THE INTERNATIONAL JOURNAL OF BUSINESS & MANAGEMENT

Climate Resilience VIA Climate Smart Agriculture in Tanzania: Does Contract Farming Help?

Moses Ayoub Kusiluka

Lecturer, Department of Economic Studies, Mwalimu Nyerere Memorial Academy,
Dar es Salaam, Tanzania

Abstract:

This study aimed at assessing contract farming business model as an enabler of smallholder farmers' resilience to climate change through climate smart agriculture. To achieve this purpose the study investigated CSA technological and practical support deployed to contracted smallholder common-bean farmers by agribusiness company (G2L Co Ltd); assessed productivity differences between contracted and non-contracted farmers and assessed policy related obstacles to implementing contract farming. The study employed a mixed design which administered survey tool (on 241 farmers) complemented by FGD and scheduled interviews of extension staff from the government and the agribusiness company. Results indicate that farmers received specific practical training on CSA and climate smart inputs such as early and disease resistant bean seeds, inoculants, and fertilizers. There was significant difference in productivity of common beans (measured by yield per acre) before and after farmers were contracted into contract farming with the agribusiness company and between contracted and non-contracted farmers. This difference was attributed to support the contracted farmers received from the agribusiness company (G2L). However, a number of policy-related constraints seem to hinder effectiveness of contract farming in the country. Overall, this study demonstrated that contract farming business model between agribusinesses and smallholder's synergic arrangement that provides viable mechanisms that promote farmers resilience to climate change.

Keywords: Contract farming, climate change, climate smart agriculture, climate resilience, mwalimu nyerere memorial

1. Introduction

Smallholder agriculture and agribusiness are vital ingredients of Tanzania's economy which are increasingly being seriously affected by climate change. The impacts of climate change are felt throughout the country because agriculture and climate change are deeply intertwined and majority of smallholder farmers practice rain-fed agriculture which is basically vulnerable to variability in weather. The uptake of appropriate technologies and practices would therefore be necessary if farmers are to effectively adapt to these changes. This calls for deliberately concerted efforts for seriously engaging farmers in Climate Smart Agriculture, amongst other interventions. Climate-Smart Agriculture provides solution for both Climate Change adaptation and mitigation. However, development partners are concerned about the limited capacity of smallholder farmers in developing countries to implement CSA by depending on government resources only. This concern is largely based upon the background that smallholders and the government are resource-deficient to attain to the desired climate resilience levels. These stakeholders are also concerned about limited participation of private sector in combating climate-related challenges despite their relatively higher resource endowment compared to smallholder farmers. Private actors such as local and international agribusinesses are primarily concerned about maximizing profit but development partners assert that this objective will soon or later be hard to achieve in the face of climate change. Synergic win-win cooperation between private sector actors such as agribusiness and smallholder farmers could be a promising avenue toward addressing impacts of climate change on food security and agribusiness. One such synergic collaboration is known as contract farming or out-grower scheme which has traditionally been established as one of the popular ways of modernizing agriculture. FAO (2016) establishes that Contract Farming as an arrangement whereby producers and buyers agree in advance on the terms and conditions for the production and marketing of farm products. The terms of the contract typically specify prices, quantities, quality characteristics and delivery dates, and may include other mutually agreed conditions such as production technologies and practices. The advantages of contract farming include managing risk and stabilizing incomes for farmers; it provides reliable supplies of produce for off-takers (processors and distributors); provides safe, high-quality food for consumers. For smallholder farmers contract farming has been offering benefits such as gaining quick access to reliable market (the contractor); farmers are generally provided with education, production and management technologies, and infrastructure such as transportation, cold storage, and information. The purpose of this study is therefore to assess capacity of contract farming to promote climate smart agriculture (CSA) in Tanzania so as to build farmers resilience to climate change. This is because there is limited literature that talks about contract farming in relation to climate smart agriculture in Tanzania and CSA is relatively new version of agriculture with scant literature supporting it. Significant literature has discussed widely how contract farming has

promoted conventional farming instead (Simmons et al., 2005; UNCTAD, 2009); FAO; 2011; Wainaina et al., 2012; Wang et al., 2014). This study was carried in areas of Iringa, Njombe and Ruvuma regions under the auspices of G2L Company Ltd (i.e. in places where the company has entered into contract with common bean farmers). Particularly, the study explored extent of farmers' engagement and understanding of CSA in the area; explore CSA-related interventions the company provide to common bean farmers; it analysed the differences in productivity between contract and non-contracted farmers; and assessed enabling environment for effective implementation of contract farming (policy/institutional issues).

