**

Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.

iii. The principle of fairness

Organic agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.

iv. The principle of care

Organic agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

In general, organic agriculture aims for an optimum and sustainable use of local natural resources for production without the application of external inputs like synthetic pesticides, chemical fertilizers, herbicides, defoliants and chemically treated or genetically modified (GM) seed. External 'organic' inputs may be used.

2.12 Conversion to Organic Farming

Farmers wishing to convert to organic agriculture will have to go through a conversion period of one to three years, depending on their fields' history. The conversion period enables the soil and the environment to recover from previous cultivation, while applying organic methods of production. The 'in-conversion' produce cannot be sold as 'organic', and does not usually fetch a premium price in the market (Ton, 2007; Eyhon *et al*., 2005). The risks and costs of conversion are a major barrier to the adoption of OA. Organic production is generally more labour intensive, and yields may be – but not necessarily lower than in conventional production (Ton, 2007).

2.13 Premium Price

Organic farmers usually fetch a premium price for their produce in order to compensate for any yield loss, for increased handling operations and for additional costs such as inspection and certification (Ton, 2007; Eyhorn *et al.*, 2005). The premium price may also be paid in order to ensure the loyalty of producers to the organic scheme.

2.14 Organic Standards

Internationally, organic standards are set and monitored by large consumers namely USA, European Union and Japan. However these standards mainly apply to agricultural food items and dairy products, and not non-food items like cotton. For cotton to be accepted as 'organic', it must be grown according to organic principles and certified by independent third body accredited by IFOAM, USDA, or equivalent (Ton, 2007). Certification by third parties is generally requested in order to back up producers' organic claims, and to strengthen trust between the supplier and the buyer. Eyhorn *et al.*, (2005) itemize important requirements of organic standards relevant in cotton farming as follows:

i) No application of synthetic fertilizers such as urea, NPK, DAP and CAN.
ii) No application of synthetic pesticides (including herbicides, insecticides, fungicides) or growth promoters.
iii) No use of genetically modified organisms (GMOs) sucha as Bt cotton varieties.
iv) Crop rotation (no cotton after cotton in two subsequent years) and or intercropping.
v) Prevent spray drift from neighbouring conventional fields for example . by growing border crop.
vi) Maintain records and documents for inspection and certification.

In order to maintain purity, organic cotton must be handled differently from conventional cotton at all stages in the supply chain. These stages include picking, storage, buying, transportation to ginning facilities, ginning processes and transportation of lint to local ports and shipment to overseas market destinations (Ferrigno *et al.*, 2005, Eyhorn *et al.*, 2005, Ton, 2007). The separate treatment should be duly documented for the purpose of inspection and certification by a third party. Buyers will usually request a 'transaction certificate' from a third party to ensure that the cotton fibre traded was produced according to organic standards.

2.15 On-field Inspection and Certification

Organic cotton production is associated with quality control and assurance based on the stipulated standards in the entire supply chain. Eyhorn *et al.* (2005) explain procedures on on-field inspection and subsequent certification. They narrate that in order to support farmers in the certification process and to reduce costs, farmer groups can be organized within an internal control system (ICS).

To facilitate this each farmer needs to sign a contract with the organization in which they declare their commitment to following the specific organic standards of the project. The extension workers of the project advise farmers in organic crop production techniques and help them with the necessary record-keeping. Internal inspectors inspect the farmers several times a year and an internal certification committee decides about sanction against defaulting farmers.

At least once a year an external certifier inspects the functioning of the ICS and some randomly selected sample fields to establish effectiveness of the ICS. This procedure is also observed in the Meatu District where the study was conducted.

2.16 Limitations to Conversion

According to Mvena *et al.* (2013), the uptake of proven agricultural technologies in less developed countries has not been very impressive over the years despite different methods used to disseminate these technologies. In support of this argument, the failure of the Green Revolution in Africa has been ascribed to the application of new technologies within unsuitable contexts, resulting in these improved technologies not being adopted or not being functional (Van den Berg, 2013).

Conversion is the process of previously conventional farmers changing to certified organic farming techniques. It is a process that takes about three to several years depending on the field history (Ton, 2007: Eyhorn *et al*., 2005). The process of changing over from conventional to organic cotton production is in conformity with the innovation theory and its associated five-stage innovation-decision process modeled by Rogers (2003).

Farmers gauge organic cotton production system against five attributes (namely relative advantage, trialability, complexity, compatibility and observability) before they can form a decision on whether or not to adopt it. Other factors affecting adoption behaviour include socio-economic and demographic variables, technology characteristics, source of information, knowledge, awareness, attitude, and group influence (Baffoe-Asare *et al*., 2013; Oladele, 2005).

In a global perspective, organic cotton production is still lagging behind. It is assumed that production has not increased beyond the experimental stage in countries other than India, Turkey and the USA (ICAC, 2003). Yet even in these countries, expansion of organic cotton production in both spatial and temporal dimension has not reached impressive levels. For example Artukoglu *et al.* (2009) note that although Turkey is one of the first countries that started to undertake officially certified organic cotton farming, it still hasn't reached at a desired level.

In the current body of information from research findings, many factors are associated with the low adoption rate of organic systems. In developing countries where most farmers convert with the intent of gaining more financial returns, any factor leading to low farm profitability would constitute a barrier to conversion. This is also argued by most passionate advocates of organic cotton production system. For instance Ferrigno and Lizarraga (2008) maintain that “for the organic cotton to be a sustainable method of producing fibre, it needs to be more than just 'environmentally friendly'. It needs to be productive and offer decent returns to farmers”.

Based on the above arguments, cases where there are low yields in first years of conversion potentially scare farmers who would wish to undergo conversion. The situation is exacerbated when premium prices do not adequately cover the monetary value of the amount of crop lost due to elimination of prohibited inputs like inorganic fertilizers and synthetic pesticides.

2.17 Innovation Adoption Environment

The adoption of agricultural innovations is crucial for economic growth as well as economic development. However, in order to help leverage the adoption and diffusion of innovative practices, it is important to understand the process of agricultural innovation and its determinants (Akkoyunlu, 2013).

New technology that enables sustainable and profitable production of food and fibre is critical for both food security and economic development. Consequently, the dynamics of technical change in agriculture has been an area of intense research interest since the early part of the 20th century (Loevinsohn *et al*., 2013; Kasirye, 2013; Nederlof and Dangbe´gnon, 2007; Lybbert and Sumner, 2010). Despite these efforts however, a nagging question is why the benefits of new agricultural technology often appear to by-pass poorer farmers – even when they are the ‘target’ group.

According to Daane *et al.* (2009) an innovation is normally spurred by a range of drivers and triggers and hindered by a range of factors. Triggers include demand, market opportunities, constraints, needs, challenges, competition, crises (food, energy and water shortages, climate change, and epidemic diseases).

The drivers of innovation include political will, enabling policies, adequate resources and infrastructure, leadership and facilitation, sector development champions, stakeholder linkages and interaction, private sector involvement, common vision, partnerships, alliances, education, technologies and credits. On the other hand factors as stated above include policy and bureaucracy, market, infrastructure, resources, linkage among stakeholders and behavior (power differences, lack of trust, ownerships).

Another body of literature on agriculture highlights two major drivers of successful agricultural technology adoption in developing countries: (i) the availability and affordability of technologies; and (ii) farmer expectations that adoption will remain profitable. Both of these drivers reflect the extent to which farmers are risk averse (Foster and Rosenzweig, 2010; Carletto *et al.*, 2007). Most smallholders' operations occur in farming systems with the family as the centre of planning, decision-making and implementation while operating within a network of relations at the community level (Salami *et al*., 2010).

In view of the above observation, Ferder *et al.* (1985) distinguished individual adoption (farm level) from aggregate adoption. Individual (farm level) adoption is defined as the degree of use of a new technology (innovation) in a long-run equilibrium when the farmer has full information about the new technology and its potential. On the other hand, aggregate adoption (diffusion) is defined as the process of spread of a technology within a region. This definition implies that aggregate adoption is measured by the aggregate level of use of a given technology within a given geographical area.

Based on the above description, adoption of agricultural innovations involves a systemic multidimensional process that is not subject to reductionism. In view of this fact, getting innovations adopted in a given social system requires multisectoral participation, collaboration and coordination.

The individual and aggregate adoption stages of innovations are of paramount importance for innovations to deliver the projected positive socio-economic impacts to the target social systems. This study therefore seeks to find out factors limiting both individual and aggregate adoption of organic cotton production practices in Meatu District.

2.18 Adoption Decision Theories in Agriculture

Important decisions by human beings in their environments as individuals or groups are underpinned by theory-based directional mental processes. Ndah *et al*. (2010) provide various theories related to adoption decisions towards agricultural innovations. These theories fall under two major categories, namely behavioral and cognitive theories. In this study however, *diffusion of innovation theory* by Rogers (2003) and Rogers (1995) is described since it adequately explains the dynamics associated with adoption of most agricultural innovations by smallholder farmers.

2.19 Innovation diffusion theory terminologies and concepts

There are various terms and concepts associated with the *diffusion of innovation theory.* Different adoption studies use different concepts depending on the contexts under which such studies are carried out and the objectives that such studies set out to achieve. Some of the concepts and terms which are pertinent to this study are reviewed and described.

2.19.1 Adoption

According to Rogers (2003), adoption is a decision of "full use of an innovation as the best course of action available" and rejection is a decision "not to adopt an innovation". Loevinsohn *et al*. (2013) further explains that adoption is integration of a new technology into existing practice, usually proceeded by a period of 'trying' and some degree of adaptation.

2.19.2 Innovativeness

Is the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a system (Rogers, 2003). To further delineate the term, Braak (2001) described innovativeness as "a relatively-stable, socially-constructed, innovation-dependent characteristic that indicates an individual's willingness to change his or her familiar practices".

2.19.3 Rate of adoption

Is the relative speed with which an innovation is adopted by members of a social system. It is generally measured as the number of individuals who adopt a new idea in a specified period, such as each year (Rogers, 1995).

2.19.4 Innovation consequences

Consequences are the changes that occur in an individual or a social system as a result of the adoption or rejection of an innovation (Rogers, 2003,). Individuals need to be well informed about advantages and disadvantages associated with a given innovation in order to reduce uncertainty. The latter is an important obstacle to adoption of innovations.

2.19.5 Diffusion

Rogers (2003) defines diffusion as "the process in which an innovation is communicated thorough certain channels over time among the members of a social system".

2.19.6 Reinvention

Is "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" (Rogers 2003).

2.19.7 Active rejection and passive rejection

Active rejection is the rejection of an innovation after adopting it earlier. It is also referred to as a discontinuance decision. Passive rejection is a situation whereby an individual does not think about adopting the innovation at all (Rogers 2003).

2.19.8 Innovation system

An innovation system is a network of actors and organizations that are linked by a common theme with the aim of developing new technologies, methods and new forms of organisation for use by the end users to tackle identified problems (World Bank, 2007b).

An innovation system is governed by the prevailing institutions and policies that affect performance of the actors involved and the regulation of the technologies developed (World Bank, 2007).

2.19.9 Agricultural technology

According to Rogers (2003), a *technology* is a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome". It is composed of two parts: hardware and software. While hardware is "the tool that embodies the technology in the form of a material or physical object," software is "the information base for the tool" (Rogers, 2003). Additionally, Loevinsohn *et al*. (2013) note that Technology is the means and methods of producing goods and services, including methods of organization as well as physical technique. However to keep this study in perspective, the words innovation and technology are viewed as synonyms as further noted by Rogers (2003) and will therefore be used to mean the same thing throughout this text.

2.20 Main Elements of Diffusion of Innovations

Diffusion of any innovation is a rather complex process that should be looked at as a several-component system than a single social event. As embodied in the definition, four key elements are innovation, communication channels, time, and social system.

2.20.1 Agricultural innovation

Rogers offered the following description of an innovation: "An *innovation* is an idea, practice, or project that is perceived as new by an individual or other unit of adoption" (Rogers, 2003). An innovation may have been invented a long time ago, but if individuals perceive it as new, then it may still be an innovation for them.

2.20.2 Innovation time aspect

According to Rogers (2003), the time aspect is ignored in most behavioral research. He argues that including the time dimension in diffusion research illustrates one of its strengths. The innovation diffusion process, adopter categorization, and rate of adoptions all include a time dimension.

2.20.3 Innovation social system

Rogers (2003) defines the social system as "a set of interrelated units engaged in joint problem solving to accomplish a common goal". Since diffusion of innovations takes place in the social system, it is influenced by the social structure of the social system. He further claimed that the nature of the social system affects individuals' innovativeness, which is the main criterion for categorizing adopters.

2.20.4 Innovation communication channels

According to Rogers (2003), communication is "a process in which participants create and share information with one another in order to reach a mutual understanding". This communication occurs through channels between sources. Rogers states that "a *source* is an individual or an institution that originates a message. A channel is the means by which a message gets from the source to the receiver". Diffusion is viewed as a specific kind of communication and includes these communication elements: an innovation, two individuals or other units of adoption, and a communication channel. Mass media and interpersonal communication are two broader types of communication channels. While mass media channels include a mass medium such as TV, radio, or newspaper, interpersonal channels consist of a two-way communication between two or more individuals. In the study area both mass media and interpersonal channels are used depending on the type of message to be delivered.

2.21 Determinants of Adoption

In portraying components determining the rate at which adoption of a given innovation occurs, Rogers (2003) and Rogers (1995) identified various factors that were referred to as independent variables while holding the rate of adoption as dependent variable. These independent variables include perceived attributes of innovation (relative advantage, compatibility, complexity, trialability, observability), innovation decision (optional, collective, authority), communication channels (mass media or interpersonal), Social system (norms, degree of network connection) and extent of change agents' promotion efforts.

2.22 Innovation-decision Process

Adoption of innovations is a rather complex and multistage process. Rogers (2003) conceptualizes innovation adoption decision as a five time-ordered steps process. The steps are: (1) Knowledge, (2) Persuasion, (3) Decision, (4) Implementation, and (5) Confirmation. This process is underpinned and conditioned by a number of physical, socio-economic, demographic and institutional factors. In a Model of Five Stages in the Innovation-Decision Process by Rogers (2003), these factors are divided into three main groups. The groups are prior conditions (previous experience, felt needs/problems, innovativeness, norms of the social system), characteristics of the decision making unit (socio economic characteristics, personality variables, communication behaviour) and perceived attributes of innovation).

In this study, adoption process in organic cotton production is mainly at implementation and confirmation stages. Salient features are a mixture of reinvention, passive and active rejections of the relatively novel farming practice.

2.23 Adopter Categories

Rogers (2003) defines the adopter categories as “the classifications of members of a social system on the basis of innovativeness”. In this classification, members of a social system are normally distributed. The classification with relative size in percentages is: innovators (2.5%), early adopters (13.5 %), early majority (34 %), late majority (34 %), and laggards (16 %).

Understanding characteristics of each of these categories is of paramount importance as it significantly contributes in the planning of strategies to improved rate of adoption. Although discussed at some lengthy details by Rogers (2003), Ndah, *et al*. (2010) summarize some characteristics of adopter categories using salient features in parentheses as follows: Innovators (venturesome, educated), early adopters (Social leaders, popular, educated), early majority (deliberate, many informal social contacts), late majority-skeptical, laggards (traditional, lower social economic class.

2.24 Global Market Scope for Organic Products

There is a reliable and expanding market opportunities for organic products in the world today that make it possible for farmers to reap the benefits of a trade with relatively high price premiums (CBTF, 2006; Garibay and Jyoti, 2003). However this market is not very well known by farmers especially in developing countries. Furthermore information about it is not readily available to farmers in the developing countries (Garibay and Jyoti, 2003). The absence of technical and market information and financial support also means that few farmers will risk changing their method of farming.

Global market analysis show that regions of the world where people are more health and environment-conscious present huge market opportunities for certified organic agricultural products than those whose population are less so. The world organic market trend indicates that huge markets are found in Europe and USA, followed by South America, Asia and lastly Africa (Sadek and Shelaby, 2011; CBTF, 2006). For Africa therefore, with the exception of South Africa, marketing strategies mainly target lucrative overseas market niches (Garibay and Jyoti, 2003; CBTF, 2006).

A study commissioned by the organic products export development program, the Export Promotion of Organic Products from Africa (EPOPA) revealed that the size of the organic market in Tanzania is relatively very small and there is no structured approach on pricing of organic products (Mjunguli, 2004). Potential consumers were identified as expatriates and well- to- do Tanzanians.

2.25 Marketing Strategies for Organic Cotton

Unlike organic food items, marketing for organic cotton is characterized by special linkages along the entire supply chain. For example, Meyer and Hohmann (2000) note that for organic cotton, the "company binds its suppliers and customers closer to itself and is equally willing to bind itself to them". In this arrangement, Goldbach *et al*., 2003 argue that the organic cotton supply chain has a specific coordination mechanism. For practical purposes, Malian and Tanzanian experiences are delineated. In Mali, the whole supply chain is coordinated by Helvetas and Ecocert, an independent German certification agency. It is responsible for certifying that the cotton is organic and stays organic throughout the supply chain (Lakhal *et al*., 2008).

Typically an international coordinating agency is represented by a local agency in a given country. In Mali, Helvetas works in close collaboration with the Malian Company for the Development of Textiles (CMDT). In Tanzania, Remei AG, a Swiss trading company is the chain coordinator. It works through a local company BioRe (Pattni, 2008). The local companies buy organic cotton on behalf of the foreing companies, gin it and transport the same to the latter under specially agreed terms. Apart from buying organic cotton from contracted farmers at a premium price, local agencies are responsible for provision of inputs, extension services, certification and maintenance of local internal control system.

Demand for organic cotton is greater than supply, and this gives rise to fierce competition among companies in the sector. However, this competition does not reflect down to the producers in the way that it should (Adanacioglu and Olgun, 2010). For example, one of the important points which producers of organic cotton in the United States see as a problem in the marketing of organic cotton is the necessity of finding a market to meet the extra costs engendered by organic production (Pick, 2006). In a study carried out in Turkey, it was found that cotton prices were variable and tended to fall, and a reliable market for organic cotton could not be found, and the lack of a reliable market is the reason why the contracting companies pay such low premiums to producers (Olgun *et al*., 2008).

The market for conventional cotton is characterised by spot-market transactions and the product is traded anonymously on commodity exchanges around the world (Meyer and Hohmann, 2000). There is no global coordination within this chain among stakeholders (seed cotton producers, fibre producers, spinners, fabric producers). Therefore exchanges along the supply chain are based entirely on the market scenarios of which main drivers are price and negotiations.

2.26 Economic Profitability and Scope of Organic Farming System

While the potential of organic agriculture in delivering public goods like healthy environmental resources and promotion of human and livestock health is undisputed, its potential for increased yield relative to conventional agriculture is contentious worldwide. In most farming systems particularly in developing countries, yield is a keystone component of agricultural production process and which therefore actuates farmers in adopting any technology at offer. In support of this point, Ferrigno *et al*. (2005) and Artukoglu *et al*. (2009) maintain that for organic cotton production system to have a bright future, improved yield of organic seed cotton should be taken into account since economic profitability takes precedence over social and environmental motives.