2. Literature Review

Climate change is defined as changes conditions of natural environment resulting from temperature variability due to emissions of greenhouse gases produced by human activities (Hope, 2009). Literature cites a number of factors in the globe that contribute to climate change to include human activities such as 'burning of fossil fuels, industrial production, cutting down of rainforests leading to changes in the atmosphere's composition by increasing the amount of greenhouse gases, which, in turn, trap heat in the atmosphere, thereby facilitating climatic changes (Levira, 2009). Globally, the impact of climate change is two-fold, bio-physical and socio-economic. The bio-physical impact includes rising sea waters, more frequent and intense storms, extinction of species, worsening drought, crop failure (Mendelsohn and Dinah, 2005; UNDP, 2004; UNFCCC, 2007; Mubaya et al., 2010). In Tanzania, climate change is becoming a common phenomenon whose presence has been significantly recorded. For example, a mean annual temperature increase of 10C has been recorded since 1960 and rainfall decreased at an average rate of 2.8 mm per month and 3.3% per decade (Mashingo, 2010; ESRF, 2014). The impact of climate change is primarily felt by farmers mainly in the "timing, frequency and intensity of rainfall events, and in the distribution of these events within a production season (Blignaut et al, 2009; ActionAid, 2016). Impacts are felt throughout the country because majority of smallholder farmers practice rain-fed agriculture which is basically vulnerable to climate change and variability. The effects of climate change in agriculture are directly visible in the agribusiness sector in terms of reduced flows of agro-commodities moving downstream agro-value chains. It is predicted that extreme events such as negative impacts on food production, energy and water supplies, as well as a decrease in the population health, particularly in rural households which represent the majority of the country's inhabitants will increase over time (Maclean, 2009)". However, available efforts by the government and development partners have not yielded notable fruits. The country needs strategic adoptive means that will among others build smallholder farmers' resilience to climate change. Climate Smart Agriculture is one of the interventions that have received great attention by development agencies and many country governments.

FAO (2016) defines climate-smart agriculture (CSA) as an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate. CSA basically aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible. CSA seeks to increase productivity in an environmentally and socially sustainable way, strengthen farmers' resilience to climate change, and reduce agriculture's contribution to climate change. It includes proven practical techniques such as mulching, intercropping, conservation agriculture, crop rotation, integrated crop-livestock management, agro-forestry, improved grazing, and improved water management but also innovative practices such as better weather forecasting, early warning systems and risk insurance (FAO, 2017). The United Nations Framework Convention on Climate Change (UNFCCC) puts high priority on CSA as viable means to both Climate Change mitigation and adaptation (Ahmad, 2015). However, there are serious concerns by development stakeholders about the limited capacity of smallholder farmers especially those in developing countries to implement CSA due to their limited resource endowment. On the other hand, there are concerns about limited participation of private sector in combating climate-related challenges despite their better resource endowment position compared to farmers. Private agribusiness companies are primarily concerned about maximizing profit from agro-traded commodities, which development partners predict that they will diminish over time due to impacts of climate change. Governments in developing countries are burdened by numbers of issues to address which has proven that they need a helping hand from private sector stakeholders. Forging synergic win-win cooperation between private agribusiness and smallholder farmers could leverage complementary resources and efforts toward addressing impacts of climate change for improving food security and agribusiness. One such synergic collaboration is known as contract farming or out-grower scheme which has traditionally been established as one of the popular ways of modernizing agriculture.

Contract Farming refers to agricultural production carried out according to an agreement between a buyer and farmers, which establishes conditions for the production and marketing of a farm product or products (FAO, 2013). In contrast, traditional marketing refers to systems in which farmers produce under their decisions on variety, quantity, quality and timing and then sell to open market at the market price (Wang et al., 2014). In traditional contract farming arrangement, the farmer consents to provide certain quantities of a commodity at the specified quality standards, price and time, and the buyer commits to procure the commodity at a specified price. The buyer may also agree to supply some inputs and technical support to the farmer. Typical farming contracts specify quantity of output farmers should sell to the contractor. Well-organised contract farming provides mutual benefits between farmers and agribusinesses. Alongside many drivers for farmers' engagement in contract farming, research establishes a number of determinants of farmers' capacity to adopt CSA technologies and practices. Among others, these include availability and access to financial resources needed to procure requisite technologies and use appropriate CS practices; availability of land, labour; potential benefits to be accrued vis-à-vis other practices; the required CSA skills and information to use; capacity to cope with challenges that might arise during or after using the practices; and compatibility with local social and cultural practices (Waithaka et al., 2013, Sanga et al., 2013) as cited in Nyasimi (2016). Simmons et al., (2005) consider farmer access to

credit as one potential motive for contract participation. Farmers with poor access to credit may be particularly vulnerable to market fluctuations and therefore find it relieved when they extend this risk to contractors and thus find increased safety when engaged in a contract. In some farming contracts farmers are linked to loan providers, which provide further motive for credit constrained farmers to participate in a contract. A large number of studies report a positive income effect from contract farming in developing countries, where governments and international nongovernment organizations (NGOs) pay more attention. These studies include Leung, et al., 2008; Wainaina, et al., 2012; Kalamkar 2012; Bellemare 2012; and Michelson 2013). However, many studies document that the increase in farmer income from contract farming may come from several other sources such as better price (Henson, 2005; Simmons et al., 2005; Bijman, 2008); better technology and inputs provided by the contracting firms (Gulati et al. 2007; Leung, Sethboonsarng, and Stefan 2008) and supports such as loans and insurance from the NGOs; financial institutions, government agencies (Zhu and Wang 2007; Bijman 2008; Michelson 2013). The distance to market may be a particularly important factor for farmers in developing countries. Farmers find reduced cost and additional security when engaged with contractor because in that way they avoid transaction costs associated with marketing of their commodity given their relative remoteness (Wang et al., 2014). On the one hand, farmers that are not connected to main highways are less attractive partners for the processor, but farmer associations can play an important role in contract farming, helping small farmers to gain more bargaining power in negotiations with large firms and association of farmers reduces transaction costs for the agribusiness companies to deal with individual farmers (Guo and Jiang 2007). The potential benefits of contract farming are, however, not necessarily guaranteed because failed attempts of contract farming have been documented from around the Globe (Grossman 1998; Kumar and Kumar, 2008; Ramsundar and Shubhabrata, 2014). The common pitfalls of contract farming include Breach of contracts by either partner; Side-selling by farmers; delays in agreed payments to farmers and unequal power balance between parties, where farmers have always been inferior to contractors.

The literature review above gives a picture that there might be potential of building farmers resilience to climate change by enabling them to engage effectively into climate smart agriculture by establishing synergic cooperation with private agribusinesses. However, there has not been evidence of this cooperation happening in Tanzania using scenarios that fit well into the era of climate change.

3. Methodology

This study was conducted in four wards located in the southern highlands of Tanzania (Iringa, Njombe and Ruvuma regions) where G2L Company Ltd is working with smallholder common bean farmers. The four wards are Madaba (Ruvuma), Mavanga (Njombe), and Maboga and Image (Iringa). The author chose to work with this company because he was engaged in the management of one of the DFID-funded CSA-promoting development projects which was implemented by the company in the three regions. The study was conducted between February and June 2018 which is the common bean growing season, however, some farmers production figures such as yield before the farmers were contracted by the private agribusiness company (G2L Co. Ltd) were recorded in 2016. The sample size of farmers was 241; out of which 81 were non-contracted farmers who were included in the study for the purpose of comparing their performance vis-à-vis contracted ones (experimental group) in terms of productivity. Both experimental and control groups of farmers were selected randomly. Data were collected through survey technique which was complemented by qualitative village-based FGDs and key informant interviews. The multiple nature of the data collection methods employed enabled comparisons among villages and fact checking (FAO, 2013). The survey gathered data and information on household socio-demographic characteristics, CSA practices and technologies employed in the study villages/wards. Nine focus group discussions with farmers engaged in contract farming and those not engaged in contract farming were conducted. The group size ranged from 7 to 15 participants who were mixed gender. The men were then separated from women to accommodate gender-specific information and address short-comings that could result when men are mixed with women such as limited freedom of women to express themselves in the presence of men and vice versa. Interviews were particularly used to collect qualitative information from key-informants particularly agribusiness company staff and government extension staff. The sampling frame included SHFs cultivating common on 1 to 5 acres.