Adding to the point, Ton (2007) a staunch supporter of organic cotton cites failure of the organic cotton to meet global demand for organic fibre, yarn and fabrics as one of the threats of organic cotton production system. Based on the dynamics of demand and supply theory, we would imagine organic cotton to have a high relative economic advantage over conventional cotton. Therefore high uptake of the new system would have been expected in the study area had there been no other systemic hindrances somewhere along the organic cotton supply chain.

Some studies report that productivity in organic systems are comparable to and sometimes higher than those in conventional systems (Eyhorn *et al*., 2005; Eyhorn *et al*., 2007; Ferrigno and Lizarraga, 2009; Panneerselvam *et al*., 2011; Leifeld, 2012). Despite these arguments, yet still external validity of these findings is limited since they are more crop and location specific. For example Ponti, *et al*., (2012) compiled and analyzed a meta-dataset of 362 published organic–conventional comparative crop yields in an attempt to contribute to the debate on whether organic agriculture could feed the world. Their results show that organic yields of individual crops are on average 80% of conventional yields, but variation is substantial (standard deviation 21%). In their dataset, the organic yield gap significantly differed between crop groups and regions.

In-depth analysis of research study findings from reviewed literature in some Asian and African countries converge by positing that organic agriculture is economically more profitable compared to conventional agriculture only when premium prices are taken into consideration. Such studies include those conducted in Uganda, Nigeria, Ghana, Zimbabwe, India and Turkey (Tovignan and Nuppenau, 2004; Eyhorn *et al*., 2007; Elepu and Ekere, 2008; Svotwa *et al*., 2009; Adebayo and Oladele, 2013; Osei-Asare, 2009; Eyhorn *et al*., 2005). Based on the *a priori* analysis, this situation signals slow adoption of organic farming as a system in space and time dimensions at least in the medium run since premiums will largely cover few high valued crops in most developing countries.

Inconclusiveness in the ruling that organic systems could supplant conventional systems in food and fibre production is primarily due to the unique conditions inherent to local organic systems. For example in assessing organic yields, it is less easy to generalize than for the more uniform conditions of non-organic farming. Therefore an enormous amount of data from around the globe would be required to answer the question both conclusively and definitively (Hewlett and Melchett, 2008). This caveat applies as well to reviewed results of organic and conventional cotton comparative studies conducted in African and Asian countries.

In most developing countries organic farming lack public support as compared to conventional farming. As such it is left at the mercy of private sector through project-based contract farming (Bolwig *et al*., 2009; Ferrigno *et al.*, 2005). Tanzania is no exception in this regard. For instance in organic cotton sub-sector all businesses are run by a private firm, the BioRe (T) Ltd. Major specific activities by the firm (BioRe) include registration of members farmers, training, inputs supply, buying and ginning.

Another important feature is that farmers who by default manage their farms organically are not recognized as organic farmers and hence out of adopters' database. This is in line with the argument that due to very low take ups of green revolution technologies most farming in Africa is already *de facto* organic although it is not so recognized due to stringent and bureaucratic certification procedures (Bolwig *et al*., 2009; Osei-Asare, 2009; Ton *et al*., 2007).

From the literature review, it can be seen that certified OA is still a recent concept and practice in a global perspective in historical timeline. Although its socio-economic and ecological benefits are obvious and undisputed, its wide acceptance is not yet realized if aggregate statistics are anything to go by. Many national governments and farmers alike seem to be skeptical about its ability to replace conventional agriculture in the improvement of socio-economic welfare and food security of farming communities which constitute the majority particularly in developing countries.

The situation is compounded when considering changing over to organic management strategies for most important cash crops like cotton which are typically produced conventionally. This is most probably why the organic sector is least researched on compared to conventional agriculture. However, with the increased agrochemical-inflicted global socio-economic and environmental concerns OA appears to be indispensable.

In view of the above, rigorous research endeavours need to be directed to the OA sector in order to bring to light context-specific challenges and identify existing and potential barriers to the adoption of OA. Addressing the same is hoped to dramatically improve both farm-level and aggregate adoption of organic farming paradigm, as is the case with organic cotton production in Meatu District.

CHAPTER THREE

3.0 METHOBOLOGY

3.1 Description of the Study Area

The study was carried out in Meatu. The district is one of four districts in Simiyu Region. It is located between latitude 2º57'S and 4 º 9'S and longitudes 34º 8' E and 34º 49' E. It is about 136 km from regional headquarters to the East. On the basis of rainfall amount, the district is divided into three agro ecological zones, namely Northern Zone (800-1000 mm/annum), Central Zone (600-800 mm/annum) and Southern Zone (<600 mm/annum).

Cotton is produced in 96 villages, with the intensity skewed towards Kisesa Division (Northern zone) due to relatively favourable moisture conditions. BioRe (T) Ltd, the company managing organic cotton production is headquartered at Mwamishali village. Currently organic cotton production covers 15 villages, mainly in the Central and Southern zones. Conventional cotton production covers all 96 villages. In villages where organic cotton is produced, other farmers produce conventional cotton as well i.e. there are no specific villages for organic cotton only. The major reason for selecting this area for the study was the fact that organized organic cotton production is currently only implemented in Meatu District in Tanzania. The map of the study area is shown in Fig. 2.

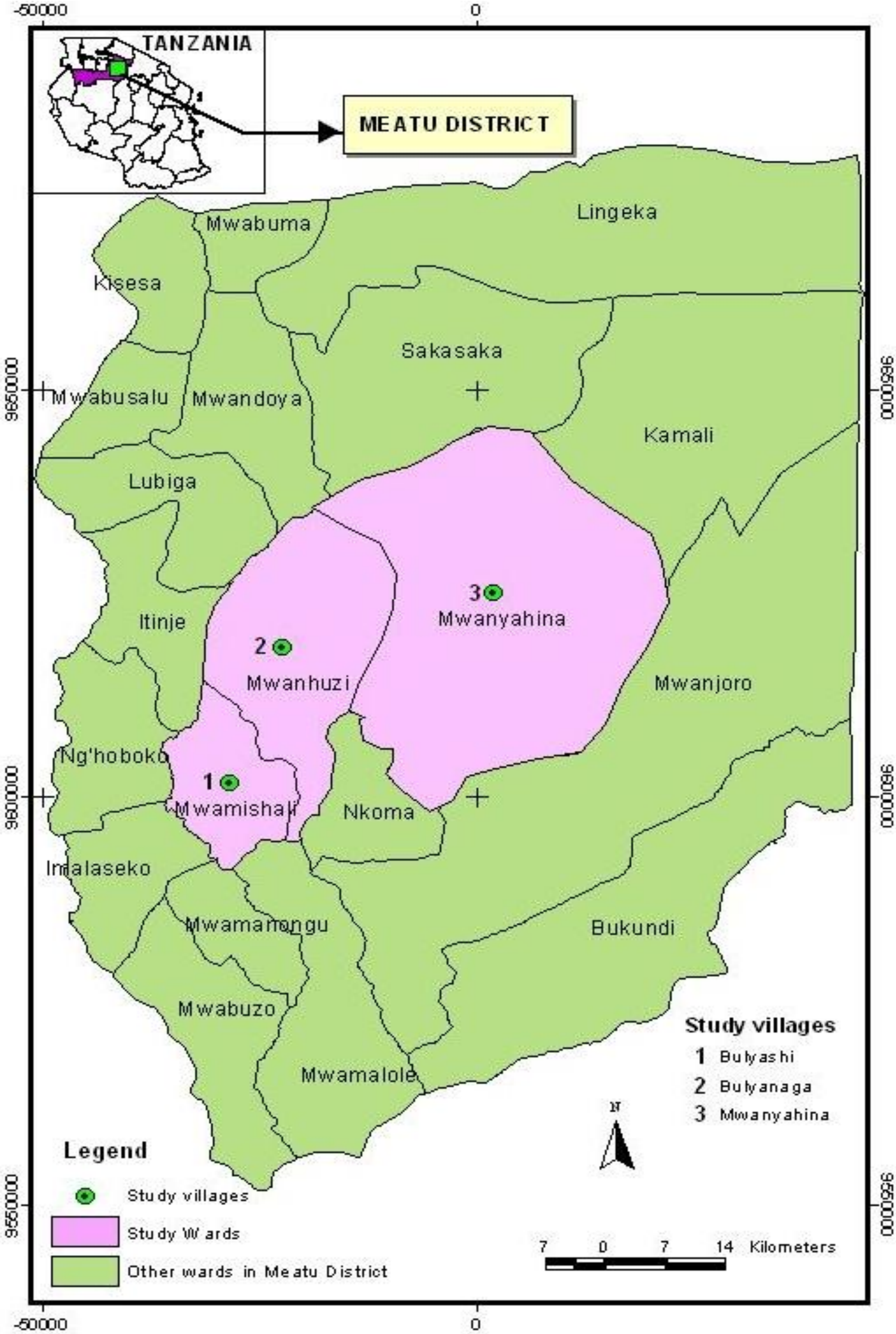

Figure 2: Meatu District map showing the study area

3.2 Research Design

The study employed a cross-sectional survey design whereby data were collected at a single point in time in the study area from the sample selected to represent the population from which it was drawn (Bailey, 1994; Babbie, 2007). The design was appropriate as it allowed for collection of all required data given limited time and resources. The design was also suitable for description purposes as well as determination of relationship between and among variables.

3.3 Sampling

3.3.1 Population

Population of this study consisted of all cotton growers in the District. It involved two categories of farmers, namely those who produced conventional cotton and others who were producing organic cotton. In this study they were referred to as conventional and organic farmers, respectively.

3.3.2 Sampling frame

There were two sampling frame categories depending on the stage of sampling. The first category consisted of a list of 15 villages where organic and conventional cotton lines were produced. The reason for purposefully selecting 15 villages is that farmers in the rest of 81 villages out of all 96 cotton producing villages in the district cultivate only conventional cotton. The second category consisted of a list of farmers in the selected villages.

3.3.3 Sample size

Based on the sample size formula by Kothari (2011) for infinite populations and Hussey and Hussey (1997) cited by Aluvi and Kimutai (2009), sample size was 119 farmers

(Appendix 1), each of whom represented one household. The sample was composed of almost equal numbers of organic and conventional farmers (59 and 60 respectively). Procedure for sample size determination is delineated in Appendix 1.

3.3.4 Sampling procedure

Multistage sampling procedure was adopted. Non-probability and probability techniques were used, namely purposive and simple random sampling designs (SRSD) respectively. In the first stage, Meatu District was purposively selected because it is the only place where organic cotton production program is located as afore stated in Sub section 3.2.

The second stage of sampling involved purposive selection of 15 villages where both organic and conventional cotton production systems are practiced in order to ensure conventional and organic farmers were represented in the sample. Inclusion of conventional farmers in the study was desirable in order to triangulate reasons for poor adoption of organic cotton production practices. For instance reasons for their non-adoption stance was instrumental in shedding some light on the factors limiting wide adoption of organic cotton farming system. List of 15 villages constituted the first sampling frame where individual villages were the sampling units.

The third stage consisted of selecting 3 villages using SRSD from a sampling frame of 15 villages. The number of farmers in three randomly selected villages sufficiently represented cotton farmers as required by this study. The selected villages were Bulyashi, Mwanyahina and Bulyanaga. The fourth stage involved selection of a total of 119 households using SRSD to constitute the study sample. List of farmers in 3 villages constituted the second sampling frame. In each village there were two types of sampling frames, namely one for conventional and the other for organic farmers.

Sampling frame categories for both conventional and organic farmers were obtained from the residents' registers at the office of Village Executive Officers (VEOs) with the assistance from the resident Village Agriculture Extension Officers (VAEOs). In each of two villages (Bulyashi and Mwanyahina), 40 farmers were selected (20 organic and 20 conventional) while in one village (Bulyanaga) 39 farmers were selected (19 organic and 20 conventional) using SRSD technique. Finally, 119 farmers from the selected households were thus sampling elements and hence used as respondents in the interviewing exercise.

3.4 Instrumentation

The study used structured questionnaire which comprised both closed and open-ended questions. The questionnaire was a purpose-built tool for collecting both qualitative and quantitative data from respondents. There were two sets of questionnaires, namely one for organic respondents and the other for conventional respondents (Appendices 6 and 7). Both sets had sections of similar questions and other sections with different questions that were only relevant to specific farmer category. Other types of instruments included key informants checklist and Focus Group Discussion (FGD) checklist/guide (Appendices 8, 9 and 10).

In-depth information was elicited using key informants interview checklist and during FGDs. Direct observation was employed to collect information about organic cotton production practices. The method assisted in gaining current information that was not influenced by past behaviour, future intentions or attitudes (Kothari, 2011).

3.5 Pre-testing

In order to ensure reliability and validity (face and content validity) of the instrument, the questionnaire was evaluated before being used in the actual field work at the study area.

This was was done by administering the instrument to respondents in villages that were not part of the actual study (Metrick, 1993). The pilot study involved 20 organic and 20 conventional cotton farmers. Based on the findings from the pilot study, some corrections were made so as to improve the instrument.

3.6 Data Collection Methods

The nature of the topic and study objective entailed in-depth inquiry into reliable and valid facts from respondents and other key sources of relevant information. The study therefore adopted methodological triangulation concept whereby several data collection methods are used in collecting both quantitative and qualitative data (Hussein, 2009; Olsen, 2004; Sabina and Khan, 2012).

3.6.1 Primary data

They involved data collected directly from first-hand experience in the study area based on some important independent variables. The latter included socio-economic and demographic characteristics of respondents, various organic cotton production practices, organic seed cotton marketing arrangements, opinions on profitability of organic cotton farming and opinions on factors hindering adoption of organic cotton in both spatial and temporal dimensions.

Self-administered interview was conducted to collect relevant information using structured questionnaire. The questionnaire was administered to 119 respondents on a one-on-one basis to collect quantitative and some of the qualitative data. The researcher was assisted by three interviewers, who were the VAEOs. Before the commencement of field work, the latter underwent a three day training that imparted into them a thorough knowledge on the interviewing skills.

In-depth qualitative information was elicited using key informant interviews (KIIs). A checklist with open-ended questions was used. Key informants included two private and two public sector extension officers, three progressive cotton farmers, the Director of BioRe Company (T) Ltd, one Agriculture Officer in the Meatu District Council Directors' Office and four cotton warehouse clerks (2 conventional and 2 organic).

Three Focus Group Discussion (FGD) meetings were convened. Each meeting session was composed of 10 members. The FGD members were mainly cotton farmers and village leaders. Two meetings involved organic and conventional farmers separately while the third meeting involved both of them. The FGD checklist (Appendix 8) was used to guide discussion. Meetings were facilitated in a casual manner such that every participant spoke his/her mind honestly and candidly. Discussion proceedings were dully recorded in the field note book for reference.

Direct observation was employed to collect information about the current status of organic cotton production practices in the study area. Explored issues included existence of untreated cotton seed and agronomic practices, organic inputs and marketing situations.

3.6.2 Secondary data

Secondary data were used to enrich the study by furnishing additional information to various aspects of the study and a basis for comparison of various facts from the study findings. Most of the information was drawn from reviewing of literature which included books, journals, theses, and websites. Others included publications in the Ministry of Agriculture, Food Security and Cooperatives, Tanzania Cotton Board (TCB) and working reports in the Meatu District Council Authority (MDCA) and BioRe Co.Ltd.

3.8 Data Processing and Analysis

3.8.1 Quantitative data analysis

Primary data were organised, coded and analysed using statistical software, the Statistical Package for Social Sciences (SPSS) version 16.0. Descriptive statistics was employed in the presentation and description of quantitative data output. Frequencies and percentages analyses were used to indicate relative strengths and distributions of respondents based on various variables. Chi square test was used to test significance of influence of socio-economic factors in the adoption of organic cotton production system based on bivariate cross tabulations.

3.8.2 Qualitative data analysis

Qualitative information from FGD and key informants were analysed using content analysis procedure. This involved organising data from FGD participants and key informants, categorising them around themes and coding them as described by Debus (1988) and Stemler (2001). Analysis was done using MS Excel spreadsheet.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Assessment of Socio-economic Characteristics of Respondents

Socio-economic characteristics of farmers are one of important components of characteristics of the decision making unit in the five time-ordered steps of the Innovation-Decision Process modeled by Rogers (2003). The study sought to assess their influence in the adoption behaviour of farmers towards organic cotton system in the study area. The effect of each characteristic was independently assessed based on the descriptive statistics. Frequency and percentages were used in drawing implications in each case.

Tables 2-10 below delineate distribution of respondents based on the selected socio-economic characteristics. For clarity, each socio-economic characteristic (variable) is discussed individually in the subsequent Tables.

The influence of socio-economic variables to the adoption of organic cotton production (OCP) was also examined in order to shed more light on the existing and potential hurdles to the conversion. A chi square technique was used to test association between the variables and type of farmer (organic or conventional). Table 1 below displays the results.

Table 1: Influence of socio-economic variables in the adoption of OCP (n=119)

Variable	χ^2	df	p-Value	Significance
Gender	1.028	1	0.311	**
Age	12.052	3	0.007	*
Education	16.376	3	0.001	*.
Marital	1.561	3	0.668	**
Average annual income	11.919	4	0.018	*
Land size	18.807	4	0.044	*
Number family members capable of farm work	20.597	4	0.000	*
Land tenure	11.263	5	0.046	*
Type of occupations	2.288	3	0.515	**

$p < 0.05$ (95 % level of confidence), * significant, ** not significant

Discussion of results in Table 1 is made alongside relative frequencies and percentages of respondents' distributions based on specific socio-economic variables in the subsequent Sub sections.

4.1.1 Gender

Results presented in Table 2 show that male farmers constituted the majority of respondents (92.4 %) while female farmers accounted only for 7.6 %.

Table 2: Distribution of respondents by gender (n=119)

Sex	Conventional (n=60)		Organic (n=59)		Total	
	Frequency	**Percent***	**Frequency**	**Percent***	**Frequency**	**Percent**
Male	54	45.4	56	47.1	110	92.4
Female	6	5.0	3	2.5	9	7.6
Total	**60**	**50.4**	**59**	**49.6**	**119**	**100**

**Percentage is based on the total sample denominator (n=119), in order to be more informative. It applies to all subsequent Tables with two sub-samples (n=60, n=59).*

This suggests that cotton is one of the male-controlled crops in Meatu District, alongside others like maize, sunflower and sorghum. This observation is in line with similar situations in most African countries. For example Tovignan and Nuppenau (2004) argue that in Benin cotton production has been for long time dominated by men who use women as labour force only, although they are highly involved at household level in critical cotton production activities such as sowing, fertilizing, weeding and harvesting. Similar results are reported in Nigeria in a related study conducted in several Local Government areas of Ekiti State (Oyesola and Obabire, 2011).

Furthermore, access to modern inputs (synthetic pesticides and fertilizers) and particularly the manipulation of pesticides are among the major constraints for women in cotton production. This is because based on their gender-defined roles, women can be the victims of abortion, contaminate family food and unintentional poisoning of their children, particularly those who are still suckling.

As shown in Table 2, almost twice as many (5 %) female respondents were engaged in conventional cotton farming compared to 2.5 % who produced organic cotton. This suggests female farmers are more inclined towards conventional than organic agriculture just like male farmers. However, this may not necessarily be the result of conscious choice since female farmers lack decision making powers for male-dominated enterprises. This is compounded by their inherent limited access to own lands. It further implies that opinions and perceptions on any socio-economic aspects in cotton production are most certainly and unavoidably gender-biased.

In support of the above view point, results from a Pearson chi-square test (Table 1) revealed that there was no statistically significant relationship between gender of respondents and a choice between being a conventional or organic farmer ($\chi^2 = 1.03$, df =1, p (0.311) > 0.05). These results suggest that decision to adopt OCP is not influenced by the fact that a farmer is male or female. Some related studies appear to be contradicting with these findings. In a study conducted in Zimbabwe in non-cotton organic systems (maize, vegetable, fruits and groundnuts) it was found that majority (79 %) of farmers were female (Svotwa *et al*., 2009).

4.1.2 Age

Results in Table 3 indicate that respondents concentrated in the age groups 31-41 years (48.7 %) and 42-52 years (42 %). Therefore majority of respondents (90.7 %) ranged between 31-52 years of age. This situation implies that most cotton growers in the Meatu District belong to the economically active age group. Their technologies adoption behaviours are thus critical to the improvement of agricultural productivity and farm households' welfare in general.

Table 3: Distribution of respondents by age (n = 119)

Age	Conventional (n=60)		Organic (n=59)		Total	
	Freq	Percent	Freq	Percent	Freq	Percent
≤ 30 yrs	0	0.0	1	0.8	1	0.8
31-41 yrs	22	18.5	36	30.3	58	48.7
42-52 yrs	29	24.4	21	17.6	50	42.0
53-63 yrs	9	7.6	1	0.8	10	8.4
Total	**60**	**50.5**	**59**	**49.5**	**119**	**100**

Based on frequency analysis, age distribution between organic and conventional cotton producers showed a marked difference. Age group 31-41 years had 18.5 % of conventional respondents while organic respondents in the same age group accounted for 30.3 % of all respondents (119). The age group 42-52 years had 24.4 % of conventional respondents but 17.6 % of organic respondents. Other salient observations from the table indicate that as the age increases, there was less of organic relative to conventional respondents. This trend is presented in the age ranges as follows: 42-52 years (17.6 %), 53-63 years (0.8 %) and above 63 years (0 %).

Other results (Table 1) from a Pearson chi-square test revealed that there was statistically significant relationship between age and adoption of OCP (χ^2 = 12.05, df =3, p (0.007) <0.05). Based on results from Tables 2 and 4, it can be said that relatively younger farmers are more inclined to produce organic cotton than older ones. This is why at least the age group 30 years and below was represented for organic (0.8 %) and not for conventional respondents.

Based on these observations, it could be inferred that elderly farmers with their long experience through experimentation and observations in conventional cotton production (CCP) are more risk averse in the face of novel innovations like organic cotton farming system than are the younger ones. Also erosion of physical strength which is correlated with old age accounts for the scenario.

It can further be argued that the age of farmer assumes a quadratic function which implies that farmers' rate of adoption is low at both the younger and older age extremes. At the younger age, farmers may not be able to adopt modern agricultural production technologies, especially capital intensive ones because of the fact that they might not have adequate resources to do. Also according to cultural manners in Meatu District most youths below 30 years of age are still under the parental control and incapable of making independent consequential decisions. At an older age, farmers' volume of economic activities are reduced hence they may be unable to pay for technologies. They therefore become persistently and progressively interested in maintaining the status quo. Therefore, most older farmers find themselves implementing *de facto* rather than certified OA.

These findings were however found to be contrary to some similar studies conducted elsewhere. For example a study conducted in Maikaal BioRe Project in Central India, Eyhorn *et al*. (2005) indicate that average age for both conventional and organic farmers are about the same (41-44 years).

Furthermore in a study conducted in Turkey, Artukoglu *et al*. (2009) found that age of farmers affected the transition in the organic farming positively. As the age rises, the possibility of shifting to the organic farming rises. Similar results were observed in Zimbabwe where it was reported from the study conducted in Juru communal area that most of the organic farmers were elderly people (Svotwa *et al*., 2009). It was however pointed out that this scenario was possibly due to failure of elderly small-scale farmers to purchase expensive synthetic inputs as they tend to be progressively financially constrained with age (Mella *et al*., 2007; Artukoglu *et al*., 2009; Svotwa *et al*., 2009).

Findings from this study are also similar to results from several other studies conducted elsewhere. For example in a study conducted in the Bawku West District of the Upper East Region of Ghana it was observed that relatively more younger farmers adopted organic cotton production (OCP) than were old age farmers (Akudugu *et al*., 2012).

In another observation, low representation of the age group 30 years and below implies that most of youths in the study area are either at schools/colleges or engaged in other less capital-intensive off-farm economic activities. It also suggests that most of the age group members are still resource-limited and therefore incapable of independent decision making.

4.1.3 Education

Table 4 below shows that respondents who did not attend formal education accounted for 10.9 %, completed primary education constituted 79.0 %, completed secondary education accounted for 6.7 % whereas 3.4 % had completed tertiary education.

Table 4: Distribution of respondents by level of education (n =119)

Level of education	Conventional (n=60)		Organic (n=59)		Total	
	Freq	Percent	Freq	Percent	Freq	Percent
Not attended any formal education	13	10.9	0	0.0	13	10.9
Primary education	44	37	50	42.0	94	79.0
Secondary education	2	1.7	6	5.0	8	6.7
Tertiary education	1	0.8	3	2.5	4	3.4
Total	**60**	**50.4**	**59**	**49.5**	**119**	**100**

From these results, it can be seen that organic respondents had no members who did not attend formal education. This category (organic respondents) had also more members who had attended tertiary education (2.5 %) compared to conventional farmers (0.8 %). It could then be inferred that more educated farmers have relatively more positive perception towards organic cotton production than less educated farmers.

In support of the above suggestion, results from a Pearson chi-square test (Table 1) revealed that there was statistically significant relationship between level of education of respondents and a decision to adopt OCP (χ^2 = 16.38, df =3, p (0.001) <0.05). These results provide an indication that farmers with relatively higher level of education are better placed to adopt OCP paradigm than farmers at the lower level of education ladder. This is because education enlightens individuals and enhances one’s capacity in making informed decisions based on insightful analysis.

The results were consistent with similar studies conducted in other places. For instance a study at the Maikaal BioRe Project in Central India reveals that most organic cotton farmers have, on average, higher education level than conventional cotton farmers (Eyhorn *et al*., 2005; Eyhorn *et al*., 2007). Another similar study conducted in South Africa asserts similarly (Niemeyer and Lombard, 2003). Furthermore, related adoption studies conducted in Tanzania (Nkonya *et al.*, 1997) and Ethiopia (Ersado *et al*., 2004) support this observation.

However, observations in this study differ from those of some similar studies conducted in other parts of the world. In a research study conducted in Turkey, Artukoglu *et al*. (2009) observe that the level of education affects the transition in the organic farming negatively. The reason posited was that educated farmers had higher capacity to search for market information and hence they possibly knew that there were no reliable markets for organic cotton yet.

4.1.4 Marital status

As displayed in Table 5, married respondents constituted 92.4 %, single 4.2 %, divorced 2.5 % whereas those separated represented 0.8 % of respondents.

Table 5: Distribution of respondents by marital status (n=119)

Marital status	**Conventional (n=60)**		**Organic (n=59)**		**Total**	
	Frequency	**Percent**	**Frequency**	**Percent**	**Freq**	**Percent**
Separated	0	0.0	1	0.8	1	0.8
Single	2	1.7	3	2.5	5	4.2
Married	56	47.1	54	45.4	110	92.4
Divorced	2	1.7	1	0.8	3	2.5
Total	**60**	**50.5**	**59**	**49.5**	**119**	**100.0**

From these results it can be deduced that most cotton growers are married as could be expected for other crops. This observation is in line with the fact that most social systems to which innovations are targeted are largely constituted by households with married couples. Therefore the uptake of most innovations depends very much on families jointly led by husbands and wives, and which therefore qualify as primary social institutions where most planning takes place.

Results from a Pearson chi-square test (Table 1) reveal that there was no statistically significant relationship between marital status of respondents and decision to adopt OCP ($\chi^2 = 1.56$, df =3, p (0.668) >0.05). These results suggest that type of farmer (organic or conventional) is not influenced by whether or not a farmer is married. Therefore there is no point targeting one's marital status in attempts to improve adoption of OCP.

4.1.5 Main occupation of respondents

Distribution of respondents based on main occupations other than crop production is displayed in Table 6. Results indicate that majority (81.5 %) of respondents kept livestock, 11.8 % did other businesses. Those employed in public and private sector each represented 3.4 % of all respondents. These statistics translate into the fact that most farmers in Meatu District are crop producers *cum* livestock keepers. It implies that there is a great potential for OA since the two components of farming system complement each other. For example farmyard manure (FYM) is one of the indispensable core inputs in all organic farming systems.

Table 6: Main occupation of respondents apart from crop production (n = 119)

Occupation	Conventional (n=60)		Organic (n=59)		Total	
	Freq	**Percent**	**Freq**	**Percent**	**No**	**Percent**
Livestock keeping	48	40.3	49	41.2	97	81.5
Business	8	6.7	6	5.0	14	11.8
Civil service	1	0.8	3	2.5	4	3.4
Privately employed	3	2.5	1	0.8	4	3.4
Total	**60**	**50.3**	**59**	**49.5**	**119**	**100.0**

Furthermore, results from a Pearson chi-square test (Table 1) revealed that there was no statistically significant relationship between other main economic activities apart from crop production and a decision to adopt OCP (χ^2 = 2.29, df =3, p (0.515) >0.05). These results indicate that decision to convert or remain conventional is independent of the influence of type of activities farmers are commonly engaged in, apart from crop production.

4.1.6 Average annual income

Table 7 delineates how respondents were distributed according to household incomes. It was found that respondents whose annual incomes ranged between Tshs 500 000- 1 500 000 formed 44.5 %. Others categories with percentages in parentheses were; Tshs 1 500 001 -2 500 000 (41.2 %), Tshs 2 500 001-3 500 000 (9.2 %), Tshs 500 000 and below (2.5 %) and Tshs 3 500 000 and above (2.5 %).

Table 7: Average annual income of respondents (n=119)

Income range in Tshs.	Conventional (n=60)		Organic (n=59)		Total	
	Frequency	**Percent**	**Frequency**	**Percent**	**No**	**Percent**
500 000 and below	3	2.5	0	0.0	3	2.5
500 001-1 500 000	24	20.2	29	24.4	53	44.5
1 500 001-2 500 000	21	17.6	28	23.5	49	41.2
2 500 001-3 500 000	9	7.6	2	1.7	11	9.2
Above 3 500 000	3	2.5	0	0.0	3	2.5
Total	**60**	**50.4**	**59**	**49.6**	**119**	**100.0**

A look at Table 7 above reveals that there were more organic respondents in the ranges 500 001-1 500 000 (24.4 %) and 1 5000 001-2 500 000 (23.5 %) than there were conventional respondents (20.2 % and 17.6 % respectively). Conversely, there were more conventional respondents in the ranges 2 500 001-3 500 000 (7.6 %) and above 3 500 000 (2.5 %) than there were organic respondents (1.7 % and 0 % respectively). Furthermore, none of the organic respondent was represented in the range below 500 000.

Other results (Table 1) from a Pearson chi-square test revealed that there was statistically significant relationship between average annual income of respondents and a decision to adopt OCP (χ^2 = 11.92, df =4, p (0.018) <0.05). These results provide an impression that the decision to adopt OCP is influenced by the economic status of the farmer. This is because organic farming being a holistic approach requires that a farmer has economic power to own and manage other basic and complementary projects such as land and livestock. He/she also needs to be able to meet variable costs commitments in acquisition of consumable inputs and services that require cash outlays such as seed, pesticides (organics), extra labour and transport.

Based on the above scenario (Table 7), it can be seen that organic cotton farmers were mainly average earners while conventional farmers spread all along the income continuum, including both extremes (lowest and highest income earners). Thus OCP was not attractive to both the ‘richest’ and ‘poorest’ farmers as operationally defined in this study (Appendix 11).

One explanation could be that being rich in Meatu District context has association with livestock keeping. Given chronic water and pasture shortages coupled with labour intensity of OCP, large part of family labour does with caring the stock. Livestock keepers tend to move sometimes far from villages in temporary pasturing camps locally known as *lubaga* starting June through late December. This period marks dry spell in every year in Meatu District.

The other explanation is that well to do individuals are characteristically imbued with opportunistic tendencies than average income farmers. As such they become hardly attracted to OCP which is more taxing in terms of time and labour compared with traditional conventional cotton production (CCP). This was also reported by the results from focus group discussion (FGD) meetings and key informant interviews (KIIs).

Some studies seem to be at odds with this observation. A similar study conducted in India in Madhya Pradesh (Pradesh is equivalent to district in Tanzania) under the project run by the same company operating in Meatu (Maikaal organic cotton project) shows that organic farmers are relatively richer than conventional farmers in the region. Using proxy and direct indicators, it is claimed that greater percentage of the organic farmers have higher education, belong to higher castes and live in better houses (Eyhorn *et al.*, 2007). The economic, education and technological disparities between Tanzanian and Indian farmers could underlie this observation nonetheless.

On the other hand, poor farmers are associated with access to very little or no land at all to allow for crop rotations and other organic prerequisites like livestock for FYM. As such, they cannot be eligible candidates for certified OA, although they may be *de facto* organic farmers on account of their inherently low capacity to purchase external inputs (Mella *et al*, 2007).

More strikingly, Eyhorn *et al.* (2007) analyzed the group of farmers who defaulted and found that most of them were wealthier with 60-70 % more land compared to the organic farmers who remained certified. This again supports findings from this study that most of the wealthier farmers were opportunistic in which case they would either cheat or quit the project.

4.1.7 Respondents' landholdings

Distribution of respondents based on amount of land owned is shown in Table 8 below. It was found that 52.9 % of respondents had 1-2 ha, 29.4 % had 3-4 ha, 9.2 % owned 5-6 ha, 6.7 % owned more than 6 ha while 1.7 % had less than 1 ha of farmland.

Table 8: Amount of land owned by respondents (n=119)

Land size in ha	Conventional (n=60)		Organic (n=59)		Total	
	Freq	Percent	Freq	Percent	N	Percent
< 1	2	1.7	0	0	2	1.7
1-2	24	20.2	39	32.8	63	52.9
3-4	21	17.6	14	11.8	35	29.4
5-6	7	5.9	4	3.4	11	9.2
>6	6	5.0	2	1.7	8	6.7
Total	**60**	**50.4**	**59**	**49.7**	**119**	**100**

From the Table 8 above, it is evident that majority (82.3 %) of respondents had 1-4 ha of farmland which was available for allocation to various household uses. This is presented in the ranges 1-2 ha (52.9 %) and 3-4 ha (29.4 %). On the other hand, there was progressively small number of organic respondents as land size increased. The trend is shown in the ranges 3-4 ha (11.8 %), 5-6 ha (3.4 %) and above 6 ha (1.7 %). Also, none of the organic respondents were represented at the range below 1 ha.

Results from a Pearson chi-square test revealed that there was statistically significant relationship between size of land holdings of respondents and a decision to adopt OCP ($\chi^2 = 9.782$, df =4, p (0.044) <0.05). These results suggest that adoption of OCP is positively influenced by the amount of land a farmer has access to. This is because organic management requires fairly large farmland to accommodate such operations like crop rotation, intercropping and inclusion of border and trap crops. However as is the case for farmers' level of income, the positive relationship did not cover the extremes, that is farmers with relatively bigger (> 6ha) and smaller landholdings (<1 ha).

Based on the picture displayed in Table 8, it is shown that organic cotton farming was not an attractive option for farmers with relatively large landholdings. This was antithetical to what could have been expected. The reason is that farmers with large landholdings were almost invariably livestock keepers as well. Most of them were also business persons dealing in a variety of farm and off-farm entreprises. Therefore significant amount of land, time and family labour were allocated to livestock keeping and business transactions. Most of the members in this social class therefore find conventional cotton a better choice than laborious and stringent rule-guided OCP.

Additionally, revelation from KIIs showed that this group of farmers was socially and economically positioned to collude with registered organic farmers so that they could as well sell their conventional seed cotton crop at an organic premium price (OPP). Eyhorn *et al*. (2005) refers this form of opportunism as 'free riding'.

This observation is in disagreement with results from other studies. For example in India it is shown that farmers with relatively large landholdings are more attracted to OCP (Eyhorn *et al*., 2005; Eyhorn *et al*., 2007).

As afore stated in the average farmers' annual incomes however, Eyhorn *et al.* (2007) observe that most defaulted farmers had more land to the tune of 60-70 % than those who chose to remain in the program. These contradicting results support the finding that, other things being equal, OCP in Meatu District is not suited to farmers with very large landholdings, for instance more than 6 ha. However this position is not static, it may change depending on the rate at which farmers' attitudes are favourably changed in response to the dynamics of facilitative environments.

Farmers with less than 1 ha were not represented in the sample for organic respondents (0 %). This was due to the fact that such individuals could not manage rotations and other rules governing organic farming practices since they are strongly land-constrained. Based on the findings in Table 9 and explanation given above, it could generally be said that organic farming system in the study area is neither feasible for 'land-poor' nor popular for 'land-rich' farmers.

4.1.8 Land tenure

Land tenure is defined as the legally or customarily defined terms and conditions on which land is held, used and transacted (Adams *et al*., 1999). The mode of land ownership is of critical importance to the management of certified organic fields. There are different ways through which one gets land. Lands may be acquired through some arrangements like bequests from ones' parental lineage, cession and direct purchase. Other avenues include rewards, renting and borrowing. Distribution of respondents based on land ownership status is displayed in Table 9.

Table 9: Distribution of respondents based on type of land ownership (n= 119)

Type of ownership	Conventional (n=60)		Organic (n=59)		Total	
	Freq	**Percent**	**Freq**	**Percent**	**Freq**	**Percent**
Own land	18	15.1	19	16.0	37	31.1
Part is owned and part is rented	23	19.3	24	20.2	47	39.5
Part is owned and part is borrowed	5	4.2	13	10.9	18	15.1
Part is rented and part is borrowed	2	1.7	1	0.8	3	2.5
All borrowed	2	1.7	0	0.0	2	1.7
All rented	10	8.4	2	1.7	12	10.1
Total	**60**	**50.4**	**59**	**49.6**	**119**	**100.0**

From the Table 9, it is indicated that 39.5 % of respondents both owned and rented land, 31.1 % had total ownership of lands they had access to, 15.1 % both owned and borrowed lands, 10.1 % rented land they used, 2.5 % both owned and rented and 1.7 % had their land borrowed. From the statistics in Table 10, it is evident that far less than a half (31.1 %) of cotton farmers in the district are eligible candidates for full-fledged certified organic farming, based on IFOAM basic standards. This to some extent compromises the previously stated district's potential for certified organic farming.

Results from a Pearson chi-square test revealed that there was statistically significant relationship between how the land was owned and decision to adopt OCP (χ^2 = 11.26, df =5, p (0.046) < 0.05). These results suggest that the status of land ownership positively influence the decision to adopt OCP. This observation indicates that farmers with secure land tenure are more likely to adopt organic cotton production than those with insecure temporary land ownership arrangements. This was also consistent with FGD and KIIs results that small landholdings coupled with lack of permanently owned farmlands by most farmers constituted a hurdle to conversion and exercising loyalty to organic standards.

Based on the above argument, type of land ownership where most of the household's land is borrowed or rented presents existing and potential hurdle to effective implementation of certified organic agriculture. This is because the farming model requires a holistic approach in its implementation. For instance, household producing certified organic cotton must use organic strategies in all other farm-based enterprises including production of other crops (apart from cotton) and livestock. This argument is consistent with observations from similar studies conducted in India, Turkey and Benin (Eyhorn *et al*., 2005; Artukoglu, *et al*., 2009; Tovignan and Nuppenau, 2004).

Furthermore, the organic systems require that some physical investments be put in place like compositing facilities, FYM storage structures and elaborate crop rotation scheme, all of which require relatively large wholly owned lands preferably with legal title deeds.

4.1.9 Amount of family labour

Organic agriculture is known to be relatively more taxing compared to conventional farming. Therefore in this study, the focus was on the number of family members able to undertake regular farm operations rather than general household size. The study sought to analyze cotton producers in terms of amount of family labour force. The latter is of critical importance to smallholder farmers most of whom cannot afford costs for hiring extra labour for farm operations.

Table 10 displays respondents’ distribution based on amount of labour based on number of family members capable of executing regular farm operations as units of labour. Thus the number excluded all handicapped family members, small children, pupils who work during vacations and temporary family guests. Based on this index, the higher the number the higher the amount of labour a household possess.

Table 10: Number of family members capable of participating in farm operations (n=119)

Number	Conventional (n=60)		Organic (n=59)		Total	
	Freq	Percent	Freq	Percent	Freq	Percent
1	3	2.5	4	3.4	7	5.9
2	23	19.3	43	36.1	66	55.5
3	19	16.0	11	9.2	30	25.2
4	14	11.8	1	0.8	15	12.6
5	1	0.8	0	0.0	1	0.8
Total	**60**	**50.4**	**59**	**49.5**	**119**	**100**

From Table 11, it was revealed that the modal unit was 2 (66, 55.5 %), followed by 3 (30, 25.2 %). That is, most households had 2-3 family members capable of full-time participation in farm operations. Inspection of statistics in the Table 11 shows that organic respondents had more of families (36.1 %) with 2 units undertaking farm operations than conventional families (19.3 %). Also, conventional respondents had more families with 3, 4 and 5 units (16.0 %, 11.8 % and 0.8 % respectively) than organic respondents (9.2 %, 0.8 % and 0 % respectively).

Other results from a Pearson chi-square test showed that there was statistically significant association between amount of family labour of respondents and a choice between being a conventional or organic farmer (χ^2 = 20.60, df =4, p (0.000) <0.05). These results suggest that type of farmer (organic or conventional) is influenced by the amount of labor force that is available. It may however be stated that household labour force is inversely related to the decision to adopt OCP since the more labour becomes available the more farmers are likely to remain conventional.

From these results it can strikingly be seen that organic farmers had less labour force than conventional farmers. One would tenably think that given labour-intensive nature of organic agriculture those with more labour would have been attracted to organic cotton production as early adopters and early majority as in the case of other studies conducted in India and South Africa (Eyhorn *et al*., 2007; Eyhorn *et al*., 2005; Niemeyer and Lombard, 2003).

The observed picture could be explained by the fact that large family labour is associated with the polygamous tradition of *Sukuma* ethnic society. This is in turn is associated with all or either of possession of relatively large landholdings, large herds of livestock and other off-farm business ventures. The opportunistic proclivity of this social group is already explained in the foregoing (Sub-sections 4.1.6 and 4.1.7).

4.2 Assessment of the Marketing Availability for Organic Cotton

Many agricultural innovations from various developers at different stages in the innovation-decision process have suffered discontinuation due to failure of market and inequity among local and international actors. Smallholder farmers are particularly vulnerable to market vagaries as they are poorly informed, coupled with their inherently low bargaining powers. The only weapon left at their disposal is to shun all innovations they identify as not delivering their perceived relative advantage tag they initially attached to those innovations.

In realization of this fact, World Bank has recently introduced an ‘innovation systems concept’. The concept is defined as a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their behaviour and performance (World Bank, 2006). In a community of farmers, reliable markets for their produce and inputs are the core aspects in their livelihoods irrespective of geographical location and scale of production. Therefore, the interplay between and among local, national and international stakeholders (Appendix 2) has a significant bearing on the fate of organic cotton farming system in the study area.

In view of the above, assessment of the marketing arrangements for organic cotton in Meatu District was of prime importance. Understanding of the prevailed practices in the market provided insights into what opportunities and challenges there were in the district organic cotton industry. Major challenges would constitute constraints in the adoption of OCP system. To achieve this, respondents were asked to respond to various questions related to marketing of organic seed cotton (OSC).

4.2.1 Reliability of market for organic cotton

Market reliability is one of the drivers in the improved rate of adoption and diffusion of new technologies. It tries to answer one of the famous questions in the economics corpus ‘where to sell’?

Results displayed in Table 11 show that 96.6 % of ‘organic’ respondents remarked that market for organic cotton was very reliable while only 3.4 % thought the market was just moderately reliable. None queried issues related to absence of the market. This implies that market for OSC in the district was not a constraint for the program. For example 100 % of respondents maintained they sold all of their produce to BioRe. This result was consistent with marketing practices for contracted commodities (Bijman, 2008; Eaton and Shepherd, 2001). However, existence of a reliable market is indeed necessary but not sufficient condition for equitable exchanges. This is because there could be exploitation considering that farmers were not exposed to dynamics of market signals for 'real' prices for OSC and organic inputs.

Table 11: Reliability of market for organic cotton (n = 59)

Rating	Frequency	Percent
Very reliable	57	96.6
Moderately reliable	2	3.4
Not reliable	0	0
Total	**59**	**100.0**

4.2.2 Price fairness for inputs

Price is a value that will purchase a finite quantity, weight, or other measure of a good or service (Business dictionary). It is one of the most important concepts in the day to day exchanges of goods and services which have profound implications in marginal revenues in the business transactions. Unfortunately smallholder farmers in developing countries have for a longtime been double price takers, that is they take price for what they sell and also for what they buy. As such, most smallholders as a community find themselves chronically beset by unfavorable balance of trade through being made easy prey for unscrupulous local and multinational profit maximizing businesses.

In view of this backdrop, responses from respondents were elicited to find out their perceptions on the fairness of the price they were offered for organic inputs from the contracting firm. Responses are shown in Table 12.

Table 12: Respondents' opinion on the price fairness for organic inputs (n=59)

Rating	Frequency	Percent
Fair	0	0
Moderately fair	25	42.4
Unfair	34	57.6
Total	**59**	**100.0**

Table 12 indicates that 57.6 % of respondents were of the view that the price for organic inputs was unfair, 42.4 % considered it moderately fair where as none felt it was fair. Results from FGD and KIIs disclosed that organic cotton farmers enjoyed government subsidies on organic inputs alongside conventional farmers. The inputs included untreated cotton seed and part of organic pesticides.

The fact that there was no great divergence of opinions (42.4 % and 57.6 %) indicates that government subsidies could have significantly cushioned the impact of otherwise high inputs prices. This has policy implications, that government subsidies in agro-inputs are vitally important in enhancing farmers' incomes in the face of inequitable local and international market environments. Therefore scrapping subsidies would most obviously lead to organic inputs' prices evolving into a real and potential constraint in the adoption of OCP.

Heavy subsidies farmers in developed countries enjoy have lead to distortion of market forces to the detriment of poor farmers in developing countries particularly in SSA. For example Vasilikiotis (2000) points out that organic farmers in Europe and US are financially supported in order to ensure they remain economically buoyant while delivering public goods through reduced environmental consequences emanating from heavy usage of agrochemicals.

The above argument corresponds with observations that African cotton (OSC and CSC) is affected by subsidies paid by the USA, European Union and China that undermine world market prices (Linard, 2002; Goreux, 2003, Watkins, 2002 as cited by Ferrigno *et al*., 2005).

4.2.3 Marketing problems

Apart from transportation hurdles, bulky selling of agricultural produce presents some challenges with unprecedented cost implications to farmers. Respondents were asked to identify some of the problems they face in this regard. Results are recorded in Table 14.

Results in Table 14 show that 94.9 % of respondents maintained that lengthy procedures disconcerted them while 5.1 % mentioned late commencement of the buying season as an issue of concern. None reported of late payment.

Table 13: Problems Faced During Marketing of Organic Cotton (n = 59)

Problems	**Frequency**	**Percent**
Late buying	3	5.1
Lengthy procedures	56	94.9
Late payment	0	0
Total	**59**	**100.0**

The above observations show that certified organic systems are well organized in effecting timely payments to their clients. The lengthy procedures at the buying posts were most likely associated with strict inspections on registration status of farmers and quality of the crop before it was approved for payment based on the IFOAM basic standards. These procedures are common in all markets for certified organic commodities all over the world, not least cotton (Ton, 2007).

Based on the above findings, it can be indicated that stringent organic rules that are extended from on-field operations to selling the crop constitute a constraint in the adoption of OCP system.

4.2.4 Procurement procedures for organic inputs

Organic inputs are a keystone to organic agriculture in general. Based on the source of the inputs, we may categorize them into two types, namely internal and external inputs. The former are obtained within the farm or outside the farm but within small designated areas such as villages and wards in a given district (in Tanzania). They include materials like farmyard manure, compost manure, seed (intercrops, rotational crops, trap crops) and locally concocted botanical pesticides. The external type includes those that must be introduced from sources far outside the farming area. In cotton and particularly in the study area they include organically certified cotton seed, bio fertilizers, special insect traps, pheromone, and industrially prepared biocides.

During interview, all 59 respondents (100 %) admitted they purchased all inputs from BioRe on credit or cash depending on their own wishes. This implies that availability of organic inputs is not a constraint in the adoption of OCP system. However, KIIs and FGD results with a conventional farmer group revealed that some opportunistic farmers bought synthetic pesticides on their own conscious volition from sources other than BioRe to supplement ‘low-efficient’ organic inputs. This further implies that cheating in organic farming system is common particularly where and when internal control system (ICS) is lax. This observation concurs with that of Eyhorn *et al*. (2007) in a similar study conducted in India where it is alleged that significant number of farmers suffer expulsion for the program each season due to using unauthorized inputs. The same argument was advanced by key informants from BioRe.

4.3 Agronomic Practices for Organic Cotton Production

Agronomic practices for organic cotton are based on the organic farming systems approach as succinctly summarised in the generic formula embodied in equation 1 below.

Equation 1: Generic formula for organic farming systems approach

[Organic farming =(The use of locally adapted varieties) + (the reduction of nutrient losses) + (the use of locally available organic material and green manuring) + (a wide crop rotation) + (fostering natural balances) + (Natural pesticides) + (mechanical and manual weed control)] - [GMOs + synthetic inputs].

Source: Adapted from Van Elzakker, (1999) in Ferrigno and Lizzaraga (2009)

Agronomy of organic cotton involves an array of field practices which are to the extent possible free from any synthetic materials technically referred to as external inputs, while putting in to use recommended organic management strategies. Specific approved materials and practices may differ from country to country due to varying socio-cultural, physical, economic and technological setups. The difference arises from two major sources, namely type of materials and the relative intensity of use of a given material between and among countries.

BioRe management was responsible in ensuring compliance with all the organic practices by registered farmers. Major features of agronomic importance in the study area were identified through respondents' interviews, field and homesteads observations, KIIs and FGD.

4.3.1 Soil fertility management

Major strategies involved use of legumes as intercrops, farmyard manure and crop rotation. Main legumes included groundnuts, green gram, cowpeas and *bambara* groundnuts. Compost manure was used to a very limited extent. Other materials used in similar organic cotton production programs in Turkey and India (Artukoglu *et al*., 2009; Eyhorn *et al*, 2007; Eyhorn *et al*., 2007) such as green manure and biofertilizers were generally not in use in the study area. Cattle urine was applied to some extent. The urine was however not popular due to tediousness associated with collection, preparation and application. Another recommended practice was fallowing. The latter was hardly practiced due to the fact that land as an ecological footprint is increasingly becoming scarce, contrary to the previous popular belief that Meatu was a destination for people looking for farmlands and grazing expanses. Given the fact that natural mineral fertilizers are allowed (Eyhorn *et al*., 2005), Tanzania's renowned *minjingu* rock phosphate fertilizer could be used by organic cotton farmers.

4.3.2 Pest management strategies

i. Prevention techniques

They involve measures aimed at preventing insect pest population from reaching economic injury level (EIL). Specific measure included promotion of natural enemies, trap crops (sunflower), and removing crop residues from the field after harvesting. Above the EIL, economic threshold was reached and consequently botanicals and beneficial insects were used in attempts to keep pest population back to levels below EIL (direct control).

This procedure was similar to strategies used by farmers in other parts of the world, for example in India (Pujari *et al*., 2013; Eyorn *et al*., 2005).

ii. Direct control

They are applied when preventive measures are not effective in preventing pest populations from reaching economic threshold. Main specific measures included biological control and botanical insecticides (Appendix 5). Some specially prepared organic pesticides were sold to farmers on credit or cash.

iii. Diseases management

Farmers in the study area were lucky that they were not plagued by any serious diseases. This was in agreement with the argument that in most of the semi arid tropical regions, diseases are not a major problem in cotton production (Eyhorn *et al*., 2005). However few diseases were observed to occur sporadically. They included bacterial blight, root rot, boll rot and *fusarium* wilt. Specific measures included crop rotation, spraying with cattle urine, avoidance of infected seed and uprooting and burning of cotton stalks after harvesting. These strategies are across-the-board pest management practice under organic systems (Rozaq and Sofriani, 2009; Eyhorn *et al*., 2005).

In the study area, uprooting and burning of cotton stalks after harvesting was a law-enforced requirement for both organic and conventional farmers. The exercise was also efficient in controlling overwintering pest growth stages, for instance pupae. Implementation started in July through September every year. Government extension officers enforced the practice without regard to whether fields were organically or conventionally managed.

4.3.3 Weed management

Main strategies involved mechanical and cultural practices. Specific measures involved mechanical weeding, hand pulling, crop rotation and mulching. Other techniques involved leaving weed population in place when it is established that they cannot effectively compete with cotton crop. With the exception of mulching, other measures are more or less like those implemented by conventional farmers. Strikingly as a point of intersection, conventional farmers rotated cotton with cereal crops in order to break the life cycle of *striga*, a notorious weed in cereals.

4.3.4 Fencing of organic fields

Organic cotton fields were found to be intermingled with conventional cotton fields and other fields cropped with conventionally grown crops. Therefore, organic fields were, as a requirement, hedged in by other crops. The fencing crops were grown at the edge of organic fields bordering conventionally managed fields in order to reduce drift of pesticide sprays to organic fields. These crops are technically known as border crop and mainly included maize and sorghum.

4.3.5 Organic cotton seed

Contrary to the conventional cotton, seed for organic cotton had a separate chain of acquisition and distribution. BioRe Company contracted a specific ginner for its organic seed cotton as a requirement for organic cotton supply chain (Ton, 2007). Seed material was sourced from the ginning facility and distributed to farmers by the company management. Farmers were strictly prohibited to acquire seed materials from sources other than BioRe. This measure was meant to prevent farmers from using treated seed from conventional supply chain.

4.3.6 Comparison on labour requirements

Based on agronomic practices identified above, respondents were asked to provide their opinions based on their experience on how the two systems compared in terms of labour requirements. The researcher thought this might shed some light on the constraints to the adoption of organic cotton production system. Table 14 shows the results.

Table 14: Labour requirements between two systems (n=119)

Opinion	Convention (n=60)		Organic (n=59)		Total	
	Freq	%	Freq	%	N	%
Conventional cotton more laborious	0	0.0	0	0.0	0	0
Both have almost equal labour requirements	2	1.7	6	5.0	8	6.7
Organic cotton more laborious	58	48.7	53	44.5	111	93.3
Total	**60**	**50.4**	**59**	**49.5**	**119**	**100.0**

The results showed that 93.3 % of respondents were of the view that organic cotton was more laborious while 6.7 % observed that organic and conventional systems had almost the same labour requirements. Notwithstanding minor divergences in response between organic and conventional respondents, results imply that organic cotton was more demanding compared to conventional cotton production system. These results are acknowledged by most organic agriculture activists (Eyhorn *et al*., 2005, Lakhal *et al*., 2008; Ferrigno *et al*., 2005; Tegegne *et al*., 2001). This suggests that the demanding nature of organic agriculture could be one of the hurdles for its observed low take-up.

4.3.7 Adequacy of labour

Organic cotton was generally perceived as laborious based on the results in Table 15. However, in an attempt to avoid making foregone conclusion on the effect of labour-inflicted strain in the adoption of OCP, respondents were asked to give their opinions on the rate of labour adequacy with a focus on their experience on agronomy of organic cotton farming system. The Table 16 displays the opinions.

Table 15: Degree of adequacy of respondents' labour force (n=119)

Degree of adequacy	Conventional (n=60)		Organic (n=59)		Total	
	Freq	Percent	Freq	Percent	No	Percent
Adequate	1	0.8	2	1.7	3	2.5
Moderately adequate	14	11.8	13	10.9	27	22.7
Inadequate	45	37.8	44	37.0	89	74.8
Total	**60**	**50.4**	**59**	**49.6**	**119**	**100.0**

Table 15 shows that majority (74.8 %) of respondents conveyed that family labour was inadequate, 22.7 % remarked labour was moderately adequate while 2.5 % felt that labour was adequate. These results reflect the fact that family labour force has to be allocated among indispensably competing alternatives like other enterprises (apart from cotton) and manifold social commitments, including leisure time. Results from Tables 15 and 16 imply that labour intensiveness associated with OCP is one of the constraints in its adoption of OCP. Thus, labour and time saving technologies would most certainly improve adoption rate of OCP -*ceteris paribus.*

However, the rigors of labour shortage are felt differently across world organic systems. The shortage presents a serious hindrance to organic agriculture in parts of the world where socio-cultural and economic situations have rendered 'man-hour' very expensive. For example in a related study conducted in South Africa, Niemeyer and Lombard (2003) assert that increased workload is not a big problem in South Africa because labour is more readily and inexpensively available than in Europe or America, where labour is expensive. However, in the face of increasingly changing patterns in socio-cultural and economic relations towards modernity in developing countries, the real value of human labour can no longer be taken for granted.

4.3.8 Effectiveness of pest control strategies

As described in the agronomy of organic cotton, synthetic pesticides are generally strictly prohibited. Organic cotton farmers use organic strategies to control pests from reaching the economic injury level (EIL). This question was evaluated by organic respondents only since they had reliable experience on the organic strategies compared to conventional cotton growers. Respondents' opinions were given on the degree of efficacy of these strategies. Table 16 displays these results.

Table 16: Efficacy of organic strategies in pest management (n=59)

Opinion	**Frequency**	**Percent**
Effective	2	3.4
Moderately effective	15	25.4
Least effective	20	33.9
Not effective	22	37.3
Total	**59**	**100**

Based on the results, 37.3 % of respondents remarked that the strategies were not effective, 33.9 % said were least effective, 25.4% observed they were moderately effective while 3.4 % showed that they were effective. Taking cases of 'least effective' and 'not effective' (71.2 %), it implies that organic strategies were generally performing poorly compared to synthetic pesticides and consequently major pest populations could not be satisfactorily maintained below the EIL. This could therefore most certainly be one of the reasons for poor adoption of OCP in the study area.

This observation parallel results from studies on pest management using biological control agents and botanical pesticides which show 'mixed efficiency' conclusions. Although there is some degree of effectiveness, there however are reservations on full reliance on these strategies particularly for heavily attacked crops like cotton (Kühne, 2008; Mihale *et* *al*., 2009; Kennedy *et al*., 2000; Kpindou *et al*., 2013; Gupta and Dikshit, 2010; Patel *et al*., 2011).

4.3.9 Extension services providers

Extension services are known to be critically important in expediting the rate of adoption of agricultural innovations by farmers. Tanzania is among countries where pluralistic extension system is operating with clear involvement of public-private partnerships (Rutatora and Mattee, 2001). The study sought to identify extension services providers as this could have implications in the rate of adoption of organic cotton production system. The question was directed to organic farmers since they were the ones who received technical advice from the change agents. Responses are recorded in Table 17.

Table 17: Extension service providers (n=59)

Services providers	Frequency	Percent
District council extension officers only	0	0
Biore extension officers only	57	96.6
Both of them at different occasions	2	3.4
Total	**59**	**100.0**

Results from Table 17 indicate that 96.6 % of respondents asserted they received advice from BioRe extension officers (BEOs) only while 3.4 % of respondents remarked they were being served by District Council Extension Officers (DCEOs). None was attended by the DCEOs as the sole service providers. Results indicated that there was no public-private partnership in organic cotton industry. Two implications could be advanced. Firstly, it could be advantageous in that organic farmers were not receiving mixed messages. Secondly, it implies there could be lack of coordination of extension services in the district with consequent marginalization of the minority organic farmers. This was supported by

KIIs results by a revelation that there was no policy or plan in the district to foster organic programs. This scenario constitutes a constraint to the adoption of OCP.

To the contrary, results from related studies conducted in South Africa (Oladele and Tekena, 2010) and India (Yadav *et al*, 2013) indicate that public extension agents actively involved themselves in OA alongside private extension personnel. This is obviously one of the reasons for success in organic sector in other countries compared to Tanzania.

4.3.10 Frequency of extension services

Number of times in a given period a farmer gets contact with extension officer is one of the indicators of improved extension services delivery. Respondents provided their experiences in this regard as displayed in Table 18.

Table 18: Frequency of contacts with extension officers (n=59)

Extension visits	Frequency	Percent
Very frequently (every week)	4	6.8
Frequently (twice/month)	50	84.7
Infrequently (at least once/month)	5	8.5
Total	**59**	**100.0**

It was observed that 84.7 % of respondents were contacted with extension officers frequently, 8.5 % infrequently whereas 6.8 % were very frequently contacted. This is expected since organic farming systems are closely monitored by ICS for compliance of organic standards at least on weekly basis. On the basis of these observations, it implies that extension service is not a limiting factor to the adoption of organic cotton production paradigm.

However, frequent contacts alone are a necessary but not a sufficient criterion with which to judge on better extension services. Professionalism matters as well, among other factors. Observation shows that most of the BEOs are primary and secondary school leavers trained on an *ad hoc* basis. Based on this fact, there could be justifiable reasons to impugn their professional abilities. According to Din (2011), it is a truism that poor professionalism in the extension agency is one of the reasons for low take-up of improved agricultural technologies by farmers. This situation could, in part underlie the reason why productivity of organic cotton system is still low compared with conventional cotton system as experientially observed by farmers in the study area.

4.3.11 Knowledge of farmers on organic cotton agronomy

Certified organic systems are a rather novel crop production concept which requires a clear shift from traditional practices. The study explored degree to which farmers were well versed in organic agriculture principles and practices. They were asked to provide their opinions on how they rated themselves in terms of knowledge and skills in that regard. Results are shown in Table 19.

Table 19: Knowledge and skills rating in organic farming (n=59)

Rate of knowledge	Frequency	Percent
Very knowledgeable	45	76.3
Moderately knowledgeable	11	18.6
Not knowledgeable	3	5.1
Total	**59**	**100.0**

Surprisingly, 76.3 % of respondents conveyed that they were very knowledgeable. Others (18.6 %) remarked they were moderately knowledgeable while 5.1 % commented they were not knowledgeable. On the face value, one could be contented that there were no problems with farmers' knowledge and skills related to organic cotton farming. However a researcher was interested in respondents who remarked that they were very knowledgeable and hence did some probing.

For most respondents, organic farming was mainly construed as just to not spray with industrial chemicals, use of farmyard manure and planting sunflower (trap crop). But as Eyhorn *et al.* (2005) remarked, organic agriculture is much more than just avoiding spraying with synthetic chemicals and application of organic fertilizers (although these are one of the important pillars). It is also maintained that organic farming is a complex system that requires more research in attempts to push back the frontiers of knowldge in this discipline. Complexity of organic farming systems are widely described in OA literature (Ferrigno *et al*., 2005; Kimemia and Oyare, 2006). Nonetheless, elementary knowledge and skills the farmers have had in this area is, in fairness worth acknowledging.

4.4 Extent of Adoption of Organic Cotton Production Practices

4.4.1 General observations

Organic cotton production system was introduced in the Meatu District in 1994 at Ng'hoboko village as innovative project (Pattni, 2008). The project started with 25 innovators. After successfully gaining a foothold in this village the new cotton production system extended to Mwamishali village and thence to other villages with the passage of time.

Patterning the trajectory of the project on the Rogers' five steps innovation-decision process, it could be argued that the novel farming system has to some degree successfully moved through the lower steps of knowledge, persuasion and decision (Rogers, 2003).

This was because it was thought to rescue farmers who were experiencing problems related to chronically low seed cotton prices. It is however still at the implementation and confirmation steps despite 19 years of its existence.

Farmers who choose to convert had to first be registered and their farms inspected before being granted provisional approval. After at least 3 to 4 years farmers are granted full approval as certified organic cotton farmers if found to fully comply with organic standards. Extension services were provided by the BEOs (as noted earlier) who form the main part of an Internal Control System (ICS).

Organic cotton is produced under contract farming system. Farmers were constantly being evaluated for compliance with organic practices. Those who defaulted were immediately excluded from the list or served with a warning depending on the severity of the misconduct.

What has been witnessed for several years now is a situation where most cotton growers are losing interest with organic cotton despite premium price with which it is sold. This scenario could be learnt from farmers' behaviour. For example most farmers have not even tried to adopt the idea (*a passive rejection position*), others have abandoned the system and revert to conventional cotton production (*a disenchantment discontinuance decision*) or other crops like sunflower and green gram (*replacement a discontinuance decision*). Others were shying away from some recommended practices or resorted to a mixture of prohibited and recommended practices. This included doing a little spraying with synthetics in conjunction with botanicals, non-application of manure and non-adherence to rotational sequencing of crops (*reinvention of innovation*).

4.4.2 Time of awareness of organic cotton in the study area

The time dimension is one of the important elements in the innovation-diffusion process, adopter categorization, and evaluation of rate of adoptions (Rogers, 2003). Other elements include innovation itself, social system and communication channels. Time of innovation awareness brings to light the ‘knowledge stage’ in the introduction of organic cotton production system. After the innovation has been developed, it has to be transferred to a given social system through some communication channels and take some time lag for adoption and diffusion. In this case the social system was farmers in the Meatu District.

The time farmers became aware of the cotton production system was important because it marked the start of the adoption and diffusion process of OCP.

Results are presented in Table 20.

Table 20: Awareness of organic cotton production system (n = 119)

Time	Frequency	Percent
Long time ago (more than 10 yrs ago)	92	77.3
Relatively long time ago (5-10 yrs ago)	21	17.6
Only recently (less than 5 yrs ago)	6	5.1
Total	**119**	**100**

From Table 20, it was revealed that 77.3 % of respondents became aware of the system in more than 10 years ago, 17.6 % knew of the system at least five years ago while 5.1 % of respondents remarked to have come across the idea less than five years. Probably the last case involved new entrants. From the statistics it could be argued that farmers in the district became aware of the new cotton production system relatively long enough. This was in line with the literature which indicates the actual time OCP was introduced in the district (that is 1994).

4.4.3 Time farmers converted to organic cotton production

Time lag between awareness of innovation and its eventual adoption presents some important implications. Short time lag is associated with innovation being perceived as more advantageous, trialable, compatible, simple and yielding more obvious results within perceived short time. Conversely, relatively long time lag presents the opposite. Additionally, there could be issues with what Rogers (2003) refers as 'prior conditions' and 'characteristics of decision making unit'.

Time lag in the adoption studies help in the evaluation of the rate of adoption of a given innovation. Table 21 displays the groupings of respondents among response alternatives.

Table 21: Time of conversion to organic cotton production (n=59)

Time category	Frequency	Percent
Long time (more than 10 yrs ago	41.0	69.5
Relatively long time (5-10 yrs ago)	16.0	27.1
Recently (less than 5 yrs ago)	2.0	3.4
Total	**59.0**	**100.0**

From Table 22, it was found 69.5 % of respondents had converted more than ten years ago, 27.1 % converted at least five years ago while 3.4 % converted in less than five years ago. This observation shows that number of farmers converting to organic cotton became small with the passage of time. Given the time lapse and the current situation of the industry, one may assert that there could be adoption hurdles somewhere.

4.4.4 Motivation to conversion

Different motivations were responsible for the decision of the organic farmers to convert to organic farming (Niemeyerand and Lombard, 2003). The farmers were asked to rate different motivational factors according to their importance during the decision process. Table 22 displays the outcome of these ratings.

Table 22: Motivation factors to conversion (n = 59)

Reason	Frequency	Percent
Financial profitability	55	93.2
Need to avoid health hazards	3	5.1
Reliable markets for seed cotton	1	1.7
Total	**59**	**100.0**

As displayed in Table 22, 93.2 % of respondents mentioned financial profitability as the main driver of shifting to organic cotton, 5.1 % mentioned need to avoid health hazards whereas 1.7 % were driven by reliable markets for their crop. From the results, most farmers converted for reasons of getting more income. This is consistent with the argument by Tovignan and Nuppenau (2004) that among reasons justifying adoption of organic cotton, environmental reasons do not get much attention from farmers contrary to the common perception among development agencies that promote this technology.

These results were both consistent with and different from those obtained in other related studies. Results from similar studies conducted in Turkey, Mali, India and Benin show that farmers were motivated by economic reasons in shifting from conventional to organic cotton (Lakhal *et al*., 2008; Eyhorn *et al*., 2005; Tovignan and Nuppena, 2004; Artukoglu *et al*., 2009). Results in a research study conducted in South Africa shows that protecting the environment and improving the soil fertility were the two major driving forces in the decision to adopt organic farming systems (Niemeyerand and Lombard, 2003).

There also was a need to understand reasons posited by some farmers who were still hesitant to convert or rejected the idea altogether. Relating motives to either convert or remain conventional was thought to deepen insights into the limitation of adoption of organic cotton production in the district. Responses were collected from conventional cotton respondents. Responses are shown in Table 23.

Table 23: Reasons for not converting (n = 60)

Reasons	Frequency	Percent
Not certain with the market	0	0
Low production with organic cotton	57	95.0
Being bound up to only one buyer	3	5.0
Total	**60**	**100.0**

From Table 23 above, 95.0 % of respondent remarked low production was the reason for them not to convert, 5.0 % while feared lack of market competition. None expressed uncertainty with the market.

Results show most farmers who did not want to convert feared low production associated with organic cotton system while existence of the market for organic seed cotton was not an issue of concern for them. This implies low productivity of OSC was one of the constraints in the adoption of OCP. Other studies show almost similar results. For example Tovignan and Nuppenau (2004) point out that non-adopters of OCP advance low yield, lack of information and regulatory requirements they cannot fulfill as reasons.

4.4.5 Awareness of health hazards

Apart from environmental concerns, another main talking point for most proponents of organic agriculture is the potential of pesticides for poisoning humans along supply chain for conventional agricultural products. This presents a dire situation for occupational hazards coupled with suicides (fatalistic, anomic or egoistic suicides) (Artukoglu *et al*., 2009). Furthermore, it is observed that the brunt of chemical load is borne by smallholder farmers most of whom live in African countries and parts of Asia (Khan, 2011; Tovignan *et al*., 2001; Sanfilippo and Perschau, 2008).

The aim of this part was to ascertain whether farmers in the study area were aware of health hazards associated with agrochemicals and whether they ever implemented any strategies to mitigate the problem. Respondents' opinions were elicited using a yes (aware) and no (not aware) question. Out of 60 conventional respondents, 98.3 % said they were aware of the hazards caused by pesticides. Surprisingly, one respondent (1.7 %) maintained he did not know whether chemicals had bad effects to human health. Results from Table 24 show that 78.3 % of respondents did not use any precautionary measure while 20 % at least took some measures.

Table 24: Type of precautionary measures used (n= 60)

Response type	Frequency	Percent
Not aware*	1	1.7
No any specific measures taken	47	78.3
Wearing protective gears (e.g. *gumboots, gloves, overalls, face masks*).	12	20.0
Total	**60**	**100.0**

** One respondent was not aware of the hazards; hence this question was irrelevant to him*

From these observations it can be deduced that farmers are aware of pesticides-inflicted health hazards but do nothing to protect themselves. This observation was supported by personal observation where empty pesticide cans/bottles were re-used in households for various purposes, such as containers for various valuable home items instead of proper disposal.

Furthermore, these result support claims by Sanfilippo and Perschau (2008) that pesticide poisonings are a fact in cotton producers lives and are often taken for granted by farmers in developing countries. Other studies in Zimbabwe show that many farm workers are suffering insidiously from agrochemical (Magauzi *et al*., 2011). Our farmers too are highly exposed to risks of occupational health problems.

In Tanzania, paucity of data on human poisoning from agrochemicals due, among other factors, to low capacity for diagnosis and national focus may trivialize the issue. Instead, this should be taken as a policy issue. Since we cannot go organic overnight, it is recommended that intensive health education and training of farmers on proper use and disposal of agrochemicals be periodically carried out. Also, provision of adequate and proper personal protective equipment as mitigation measures to this problem should be arranged and facilitated.

4.4.6 Organic cotton productivity

The inherent relative advantage of organic over conventional cotton seems to play a critical role in the adoption of OCP. Organic respondents were asked to compare the two systems based on their experience. Two parameters were used, namely productivity before and after conversion and financial profitability. Results on the perception of respondents are shown in Tables 25 and 26.

Table 25: Productivity before and after conversion (n=59)

Experience	Frequency	Percent
Production high after conversion	0	0
Production low after conversion	50	84.7
Almost no difference before and after conversion	9	15.3
Total	**59**	**100.0**

From Table 25, 84.7 % of respondents remarked that production was low after conversion, 15.3 % remarked production was almost equal whereas none observed a higher production after conversion. It is therefore obvious that conversion is associated lowered productivity and production. However rigorous quantitative studies need to conducted to empirically find out productivity variance between organic and conventional cotton production systems.

Furthermore, lowered production after conversion was consistent with many studies particularly during first three years of conversion (Ehorn *et al*., 2005; Eyhorn *et al*., 2007; Lakhal *et al*., 2008; Artukoglu *et al*., 2009; Tovignan and Nuppenau, 2004; Ferrigno *et al*., 2005). Major reason is that soils and the whole farm ecosystem must have time to build up before they can support crops at higher yield levels comparable to conventional farms.

However the observed low yields for farmers who converted long time ago was an indication that farmers were perhaps not adhering to organic standards and rules, the latter being relatively too demanding. Other reasons could be associated with low technical and managerial capacities of the contracting firm (BioRe) through its extension personnel as highlighted in sub section 4.3.10.

4.4.7 Financial profitability of organic cotton

As noted earlier, financial profitability is a key attribute of innovations with a decisive influence on the uptake of new ideas perceived as superior. Thus an innovation which results into improved financial income of farmers in terms of gross margin is generally likely to be widely adopted. Specific strategies to improve income under organic farming settings are described in the equation 2 below.

Equation 2: Strategies to improve financial income in organic systems

Income = [Yield (kg) x Price (Tshs/kg) x Risk factor] – Production cost (Tshs)

Yield (kg)	Price (Tshs/kg)	Risk factor	Production cost (Tshs)
-Improved extension services - Use of appropriate organic inputs (e.g. varieties, fertilizers, quality seed).	-Target organic price premium. -Effective certification processes.	-Reduce pest attack. -Reduce moisture stress. -Ensure reliable markets.	-Optimum use of organic inputs. -Efficient use of organic inputs.

Respondents' opinion on the profitability of organic cotton was sought in order to furnish more insights into the overall perceived economic worth of organic over conventional seed cotton. Results are displayed in Table 26.

Table 26: Opinion on financial profitability (n=59)

Opinion	Frequency	Percent
Organic cotton more profitable	25	42.4
Conventional cotton more profitable	27	45.8
Organic and conventional cotton almost equal in profitability	7	11.9
Total	**59**	**100**

From Table 26, 45.8 % of respondents expressed that conventional cotton was more profitable, 42.4 % expressed organic cotton was more profitable while 11.9 % were of the view that profitability between the two systems was almost equal.

These findings could imply that the 20 % premium price offered to farmers did not adequately cover losses due mainly to pests and the perceived drudgery. Another reason could be associated with relatively low efficiency of organic pest management and soil fertility strategies, leading to quantitative and qualitative losses of the crop.

The most striking part of results is in Table 26 where nearly a half (45.8 %) of organic respondents maintained that conventional cotton was more profitable compared to organic cotton. The researcher wanted to know why they continued to produce organic cotton while it lacked relative financial advantage. Probing did not yield any meaningful reasons.

However, key informants helped unravel the situation on condition of anonymity. It was alleged that some farmers were not honest as they secretly sprayed their cotton with synthetic pesticides with or without connivance of extension officers. They thus got ‘super profit’ through increased yield (lowered pest load) and a premium price. Therefore remaining organic under those circumstances was more profitable than being a conventional farmer. It was also mentioned that BioRe Company relaxed prohibitively stringent rules in order to reduce number of dropouts and motives for defaulting.

4.4.7 Future plan for improvement of organic cotton

Getting respondents’ views on the future plan of organic cotton production was vitally important in shedding light on the direction of the enterprise. It was thought to help BioRe and other stakeholders formulate strategies for further improvement of the situation. Results are delineated in Table 27.

Table 27: Future plan in organic cotton production (n=59)

Plans	Frequency	Percent
To maintain current production level	32	54.2
To reduce production	9	15.3
To increase production	11	18.6
To revert to conventional cotton production	7	11.9
Total	**59**	**100**

Results show that 54.2 % of respondents planned to maintain the current level of production, 15.3 % planned to reduce production, and 18.6 % wanted to increase production whereas 11.9 % planned to go back to conventional cotton. These results imply that farmers are not convinced by the relative advantage associated with OCP, which in turn signify that there are real and potential constraints that need to be identified and addressed.

These results are to some extent comparable to those obtained in similar studies. For example results from a study conducted in Turkey show that, majority (64 %) of respondents stated that they would not change the organic cotton planting area, 24 % of them did not decide about the size of the area, 8 % of them maintained would increase production and the rest said they would decrease the area in the next season (Artukoglu *et al*., 2009).

4.5 Main Factors Limiting Adoption of Organic Cotton Production Practices

Reliability and validity is of critical importance in research studies as they determine the overall relative worth of the findings. In support of this fact, Patton (2002) states that validity and reliability are two factors which any qualitative researcher should be concerned about while designing a study, analyzing results and judging the quality of the study. Also, Newing (2011) and Nyanga *et al*. (2011) argue in favour of providing a check for consistency in farmers' responses and perceptions in accordance with the requirement of ensuring credibility of results.

In view of the above facts, special questions were included in the questionnaire in an attempt to establish consistency of respondents' responses. The main aim of this specific objective was to correctly identify factors limiting adoption of organic cotton farming system in the study area through triangulation of responses and perception volunteered by respondents, members of FGD and key informants across the four specific objectives (4.1, 4.2, 4.3 and 4.4) already covered.

To achieve the above aims, respondents were asked to rate several predetermined factors or reasons for poor adoption of organic cotton production (OCP). Responses were rated as ‘strongly limiting’ (factors that were considered by respondents as having the greatest influence in preventing them from converting to OCP system), ‘moderately limiting’ (factors that were considered by respondents as having relatively little influence in preventing them from converting to OCP system) and ‘least limiting’ (factors whose influence in preventing respondents from converting to OCP system was insignificant).

As a rule in this study, a factor was considered as ‘a constraint’ if it scored more than 50 % (i.e. 50 % exclusive) at ‘strongly limiting’ option. Distribution of respondents based on predetermined limiting factors is presented in Table 28 in the order of importance based on the magnitude of frequencies and percentages. Only the significant constraints in the adoption of OCP are discussed.

Table 28: Constraints in the adoption of organic cotton production practices (n= 119)

S/N	Constraints	Freq	Percent
1	Price of organic seed cotton.	112	94.1*
2	Stringent organic farming rules.	106	89.1*
3	Large crop losses due to pests.	105	88.2*
4	Little involvement of political leaders and District Officials.	102	85.7*
5	High quality standards before certification.	95	79.8*
6	Labour intensity.	79	79.0*
7	Lack of marketing competition.	82	68.9*
8	High prices for organic inputs.	57	47.9**
9	Lack of transparency in setting price for OSC.	38	31.9**
10	Lack of information on health hazards associated with pesticides.	36	30.3**
11	Lack of Association for organic Farmers.	24	20.2**

* Significant constraints to the adoption of OCP based on the pre-set rule

** Insignificant constraints based on the of OCP based on the pre-set rule

4.5.1 Price of organic seed cotton

Chronically low price for seed cotton has long been the major hurdle to cotton producers in the country in general, and in Meatu District in particular. Introduction of OCP system in 1994 was thought to be a landmark breakthrough to the economies of cotton farmers in the district, given the organic premium price (OPP) attached to it. This was the major reason for some farmers converting to OCP model as revealed during interview sessions. However, experience of farmers with organic cotton production has largely proved to the contrary.

Furthermore, OPP for organic seed cotton (OSC) is benchmarked on market price for conventional seed cotton (CSC) which is constantly subjected to world market price vagaries (ITC, 2013). In this way, the traditional 20 % above the prevailing market price offered by BioRe (T) Co. Ltd to OSC does not normally result into attractive price differences when compared with CSC, given losses from pests attack.

As previously noted, farmers were converting in order to make more profits from the OPP. Using their experiential knowledge, farmers tend to act as rational managers for their enterprises. In their analysis they have found that the level of OPP does not meet their objective.

It is known that OPP is the main driver of organic agriculture all over the world. Experiences from other countries show that farmers are offered with relatively higher OPPs in order to attract them into converting from conventional to organic systems. The actual rate varies from country to country and among regions of the world. However, a range of 20 – 100 % for OSC is common (Mygdakos *et al*., 2007).

4.5.2 Stringent rules

Organic farming does not mean simply replacing chemical fertilizers and pesticides with organic manures and botanical pesticide sprays. Therefore organic cotton farming means re-thinking the entire farming system. A system means that all elements (e.g. soil, crops, animals, the farmer, markets etc.) are connected with each other (Gibson *et al*., 2007; Eyhorn *et al*., 2005). In this backdrop, organic cotton must be grown in a diverse and balanced farming system that also includes other crops and livestock.

For example, an organic cotton farmer must also organically produce other crops (e.g. sorghum, maize, vegetables) even if they are not certified as organic and sold at a premium price. Furthermore, the farmer must also ensure no synthetic pesticides are applied to his/her livestock. During FGD several cases were mentioned where some farmers' contracts were terminated by just being found with *knapsack* sprayers meant for spraying *acaricide* on livestock to prevent tick-borne diseases.

This principle constitutes the foundation of strictly codified procedures that must be adhered to, if the product is to be produced and certified as organic. Day to day enforcement of these rules was done by an internal control system (ICS). In Meatu District the ICS involved BioRe Extension Officers (BEOs) who conducted scheduled field visits for both advisory and supervisory missions.

Some practices proved to be cumbersome to farmers as revealed in FGD and KIIs. For example farmers who owned small landholdings, found it difficult to implement crop rotation scheme compared with those who had relatively large own farmlands. This was also the case with those with hired and borrowed land (or combination of the two).

4.5.3 Large crop losses due to pests

As noted earlier, the cotton crop is attacked by many insects and mites. It is estimated that about 20-50% loss of cotton crop is occurring annually in the tropical region due to different pests of cotton (Mallah and Korejo, 2007; Hasan *et al*., 2007; Kpindou *et al*., 2013; Mwangulumba *et al*., 2010).

As it is understood by all cotton farmers, the crop's economic value hinges on the number and size of bolls which are derivatives of 'squares'. All insect pest species which target these fruiting bodies (the bollworms) are conferred on them the status of major pests. As is the case with cotton growers around the world, field observations and farmers own experience in the study area identified *Helicoverpa armigera* (American bollworm) as a leading real and potential danger in cotton production. This observation is also in agreement with many researchers who assert that *H. armigera* is by far the most damaging species in cotton production (Pearson and Darling, 1958; Vaissayre and Cauquil, 2000; Silvie *et al*., 2001; Torres-Vila *et al*., 2002 as cited by Kpindou *et al*., 2013).

Another equally important pest was *Dysdercus spp* (cotton stainer). Contrary to what was observed in the study area, in other parts of the world the pest was regarded as inconsequential in organic farming systems (Eyhorn *et al*., 2005). The pest was implicated in the qualitative rather than quantitative loss associated with *H. armigera*. Its impact was felt later after the bolls burst open to release protruding woolly material before it was picked as seed cotton. The pest discolored (the otherwise whitish) seed cotton by imparting it with yellowish to reddish-brown tinges which virtually faced zero tolerance during organic certification and approval exercise at buying posts.

Farmers' observations in Meatu District on cotton losses were on average consistent with the above estimates. However, in cases where the crop was not sprayed with synthetic pesticides losses of up to 70 % in some fields were reported particularly in Northern agro ecological Zone which mainly covers Kisesa Divison. This was the main reason why BioRe concentrated its project in the Central and Southern agro ecological Zones which cover Kimali and Nyalanja Divisions respectively. This area experiences relatively low average amount of rainfall per annum (≤ 800 mm) and consequently low pest load compared to Kisesa Division (> 800 mm/annum).

In Meatu District, the two insect pests, namely *H. armigera* and *Desdercus spp* were commonly used as a benchmark against which to judge the relative efficacy of organic agriculture-compatible pest management methods like botanical pesticides, bio- pesticides, crop rotations and trap crops. Information drawn from farmers' own evaluation through interview, FGD and KIIs converged to the conclusion that these strategies did not deter the pests from inflicting significant damages to the crop.

During FGD some members even went ahead joking that '*the more we sprayed our fields with botanicals, the more the pests got fat*'. However, this conclusion should at best remain provisional since this study was more of exploratory than rigorous quantitative hypothesis testing study. There could also be some confounding and intervening variables (Duvel, 1991; Msuya, 2007) that were beyond the purview of this study.

As noted earlier, it was the inefficiency of organic pest management strategies that made farmers develop opportunistic behaviour of cheating by spraying their fields with synthetic pesticides. This suggests that in the event of weak ICS, most registered organic farmers will end up becoming 'quasi organic farmers' targeting OPP or reverting to conventional cotton production (CCP).

Another aspect of stringent rules was associated with the time when a farmer became eligible for OPP. Based on FGD and KIIs, newly registered farmers in the study area had to pass through a transition period of at least 3 years. During this period farmers were required to fully manage their fields organically. In this period, OSC was bought at a normal market price like CSC, that is without OPP. For a farmer who needs fast-track options for economic benefits would definitely find this procedure prohibitive. This procedure is common in all organic farming settings around the world (Forster *et al.*, 2013; Ton, 2007; Eyhorn *et al.*, 2005; Eyhorn *et al.*, 2007).

4.5.4 Involvement of political leaders and other district officials

In a community, those who usually provide advice and information to other people and maintain high levels of credibility are usually referred to as opinion leaders. On the other hand, a change agent is "an individual who influences clients' innovation-decisions in a direction deemed desirable by a change agency" (Rogers 1995). The involvement of opinion leaders increases the credibility of innovations because these opinion leaders convince their peers to adopt appropriate innovations. In addition, innovations that are validated by an opinion leader acquire local sponsorship and sanction (Rogers, 2003). According to Oleas *et al*. (2010), diffusion of innovations through opinion leaders promotes the active participation of local farmers and validates the innovation through time.

In the study area, most important opinion leaders who are embodied in the political mainstream are the Councilors (37), Village chairpersons (100) and Members of Parliament (2). Others are political parties leaders, particularly *Chama cha Mapinduzi* (CCM) and *Chama cha Demakrasia na Maendeleo* (CHADEMA). By virtual of the political sway they wield, their active involvement would have significantly catalysed the diffusion and adoption process geared to making more farmers converting to OCP.

To the contrary, information gathered from personal observation, FGD, KIIs and interviews with respondents showed that most 'opinion leaders' supported conventional cotton production which is undertaken by over 25 000 farmers in Meatu District. They did not do so by direct campaigning but through the way they normally became aggressive in asserting for conventional farmers' rights. For example they ensured conventional farmers in their areas of action or representation were supplied with right the quantities of synthetic inputs (pesticides and treated cotton seed) at the right quality and time in every farming season.

The district officials responsible for agricultural development to a large part involved District Council Extension Officers (DCEOs) under the command of the District

Executive Director (DED). Based on the information from three sources mentioned above, DCEOs seemed to have divorced themselves from organic cotton farming system. The program was considered the sole responsibility of BioRe. Just like political leaders, DCEOs ensured all conventional farmers got the required quantities of synthetic insecticides and treated seed in every cropping season. They also were busy implementing national strategy to improve cotton productivity as enshrined in Kilimo Kwanza resolution (pillar No. 4 sub-section 4.2) through increased use of synthetic inputs like pesticides and inorganic fertilizers, among other strategies.

To further motivate production of conventional at the expense of organic cotton, there normally is an arrangement to award best cotton producers. Awards presentations are conducted annually during the National Farmers' Day, popularly known as Nane Nane. All cotton growers in the district are eligible candidates for the award contest. The main criteria include having a cotton field planted with cotton crop only (*monoculture*), plants in rows with the right spacing (45 x 90 cm), evidence of application of organic manure e.g. FYM (inorganic fertilizers are added advantage), well maintained bolls through mainly synthetic pesticides and a clean field (i.e. with as few weed plants and insect counts as possible). With the exception of organic manures and row planting, the rest are not allowed in organic farming.

There are also instances where BioRe extension officers (BEOs) and DCEOs have worked at cross purposes. This was evidenced by instances where farmers were served with conflicting messages on the same subject. For instance in the FGD it was alleged that DCEOs directed livestock keepers to dip their livestock in a program geared to preventing tick borne diseases while BEOs maintained *acaricide* could not be allowed for their clients since it was a synthetic product. BioRe finally promised to supply its farmers with botanical pesticides which were claimed to have effects comparable to *acaricide* so as to end the protracted professional wrangle.

In view of the above, little involvement of political leaders and other responsible government officers in promoting OCP was really one of the obstacles to adoption of organic cotton in the study area.

4.5.5 High quality standards

As defined earlier, organic cotton is cotton that originates from organic agriculture. Agricultural production is considered ‘organic’ when it has been certified ‘organic’ by independent inspection and certification bodies according to the rules and regulations that apply in that particular country, region, or envisaged consumer market (Ton, 2007; Lakha *et al*., 2008; Eyhorn *et al*., 2005).

In order to distinguish cotton originating from certified organic farms from conventional cotton, market players will consider cotton ‘organic’ only if the seed cotton was produced on certified organic farms and processed in certified organic ginning mills. Certification by third parties is generally requested in order to back up producers’ organic claims, and to strengthen trust between the supplier and the buyer (Ton, 2007).

To meet these standards, each level of the organic cotton supply chain has to meet certain level of quality standards before the product is passed to the next upper level in the value chain. The first level of stakeholders in the downstream consisted of producers who were in essence the registered organic cotton farmers in the study area.

Results from interviews with respondents, key informants and FGD showed that organic standards were too high for farmers to adhere and still optimize their incomes. For instance fields must first be inspected and approved for suitability in production of organic cotton on the basis of pre-set minimum standards. Fields were being periodically inspected and evaluated by BEOs to ensure all minimum standards were met from sowing to harvesting. This implied that organic farmers had to face full rigors of implementation of trans-national organic standards for quality control, assurance and traceability. Inspection and certification costs were fully borne by BioRe, although most probably this could have implications on the final price for OSC and organic inputs as a ‘stealth tax’.

In view of the above, grading of OSC after harvesting was far very strict compared to CSC. Traditionally, after harvesting, seed cotton is graded in two groups (grades). Grade A consists of clean and white seed cotton. This is described as seed cotton with almost no visible tinges, specks, soil particles, trashes (e.g. from dried leaves and twigs) and not tangled up with any foreign material. All these are referred to as ‘contaminants’. Grade B consists of seed cotton where some level of contamination is allowed.

These grades mandatorily exist for both conventional and organic seed cotton. But in the buying posts, only grade A was bought from farmers. There were no official markets for Grade B seed cotton. In many instances farmers are left with their product (Grade B) to find their own ways and outlets for disposal.

Results from FGD show that main outlets for this crop category included purchase by local small entrepreneurs who used the low-grade crop for making mattresses sold at local markets. Other channel involved selling the crop to livestock traders who fed the same to the trading stock as a fattening procedure before the latter was taken to the tertiary livestock markets mainly in Mwanza, Arusha and Dar es Salaam cities.

Due to competitive environment, buyers for conventional cotton had some tolerance to a certain degree of contamination compared to BioRe, the sole buyer for OSC. Thus, a farmer could mix large part of CSC Grade B with Grade A and still sell his/her crop. Giving an example during one session of FGD one participant remarked "*in conventional cotton buying post you may have a bale weighing 100 kg, but if you take the same bale to BioRe you may end up with only 40-50 kg due to sorting*". So, farmers thought they were losing a lot, considering that most contaminants were due to pests' damage caused by non-use of 'efficient' synthetic pesticides.

4.5.6 Labour intensity

Labour intensity was related to agronomic practices specific to organic agriculture. The arduousness associated with organic practices posed a threat to the adoption of OCP system. Specific activities that absorbed much labour included:

i) Compost making

Specific tasks involved collection, transportation and decomposition of plant *biomas* for preparation of compost manure. The procedure involved also digging of the decomposition pits and compost storage structures.

ii) Application of FYM

Specific tasks involved collection of the halfway decomposed material from the livestock kraals (locally known as *lukutu*), transportation and spreading of the same on the fields. Sometimes materials needed to be heaped and decomposed thoroughly before application. High labour consumption in management of FYM was one of the reasons for its poor adoption as a soil fertility improvement strategy according to a study conducted in Southern parts of Ludewa District in Tanzania (Haule *et al*, 2013)

iii) Preparation of botanical pesticides

Botanical pesticides are plant extracts that are variously extracted and prepared before spraying to plants. Plant species with pesticidal qualities may be used singly or in mixture to improve synergy-based efficacy (Eyhorn *et al*., 2005). For example in the study area farmers used to prepared neem (*Azardracta indica*) spray. In Tanzania this plant is popularly known as *mwarobaini*. It involved picking of the seed from the tree and removal of hard outer coat from the seed to extract kernels. A certain amount of kernels (e.g. 30 kg) was pounded, soaked in water overnight, filtered and sprayed to the cotton plants.

iv) Monitoring pests

Monitoring pest infestation based on the concept of economic thresholds with the help of a peg board. The exercise is known as scouting and starts four weeks after planting. This helps farmers make rational decision on whether or not to spray. In this exercise, farmers inspected cotton plants that were randomly selected while crossing the field in diagonals. Economic threshold levels are already established for some important pest species and available to the farmers through BEOs.

v) Mechanical reduction of pest load

This was another strategy advised to farmers. It involved hand picking and crushing of the pests in order to reduce their number, thereby reducing damage. It was found to take extra time and energy to execute. Additionally, this exercise presented a disgusting view and a nauseous sensation to some farmers.

vi) Row planting

Traditionally, to most farmers in Simiyu and Shinyanga regions the software component of technology (Rogers, 2003; Singh and Mishra, 2007) related to maintenance of plant population for improved productivity is yet to be popular. Farmers considered row planting as wastage of time and meager labour. As such, they have since long adopted broadcasting of seed materials as a labour and time saving technology. Row planting is one of BioRe's recommendations to its organic farmers.

4.5.7 Lack of marketing competition

Generally, markets for organic products all over the world are dominated by vertical integration arrangements which are underpinned by contract production and marketing (CPM). The CPM refers to an arrangement in which a firm commit itself to purchase a commodity from a producer at a price formula established in advance of the purchase (Boland and Barton, 2002; Eaton and Shepherd, 2001). In principle, contracts are beneficial to both the processors and producers. Most often processors are *contractors* (BioRe) while producers are *contractees* (organic farmers in the study area). Contractors formulate terms and offer those terms to *contractees* with limited sovereignty of primary producers in dictating terms of transactions.

However, one of the risk factors in contracting is that as producers commit higher percentages of their production to vertical coordination, and hence reduce the liquidity associated with the crop ownership. Furthermore if the price become quality-based (as is the case with organic products), quality risk is transferred to the producers as opposed to open market setups where such risks would have been borne by processors themselves. This leads to questions as to whether or not producers realize more total value in their produce in contract farming arrangements (Boland and Barton, 2002).

Conventional cotton market in the Meatu District presented a form of competitive market setup in which case many buyers 'tussled and jostled' for CSC. For example in cotton buying season 2013/14 there were 21 buying firms. In the attempts to safeguard farmers' interests, Meatu District council in collaboration with the central government prevented the firms from forming a cartel thereby reducing possibility of interfering with market forces in dictating prices.

Furthermore, the District Commissioner (DC) in collaboration with the Meatu District Council (MDC) took full responsibility to ensure contracts between conventional cotton farmers and buying firms were based on equity. For example a case was mentioned in FGD whereby in the farming season 2010/11, all contracts between farmers and cotton buyers were cancelled on grounds that they were more skewed towards the interests of the firms.

On the contrary, market for OSC bore all the hallmarks of pure monopoly business in that there was only one buyer in the district (BioRe Co. Ltd). This situation was similar to standards-based monopoly described by MacGowan (1999) because organic cotton was produced under specific standards specified by specific buyer, hence a barrier to new entrants in the market arena. Additionally, MDC and DC did not normally interfere with contractual agreements between organic cotton farmers and BioRe. This implies organic farmers enjoyed relatively less attention from the government compared to conventional farmers.

This observation was also found in Benin where organic cotton farmers did not have access to official credit system that was reserved for conventional farmers who used their association as guarantee. Organic farmers even in association counted only on informal credit (with high interest rate) and their off-farm income to finance farming activities (Tovignan and Nuppenau, 2004).

According to results from FGD and KIIs, in some seasons price for CSC was too volatile that BioRe was sometimes failing to capture the exact highest price in the market on which to peg its 20 % premium. In such instances some conventional farmers sold their crop at prices comparable to OSC.

Although price for organic seed cotton remained generally higher on average compared to that for conventional seed cotton, still farmers seemed to be skeptical on whether they were actually being equitably paid in the absence of rivals. They also thought the premium price could most likely not adequately cover financial value of crop losses due to pests and quantities sorted out during grading. Their concern parallel one of the potential challenges of contract farming that sponsoring companies may be unreliable or exploit a monopoly position (Eaton and Shepherd, 2001).

From the study findings, it can be seen that major constraints limiting the rate of adoption and diffusion of OCP included low price of organic seed cotton, stringent rules associated with organic agriculture and little involvement of political leaders and other district officials (technical and administrative officials). Other constraints were high minimum quality standards before certification of organic fields and organic seed cotton thereof, high labour requirements, lack of marketing competition and large crop losses due to pest infestation. Identification and subsequent assessment of these constraints constituted the main objective of this study.

Despite their importance, some factors were not considered as constraints in the adoption of organic cotton farming system. They included lack of information on health hazards associated with pesticides, lack of transparency in setting price for organic seed cotton, lack of strong association for organic farmers and high prices for organic inputs.

Major reasons for the above observations could be ignorance of farmers on operations and management of local and international business environments, particularly for novel enterprises like organic products which focus on specific market niches. Furthermore farmers are still ignorant on health risks associated with heavy usage of pesticides, particularly where there are no deliberate efforts to educate them. Also, little importance on a strong organic farmers' association is possibly predicated on bad experience with farmers' cooperative associations, both in pre and post market liberalization eras in the face of competitive private sector operators. Cotton apex Union-the Shinyanga Region Cooperative Union (SHIRECU) and its constituent primary societies, the Agricultural Marketing Cooperative Societies (AMCOS) are a good case in point.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This study dealt with the assessment of the constraints in the adoption of organic cotton production in Meatu District in Tanzania. Therefore the overall objective was to establish these constraints so that measures could be taken to address the situation.

The whole study was premised on five specific objectives which were the main thematic areas around which facts were elicited and discussed thereafter. These areas included; assessment of socio-economic characteristics of cotton growers, examination of the extent of adoption of organic cotton production practices, assessment of market opportunities for organic cotton, assessment of agronomic practices for organic cotton production and identification of main factors limiting adoption of organic cotton. This chapter summarises main findings on the major thematic areas which reflect specific objectives as pointed out.

5.2 Conclusions

5.2.1 Socio-economic characteristics of cotton growers

i. There is great potential for organic agriculture in Meatu District because most residents are livestock keepers and crop producers. The situation is propitious for sustainable development of organic cotton industry in the district.

ii. Organic cotton production is attractive to young and relatively more educated farmers in Meatu District.

5.2.3 Prevailing situation in organic cotton industry

i. Economic benefits takes precedence over environmental and public health concerns for cotton farmers in making decision on whether or not to convert.

ii. Despite 19 years of its existence, organic cotton production is still generally perceived as delivering low utility to farmers in terms of financial incomes compared to conventional cotton.

iii. There is no specific policy or plan to improve and foster organic sub sector in the district.

5.2.3 Marketing arrangements for organic cotton

i. Market arrangement for organic cotton in Meatu District is purely monopolistic. The situation renders farmers powerless in bargaining on issues related to pricing for organic seed cotton and organic inputs.

5.2.4 Agronomic practices for organic cotton production

i. Agronomic practices are generally perceived as laborious by most farmers. As such, they form a trigger point for defaulting and development of opportunistic behaviour of some organic farmers. The practices are also a basis for rejection of the model by the ardent supporters of conventional cotton production.

ii. Organic strategies for pest management are generally ineffective in keeping pest population below economic injury level (EIL).

5.2.5 Main factors limiting adoption of organic cotton

i. Hurdles to the wide adoption of organic cotton production are manifold. Some obstacles are of farmers own making but most others are related to institutional, political, economic and technological aspects at both micro and macro levels.

5.3 Recommendations

Based on the concluding remarks, the following are recommendations.

5.3.1 There should be deliberate efforts by the BioRe Co.Ltd and Meatu Disticrt Council Authority (MDCA) to capitalise on the synergy offered by crop and livestock sub sectors for the holistic improvement of organic cotton sub-sector in the District. This should take the form of livestock health improvement and training to farmers on making high quality farmyard manure.

5.3.2 BioRe and MDCA should mobilise, sensitise and support young and energetic farmers in order to make use of this opportunity for socio-economic gains and deliverance of ecological public goods.

5.3.3 BioRe and MDCA should make deliberate efforts to enlighten farmers and the public at large on socio-economic and environmental hazards associated with manipulation of synthetic pesticides. This measure is hoped to enhance farmers' decision making faculties since there has to be a trade-off between economic and environmental benefits.

5.3.4 BioRe and MDCA should formulate and implement an incentive package scheme to help farmers manage hurdles, particularly in the first years of conversion. such package may take the form of free inputs, long term credits and a review of the current level of 20 % organic premium for organic seed cotton. This is hoped to significantly contribute in bringing about turnaround in the district organic cotton industry.

5.3.5 The MDCA should prepare and implement the district organic agriculture strategic plan in order to align itself with the national agriculture policy and global objectives towards sustainable agriculture.

5.3.6 The MDCA should ensure articles of contract between farmers and BioRe reflect equity between the players in order to avoid monopoly-facilitated exploitation. Also, farmers should be assisted to form a strong association through which to assert their rights and scout out new market niches for organic seed cotton.

5.3.7 BioRe and MDCA should look into ways to reduce drudgery associated with organic farming by providing time and labour serving technologies. These should be supplied in cash, credit or other arrangements as deemed appropriate.

5.3.8 BioRe, MDCA and Central Government (CG) should commission more research studies to explore hard facts in organic farming. Such studies are expected to find out context-specific recommendations related to labour and time saving technologies, as well as effective and efficient organic inputs for integrated soil fertility and pest management strategies.

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APPENDICES

Appendix 1: Sample Size Determination

The formula is based on sample size determination by Kothari (2011) when estimating a percentage or proportion in infinite population.

$$\mathbf{n = (z^2 \times p \times q)/e^2}$$

Where:

n = sample size

z = the value of the standard *variate* at a given level of confident (95 % in this case) to be worked out from table under Normal distribution curve.

p = sample proportion

q =1-p

e = acceptable error

Given:

z =1.96, p =0.5, q = 0.5, e = 9 %

$n = (1.96^2 \text{ x } 0.5 \text{ x } 0.5)/0.09^2$

= 118.5679

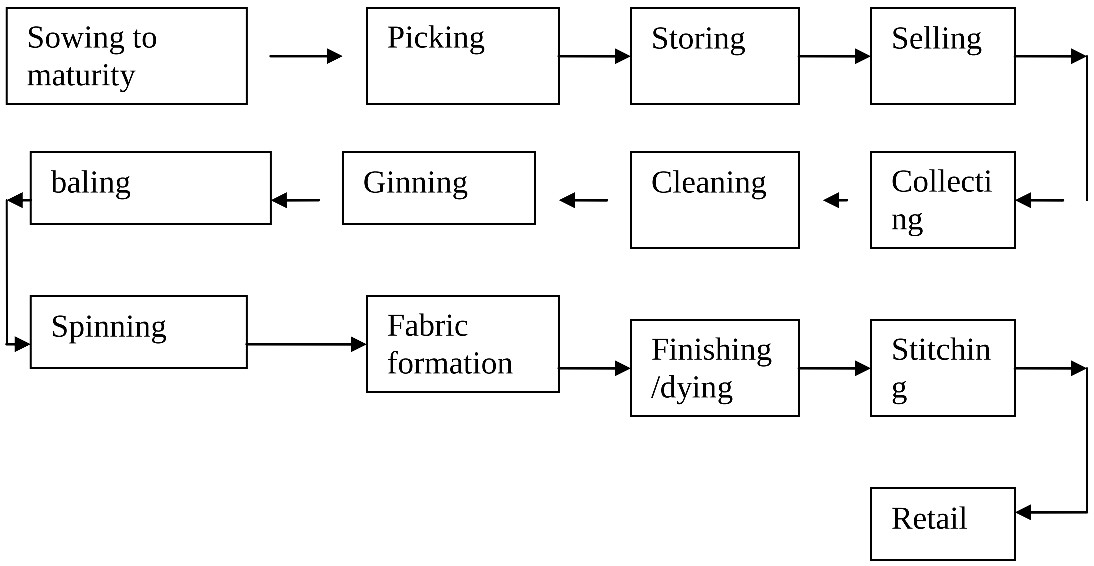
≈ 119

Note: e in this case is reckoned to be 9 %.

Therefore 119 respondents would therefore be the lowest acceptable number of respondents to maintain a 95 % confidence level and a 9 % sampling error.

According to Hussey and Hussey (1997) cited by Aluvi and Kimutai (2009), a sampling error of less than 10% and confidence levels of more than 90% are acceptable.

Appendix 2: The cotton processing value chain from field to consumer



Appendix 3: Advantages of growing cotton organically

Aspects	**Conventional**	**Organic**
Environment	• Pesticides kill beneficial insects • Pollution of soil and water • Resistance of pests	• Increased bio-diversity • Eco-balance between pests and beneficial insects • No pollution
Health	• Accidents with pesticides • Chronic diseases (cancer, infertility, weakness)	• No health risks with pesticides • Healthy organic food crops
Soil fertility	• Risk of declining soil fertility due to use of chemical fertilizers and poor crop rotation	Soil fertility is maintained or improved by organic manures and crop rotation.
Market	• Open market with no loyalty of the buyer to the farmer. • Dependency on general market rates • Usually individual farmers	• Closer relationship with the market partner. • Option to sell products at a premium price. • Farmers usually organized in groups.
Economy	• High production costs • High financial risk	• Lower costs for inputs. • Lower financial risk

Appendix 4: Influence of organic cotton on the components of ecosystem

The figure above illustrates how organic cotton contributes to sustainable ecological resources and mitigation of public health hazards posed by synthetic biocides.

Appendix 5: Common plants with pesticidal properties

Botanical name	Common name	Active component	Target pests
Ageratum conyzovides	Goat weed	Leaf extract	Effective against a wide range of sucking and chewing pests e.g. -worms (larvae) -bugs -aphids -thrips -whitefly -grasshopper etc.
Annona squamosa	Custard apple	Leaves and fruit extracts	
Argemone mexicana	Prickly poppy	Leaves extract	
Azadirachta indica	Neem	Leaves and seeds	
Calotropis procera	Giant milkweed	Leaf extract	
Carica papaya	Pawpaw	Leave and milky juice	
Catharanthus rosesus	Rose periwinkle	Leaf extract	
Chenopodium opulifolium	Malumba	Whole plant (shrub)	
Chrysanthemum spp	Pyrethrum	Flower head extract	
Citrus aurantium	Sour orange	Peel extract	
Citrus reticulate	Orange	Seed extract	
Crotalaria juneca	Junjunea	Leaves and roots extract	
Curcuma longa	Turmeric	Roots powder	
Cymbopogan citrutus	Lemon grass	Leaf extract	
Datura stramonium	Thorn apple	Fruits juice	
Echinochloa crusgalli	Barnyard grass	Transaconitic acid isolate	
Eclipta alba	Morchand	Root and shoot extract	
Eclipta alba	Mochrand	Leaf and root extract	
Eruca vesicaria	Taramina or Rocket salad	Seed oil	
Euphorbia pulcherrima	Poinsettia	Leaf extract	
Ipomoea cornea	Morning glory genus	Leaves extract	
Jatropha curcas	Jatropha or physic nut	Seed oil	
Lantana camara	Lantana	Leaves and flowers extract	
Lippia geminate	wild sage	Leaves powder	
Madhuca indica	Mahua	Seed oil	
Nicotiana tabasum	Tobacco	Leaf extract	
Piper nigrum	Piper	Seed extract	

Pongamia glabra	Puna oil tree	Oil	
Pongamia pinnata	Karum tree	Leaf extract	
Recinus communis	Castor	Seed oil	
Senna siamea	Mjoholo	Roots extract	
Tagetes ereeta	Aztee marigold	Root extract	
Tagetes pafula	Marigold	Root extract	
Tamarindus indica	Tamarind	Fruits	
Tripteryguim wilifordril	Thunder God vine	Root and bark powder	

Souce: Compiled from Prakash *et al*., (2008); Eyhorn *et al* (2005); Mihale *et al*., 2009

Appendix 6: Questionnaire for individual organic cotton growing farmers

LOCATION AND ADMINISTRATIVE USSUES

Name of interviewer………………………………………..

Date ………………………………………..

Name of the village…………………………Ward…………………District……………

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

Instructions: *Write a number of the correct answer/response in the parenthesis, unless instructed otherwise*.

A1: Sex of respondent

1) Male 2) Female ( )

A2: What is the age interval does your age fall?

1) Below 30 years
2) 31-41 years
3) 42-52 years ( )
4) 53-63 years
5) Above 63 years

A3: What is your education level?

1) Not attended any formal education
2) Primary school
3) Secondary school ( )
4) Tertiary education

A4: What is your marital status?

1) Single
2) Married
3) Divorced ( )
4) Widowed
5) Separated

A5: Apart from being a farmer (crops grower), what is your other main occupation(s)?

1) Livestock keeper (either or combination of cattle, goat, sheep, chicken)
2) Business
3) Civil servant
4) Privately employed ( )
5) Any combination of 1-5 above (e.g. civil servant and business- specify overleaf)
6) Others (specify)

A6: Apart from organic cotton, do you as well grow conventional cotton in other field (s).

1) Yes 2 No ( )

A7: In what class interval does your total annual income in Tanzanian shillings fall?

1) Below Tshs 500,000
2) Tshs 500,001 to Tshs 1,500,000
3) Tshs 1,500,001 to Tshs 2,500,000 ( )
4) Tshs 2,500,001 to Tshs 3,500,000
5) Tshs 3,500,001 and above

A8: How would you describe the total land which you use for farming activities?

1) Own land
2) Part is owned and part is hired ( )
3) Part is owned and part is borrowed (from friends, relatives and neighbours).
4) Part is hired and part is borrowed
5) All borrowed
6) All hired

A9: How much farming land in hectare (ha) do you commonly have access to?

1) < 1
2) 1-2
3) 3-4 ( )
4) 5-6
5) > 6

A10: Of all the land which you have access to, how much land in hectares do you usually allocate for organic cotton production?.

1) <1
2) 1-2
3) 3-4 ( )
4) 5-6
5) >6

A11: In your family, how many members are able to undertake farm operations (*provide number)*………….

A12: Referring to A11 above, how would you describe adequacy of your labour force you are having for your farm operations?

1) Very adequate
2) Moderately adequate ( )
3) Inadequate

A13: If the answer in A12 is 2 or 3, what are the main strategies do your normally employ?

1) Maintaining level of farm operations to match with available labour force.
2) Employing workers
3) Using casual labour (payment on a per day or per peace work basis) ( )
4) Helping each other, in turn
5) Others (specify overleaf)

A14: How do you compare labour requirements between organic and conventional cotton production systems?

1) Conventional cotton is more laborious than organic cotton
2) Have almost equal labour requirements ( )
3) Organic cotton is more laborious than conventional cotton.

SECTION B: AGRONOMIC PRACTICES

B1: When did you first hear of organic cotton production as new cotton farming system?

1) Long time ago (more than 10 years ago)
2) Relatively long time ago (less than 10 years ago)
3) Only recently (less than 5 years ago) ( )
4) This season

B2: Where did you first get information on organic cotton production?

1) Public Extension officers
2) Private Extension officers ( )
3) Village Government
4) Fellow farmers
5) Others (*specify*)

B3: When did you shift from convention to organic cotton production?

1) Long time ago (more than 10 years ago)
2) Relatively long time ago (less than 10 years ago)
3) Only recently (less than 5 years ago) ( )
4) This season

B4: What most attracted you into making a decision to shift from convention to organic cotton production system?

1) Financial profitability of organic compare to conventional seed cotton
2) The need for safeguarding yourself and your family from adverse effects of cotton pesticides. ( )
3) A reliable market for organic seed cotton compared to convention seed cotton.
4) Others reasons (specify overleaf).

B5: How often do you get advice from extension agents on recommended practices for organic cotton production?

1) Very frequently
2) Frequently
3) Less frequently

B6: In your own experience, how would you compare average production levels before and after conversion (i.e. between organic and convention seed cotton).

1) Production is almost equal in both before and after conversion periods. (   )
2) Production was higher before conversion than after conversion
3) Production is higher after conversion than before conversion

B7: If the answer in No. C6 above is 2, what do you think are the reasons?

1) Pest attack
2) High labour demand
3) Poor germination due to use of untreated seed (   )
4) All of items 1 to 3
5) Others (specify overleaf)

B8: In question No C7 above, if the answer is 1, what are some of the main strategies used to reduce the severity of the problem?

1) Spray with botanical pesticides
2) Use of cultural methods e.g. trap crop (   )
3) Both of items 1 and 2 above
4) Others (specify overleaf)

B9: In your own experience and observation, what is your opinion on the effectiveness of the strategies in question B8 above in reducing damage by pests?

1) Very effective
2) Effective (   )
3) Less effective
4) Not effective

B10: Basing on your experience, how conversant would you say you are with all the necessary agronomic practices related to organic cotton production?

1) Very conversant
2) Conversant ( )
3) Moderately conversant
4) Not conversant

B11: Regarding agronomic practices in organic cotton production, how would you generally describe organic cotton production system as compared with conventional cotton production system?

1) Very difficulty
2) Difficulty
3) Relatively difficulty ( )
4) Almost comparable
5) Easy
6) Very easy

B12: Based on your experience, how would you generally compare financial profitability between organic and organic cotton production systems?

1) Organic cotton system is more profitable than organic cotton system
2) The two systems are equally profitable ( )
3) Conventional cotton system is more profitable than organic cotton system

B13: What is your future plan regarding organic cotton production.

1) Maintaining the same level of production using the same acreage ( )
2) Increasing production by increasing acreage

3) Reducing production by reducing acreage

4) Revert to conventional cotton production system

B14: Given long time now since organic cotton farming was introduced in the district, one would expect widespread adoption of the same. Among the listed factors/reasons which ones do you think strongly, moderately or least limit large scale adoption of organic cotton production in the district (*mark with a '√' as appropriate*).

S/N	**Factor/reason**	**Strongly limiting**	**Moderately limiting**	**Least limiting**
i.	Marketing: Lack of competition in the market due to only one buyer			
ii.	Low level of premium price compared to crop losses			
iii.	Loss of large part of crop due to pests attack compared to conventional cotton			
iv.	Stringent rules associated with organic farming (e.g. not using industrial pesticides even in other crops).			
v.	Labour intensiveness associated with organic farming.			
vi.	Inadequate information to farmers on potential public health and environmental risks due to heavy applications of synthetic pesticides that are common in almost all cotton farming systems.			
vii.	Lack of transparency in setting price for organic seed cotton and input prices.			
viii.	Lack of strong organic Farmers' Association			
ix.	High standard requirements for organic seed cotton before certification.			
x.	High inputs prices compared to price offered for organic cotton			
xi.	Lack of effective sensitization by political leaders and responsible District Council officials.			

B15: Basing on your experience, what are other reasons which you think contribute towards limiting wide adoption of organic cotton production in the district? (*List if any*).

1) ………………………………………………………………………………………
2) ………………………………………………………………………………………
3) ……………………………………………………………………………………..

SECTION C: MARKETING AND POLICY ISSUES

C1: How many buyers of organic cotton do you have in your area?

1) Only one 2) Only two 3) More than two ( )

C2: Is there any association of organic cotton growers within the district? *(if Yes - i.e. 1, go to C3 if No - i.e. 2, go to C4*)

1) Yes 2) No ( )

C3: If Yes in the B2 above, are you a member?

1) Yes 2) No ( )

C4: If No to C2, who safeguards your interest in the organic cotton business.

1) Individual farmers themselves
2) District Council Authority ( )
3) Buyer himself (i.e. bioRe)
4) Others (specify)

C5: Are you aware of the premium price for organic seed cotton? (*If yes, go to C6 and C7*)

1) Yes 2) No ( )

C6: If Yes to C5, do you know how the premium price for organic cotton is computed in relation to the price for conventional cotton.

1) Yes 2) No ( )

C7: In your own experience, how would you conclude on the contribution of premium price towards net profit after selling your crop?

1) Very significant
2) Significant
3) Moderately significant ( )
4) Less significant
5) Insignificant

C8: How do you guarantee availability of market for your crop (*if the answer is 1 or 2, go to C9 and C10*)

1) Verbal contract with the buyer
2) Written contract with the buyer ( )
3) No specific arrangements

C9: How much would you say you are involved in the contractual terms?

1) Highly involved
2) Moderately involved ( )
3) Least involved
4) Not involved at all

C10: What are the items covered in the contract? (M*ark with √ for covered items and X for not covered items in the provided parentheses*)

1) Price ( )
2) Rules to be adhered to and associated measures for non –observation ( )
3) Type of agronomic practices to be adhered to ( )
4) Modalities for inputs acquisition and payment ( )
5) Certification fees ( )
6) Extension services ( )
7) Extension fees ( )
8) Others (*specify overleaf*)

C11: Who provides you with all the necessary inputs (*e.g. botanical pesticides, untreated seed for cotton, trap crops*)

1) Buyer only
2) Buyer in collaboration with District Council Authority ( )
3) Buyer and myself
4) Others (*specify overleaf*)

C12: How do you pay for inputs from the buyer (bioRe)?

1) Cash payment for all inputs
2) Cash payment for some and credit for the other ( )
3) All provided on credit payable by deduction during buying season

C13: Is there room for bargaining on the price of inputs?

1) Yes 2) To some extent 3) No ( )

C14: Who is responsible for providing you with all the necessary advisory services?

1) Buyer only
2) Buyer in collaboration with District Council Extension officers ( )
3) Others (specify overleaf)

C15: Do you equally enjoy any support from the government like your fellow conventional cotton farmers? (*Supports include inspection of the weighing scales, subsidies for both seed and botanical pesticides*).

1) Yes 2) No ( )

Thank you for your cooperation

Appendix 7: Questionnaire for individual conventional cotton growing farmers

LOCATION AND ADMINISTRATIVE USSUES

Name of interviewer………………………………………..

Date ………………………………………..

Name of the

village………………………………Ward…………………District……………

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

Instructions: *Write a number of the correct answer/response in the parenthesis, unless instructed otherwise.*

A1: Sex of respondent (write a number of the correct answer in the parenthesis)

2) Male 2) Female ( )

A2: What is the age interval does your age fall?

1) Below 30 years
2) 31-41 years
3) 42-52 years ( )
4) 53-63 years
5) Above 63 years

A3: What is your education level?

1) Not attended any formal education
2) Primary school
3) Secondary school ( )
4) Tertiary education

A4: What is your marital status?

1) Single
2) Married
3) Divorced ( )
4) Widowed
5) Separated

A5: Apart from being a farmer (crops grower), what is your other main occupation(s)?

1) Livestock keeper (either or combination of cattle, goat, sheep, chicken)
2) Business
3) Civil servant
4) Privately employed ( )
5) Any combination of 1-5 above (e.g. civil servant and business- specify overleaf)
6) Others (specify)

A6: Apart from conventional cotton, do you as well grow organic cotton in other field (s)?

2) Yes 2 No ( )

A7: In what class interval does your total annual income in Tanzanian shillings fall?

1) Below Tshs 500,000
2) Tshs 500,001 to Tshs 1,500,000
3) Tshs 1,500,001 to Tshs 2,500,000 ( )
4) Tshs 2,500,001 to Tshs 3,500,000
5) Tshs 3,500,001 and above

A8: How would you describe the total land which you use for farming activities?

1) Own land
2) Part is owned and part is hired
3) Part is owned and part is borrowed (from friends, relatives and neighbours).
4) Part is hired and part is borrowed
5) All borrowed
6) All hired

A9: How much farming land in acres do you commonly have access to?

1) < 1
2) 1-2
3) 3-4 (   )
4) 5-6
5) > 6

A10: Of all the land which you have access to, how much land in hektares do you usually allocate for conventional cotton production?

1) < 1
2) 1-2
3) 3-4 (   )
4) 5-6
5) >6

A10: In your family, how many members are able to undertake farm operations? (*Provide number*)………….

A11: Referring to A10 above, how would you describe adequacy of your labour force you are having for your farm operations?

1) Very adequate
2) Moderately adequate ( )
3) Inadequate

A12: If the answer in A11 is 2 or 3, what are the main strategies do your normally employ?

1) Maintaining level of farm operations to match with available labour force.
2) Employing workers
3) Using casual labour ( )
4) Helping each other, in turn
5) Others *(specify overleaf)*

A13: How do you compare labour requirements between organic and conventional cotton production systems? (*Answer only if you are aware of organic cotton production*)

1) Conventional cotton is more laborious than organic cotton
2) Have almost equal labour requirements ( )
3) Organic cotton is more laborious than conventional cotton.

SECTION B

B1: Are you aware of organic cotton farming system in the District? (*If the answer is Yes- i.e. 1, go to B2 below*).

1) Yes 2) No ( )

B2: When did you first hear of organic cotton production as a new cotton farming system?

1) Long time ago (more than 10 years ago)
2) Relatively long time ago (less than 10 years ago)
3) Only recently (less than 5 years ago) ( )
4) This season

B3: Where did you first get information on organic cotton production?

1) Public Extension officers
2) Private Extension officers ( )
3) Village Government
4) Fellow farmers
5) Others (*specify*)

B4: What is the main reason(s) for you not adopting organic cotton production system? *(Mark with √ in the provided parentheses for all applicable answers and X for not applicable answers).*

1) It has stringent rules that requires strict adherence ( )
2) It is generally not profitable compared to conventional cotton ( )
3) It is labour intensive ( )
4) No guaranteed market opportunities for organic cotton (e.g. one must be listed/contracted by a single buyer ( )
5) Others (*specify*)

B5: If the answer in No B4 above is 2, what do you think are the main reasons for low profitability associated with organic cotton production? *(Mark with √ in the provided parentheses for all applicable answers and X for not applicable answers).*

1) Failure to execute some farm operations due to insufficient labour (e.g. farm yard manure application, weeding) ( )
2) Losses from heavy attacks by pests that are not recovered by premium price. ( )
3) Reduced plant population due to inclusion of trap crops (e.g. sunflower) ( )
4) Others (*specify*)

B6: Are you aware of public health hazards associated with use of synthetic pesticides in cotton fields?

1) Yes 2) No ( )

B7: If Yes to B6 above, what precautionary measures do you take to mitigate health risks?

1) No any specific measures taken
2) Wearing protective gears (overalls, gumboot, gloves) ( )
3) Others (*specify*)

D8: Given long time now since organic cotton farming was introduced in the district, one would expect widespread adoption of the same. Among the listed factors/reasons which ones do you think strongly, moderately or least limit adoption of organic cotton production (*mark with a '√' as appropriate*).

S/N	Factor/reason	Strongly limiting	Moderately limiting	Least limiting
i.	Marketing: Lack of competition in the market due to only one buyer			
ii.	Low level of premium price compared to crop losses			
iii.	Loss of large part of crop due to pests attack compared to conventional cotton			
iv.	Stringent rules associated with organic farming (e.g. not using industrial pesticides even in other crops).			
v.	Labour intensiveness associated with organic farming.			
vi.	Inadequate information to farmers on potential public health and environmental risks due to heavy applications of synthetic pesticides that are common in almost all cotton farming systems.			
vii.	Lack of transparency in setting price for organic seed cotton and input prices.			
viii.	Lack of strong organic Farmers' Association			
ix.	High standard requirements for organic seed cotton before certification.			
x.	High inputs prices compared to price offered for organic cotton			
xi.	Lack of effective sensitization by political leaders and responsible District Council officials.			

B9: What other reasons do you think limit conversion to organic farming system (*List if any*).

1) ……………………………………………………………………………………

2) ……………………………………………………………………………………

3) ……………………………………………………………………………………

Thank you for your cooperation

Appendix 8: Key informants interview and focus group discussion checklist

1. It is known that organic cotton production system was introduced in the district some 19 years ago. What do you think are the reasons for many farmers not converting to organic cotton production system?
2. How organic cotton is generally perceived in terms of profitability compared to conventional cotton?
3. How loyal the registered farmers are in terms of adherence to rules and regulations governing organic cotton production system?
4. What are the measures put in place to ensure farmers' compliance to the guidelines for organic cotton production? How effective are the measures.
5. What prompts farmers to register as organic cotton growers?
6. How is the marketing of organic and conventional seed cotton done alongside conventional cotton?
7. To your knowledge, what measures are put in place to ensure organic seed cotton is not mixed with conventional seed cotton stating from harvesting, storage up to buying? How effective are the measures.
8. What other important issues related to organic cotton production that you think ought to be talked on.

Appendix 9: Key informant interview checklist for DED's Office

1. It is known that organic cotton production system was introduced in the district some 19 years ago. What do you think are the reasons for many farmers not converting to organic cotton production system?
2. As a Local Government Authority, what measures have you taken since inception of organic cotton farming system to ensure the practice is widely adopted in the district?
3. What type of collaboration do you extend to bioRe in promoting organic cotton farming in the district?
4. How loyal the organic cotton registered farmers are in terms of adherence to rules and regulations governing organic cotton production system
5. How is price for organic seed cotton set alongside that for conventional cotton
6. What reasons do you think have driven few farmers to register as organic cotton growers?
7. What do you think are the major factors limiting wide adoption of organic cotton production in the district?
8. What are you current strategies to scale up organic cotton production in the district?

Appendix 10: Key informant interview checklist for Biore Company

1. It is known that organic cotton production system was introduced in the district some 19 years ago. What do you think are the reasons for many farmers not converting to organic cotton production system?
2. What are some of the important measures you have taken to ensure wide adoption of organic cotton production system in the district?
3. What type of collaboration extended to you by the District Council Authority in promoting organic cotton production in the district?
4. How loyal the registered farmers are in terms of adherence to rules and regulations governing organic cotton production system?
5. What measures do you normally take against farmers who default on organic farming rules?
6. If all cotton growers were to produce organic cotton, would you be able to buy the entire crop in the same buying season?
7. What do you think are some of the main factors limiting wide adoption of organic cotton production in the district?
8. What are your current strategies to scale up organic cotton production in the district?

Appendix 11: Definition and description of terms

Terminology	Description/ definition
Acaricide	A synthetic chemical used to control external parasites of livestock (e.g. tick, lice and fleas).
An in-conversion	The product that is produced within the conversion period before they are fully certified as 'organic'. It does not usually fetch a premium price in the market.
BioRe	A local trading company that manages organic cotton production and buys organic seed cotton in Meatu District.
Boll	The rounded sac of seeds that contains the fibers of the cotton plant. It is an economic component of cotton plant.
Border crop	Crop grown at the edge of organic fields bordering conventionally managed fields, in order to reduce drift of synthetic pesticide sprays.
Botanical pesticide	A natural product with pesticidal properties extracted from some plant species.
Bt- cotton	Genetically modified cotton varieties containing the gene of the bacterium *Bacillus thuringensis* that causes the death of caterpillars (especially cotton bollworms) when they feed on the crop.
Certification	A process of verifying the compliance of farm management with organic standards, based on the inspection of the farm and its documentation.
Conversion	The process of changing the farm management from conventional to organic practices as per organic standards.
Conversion period	The time lag between the start of implementation of organic management and the certification of the product as organic. It normally takes 3 to 4 years.
de facto organic agriculture	Farming system that does not employ synthetic inputs but that no efforts have been taken to certify it by nationally or internationally recognized institutions. Also it is referred to as organic agriculture by default.
Default	To deliberately fail to adhere to rules and practices of organic agricultures by using an authorized inputs while risking that you may be terminated if noticed.
Economic injury level (EIL)	The level of pest infestation above which economically justifiable damage is expected. It is sometimes referred to as the break-even

Terminology	Description/ definition
	pest density.
Economic threshold (ET)	Is the time to take control action to prevent the pest population from increasing beyond the EIL.
Economic injury level (EIL)	The level of pest infestation above which economically justifiable damage is expected. It is sometimes referred to as the break-even pest density.
Extension services (under organic settings)	A support system for farmers, usually provided by the NGO or company organizing the organic project. Services may include training, technical advice, internal control, farm inputs supply and marketing.
Free riding	Is a situation whereby a farmer enjoys organic premium price while not actually adhering to organic standards (i.e. cheating).
Genetically modified organism (GMO)	An organism whose genetic characteristics have been altered by the insertion of a modified gene or a gene from another organism using the techniques of genetic engineering.
Gross margin	Crop or field output (mainly revenues from sales of crop) minus variable production costs (seeds, fertilizers, sprays, hired labour, etc.).
Hectare	Farmland with an area of 10 000 m^2 (approx. 2.5 acres)
IFOAM	The International Federation of Organic Agriculture Movements.
Intercultural operations	Collective term for mechanical weeding, ridging, hoeing, etc. implemented between the cotton rows.
Internal control system (ICS)	An inspection system managed by the project to ensure that farmers follow the agreed-upon organic standards. For certification, the functioning of the ICS is evaluated by an external agency.
Kilimo kwanza (literally ‘agriculture first’)	Is a national resolve to accelerate agricultural transformation. It comprises a holistic set of policy instruments and strategic interventions towards addressing the various sectoral challenges and taking advantage of the numerous opportunities to modernize and commercialize agriculture in Tanzania. It was launched in Dodoma on 3rd august, 2009.
Lubaga	A temporary camp set by livestock keepers away from their domicile villages for the purpose of ensuring enough pasture and water for livestock during pasture and water scarcity. Normally starting July through December of every year.
Land-rich and land-poor	The land-rich farmers are those owning more than 14 acres while

Terminology	Description/ definition
farmers	land-poor farmers own less than 3 acres (in this study).
Monoculture	Cultivation of only one type of crop in a given field, e.g. only cotton without any intercrop.
Natural enemy/beneficial insect	An insect that feed on pest insects thereby reducing their populations and hence lowered damage levels to the main crop (e.g. *ladybird beetles* and *lacewing* on American bollworm).
n	Total number of sample respondents (119).
Opportunistic farmer	A farmer who is dishonestly bent on using banned practices and/ or inputs in order to make fast huge benefits relative to others who adhere to agreed-upon performance standards. E.g. uses of synthetic inputs or to connive with conventional farmers in getting their crop sold at a premium price in return for money.
Organic certification	A process verifying the compliance of farm management with organic standards; based on inspection results.
Organic inspection	Physical inspection of the farm and its documentation. This can involve chemical or genetic analysis of soil, leave and product samples.
Organic manures	Manures derived from animal products or plant residues. They usually have considerable nitrogen content, and contain most other nutrients essential for plant growth. In addition, they are important sources of organic matter.
Organic premium	Percentage or fixed amount paid for an organic product in addition to the prevailing market price for non-organic products.
Organic standards	Minimum requirements for a farm and its products to be certified organic. Basic standards are defined on an international level by FAO in the *Codex Alimentarius* and by the IFOAM. They may however be specific to certain regions and markets (e.g. EU-regulation EEC 2092/91) or private labels (e.g. Naturland, BIO SUISSE).
Pest	Is a plant or animal detrimental to humans or human concerns (such as agriculture or livestock production). In this study, it refers to an insect (whole or some stage of life cycle) causing quantitative or qualitative damage to cotton plant or its economic products (lint and seed) e.g. *bollworms*.

Terminology	Description/ definition
Pheromone	Substance emitted by female insects that attract male insects. Synthetic pheromones are used to disorient male insects and thus to prevent mating thereby reducing pest population.
Remei AG	Is a Switzerland-based multinational company that trades in organic cotton lint and apparels. It engages local agent companies in various countries (e.g. BioRe) to facilitate operations in a vertically integrated organic cotton supply chain.
‘richest’ or ‘poorest’ farmers	Extremes of economic status of farmers based on livestock, land and financial income. Richest: more than 50 head of cattle, more than 14 acres and more than Tshs 3 500 000/ year. Poorest: less than 5 head of cattle, less than 3 acres and less than Tshs 500 000/year.
Risk factor	Is a phenomenon or situation which negatively impacts on crop yields both qualitatively and quantitatively, and hence the overall income emanation from agricultural entreprises. They include, but not limited to, weather vagaries, pest attack, volatile prices and unreliable markets.
Rotation crops	Crops grown in rotation (time sequence) with cotton on the same fields.
Seed cotton	Cotton as it is picked (fibre along with seeds).
Seed treatment	Is the application of chemicals to seeds to protect them against soil- and seed-borne diseases and pests, and/or to improve germination and initial growth. In organic farming, seeds treated with synthetic pesticides cannot be used.
Square	Is the flower bud that first appears on the plant when reproductive growth begins. Squares grow for about three weeks before a bloom appears.
Synthetic biocide	Is an industrially compounded chemical substance which can deter, render harmless, or kill any harmful organism. In agriculture, synthetic biocides are classified as pesticides which include: *fungicides, herbicides, defoliants, insecticides, algaecides, molluscicides, miticides and rodenticides*. Natural biocides include products of plants and micro-organisms origin with effects comparable to synthetic biocides.
The *Codex Alimentarius* (Latin word for "Book	A collection of internationally recognized standards, codes of practice, guidelines and other recommendations relating to foods,

Terminology	Description/ definition
of Food")	food production and food safety.
Trap crop	A crop grown in order to attract pests and to distract them from the main crop. Pests thus can be destroyed by treating a small area, or by destroying the trap crop and the pests together.
Unit of labour	One individual in a family who is regularly participating in farming operations (for the case of this study).