4. Findings of the Study

4.1. Sex of Respondents

Development practitioners are concerned about sex of rural population engaged in farming. The study consulted 129 male farmers (53.5%) and 112 female farmers (46.5%). It was reported by these farmers that more women farmers were engaged in farming activity than men, which agrees with a number of studies which report that about 70% of farm activities are carried out by women (FAO, 2011; Mohammed and Abdulquadri, 2012; Adenugba and Raji-Mustapha, 2013; Vicky, 2017). During the study, which was conducted between March and June, most of women were busy with farming; they could reportedly not find time to engage in interviews. However, there were few exceptions of meetings where the proportion of females was higher than male farmers. For example, interviews carried in Madaba village were attended by more women than men (62% females and 28% males).

4.2. Age of Respondents

The study consulted farmers in the age range of 53 years (i.e. from 18 to 71 years of age). Large proportion of farmers was under 60 years of age. G2L officials reported that their experience shows that most of farmers in this age range show prompter uptake of CSA interventions than those who are outside the range; below or above. The possible interpretation is that farmers in this age range still have hopes and aspirations to achieve various socio-economic goals. Most of those in

this age range are aware of climate change and therefore strive to cope, become resilient and thus achieve their goals regardless of the circumstances brought by this adverse phenomenon.

4.3. Education Level of Respondents

With regard to respondents' education, it was observed that 240 respondents (about 99% farmers) had completed standard seven (Primary School) level. In this regard, it is hoped that majority of farmers can understand written CSA messages especially when they are written or disseminated in Kiswahili (Tanzania's National Language). Many studies support the assertion that education level is related to adoption of new interventions (Weber, 2011; Girgin, 2011; Ntshangase et al., 2018). It is expected that contract farming arrangement which among others offer CSA education is likely to help smallholder farmers adapt to climate change in the study area. Provided that CSA messages are translated into local language (Kiswahili), smallholder farmers have high potential of understanding them because they usually integrate new knowledge with traditional one which is gained over time through farmer's practical experience.

4.4. Common Crops Grown in Surveyed Area

Farmers were generally observed to grow more than one crop. The most commonly grown crops in the study area are maize (grown by about 99% of farmers), common beans (93% of farmers), and soybeans (40% of farmers). Other crops grown in small proportions in were sunflower and Bambara nuts. In general, majority of farmers cultivate maize, followed by common beans. Crops such as sunflower and soybean are relatively new to the area. It was reported that over 90% of farmers grow crops for food security reasons as compared to about 80% farmers who reported that they grew crops to get cash in addition to food. Other factors mentioned to determine cultivation of particular crops were the influence of the Agribusiness Company, which increased market demand; other reasons were climatic conditions and seasonality. The study showed that about 17% of farmers reported that they had access to irrigation farming. These were generally farmers living near water catchment locally known as vinyungu. Despite assured year-round harvest, the farming done in these water catchments is contrary to the ongoing environment management efforts by the government and other development stakeholders.

4.5. Understanding of CSA among Contracted Smallholder Farmers

Results indicate that the level of understanding of CSA varies amongst contracted farmers mainly depending on the length of stay in contract farming cooperation. This implies that the longer the time of stay in contract farming the more the farmer acquires CSA knowledge and skills, mainly through participation. About 34.6% of contracted farmers interviewed were able to explain some elements of CSA. Majority of farmers have practiced some form of CSA for years; however, some of the practices and technologies are synonymously explained by farmers with conservation agriculture (CA). Technically defined, CSA is a wider context of CA because technologies and practices featuring in the currently accepted definition of CSA don't feature in CA. For example, CSA teaches farmers to observe weather index data, and seek weather insurance services; something which is not applicable in CA. Table 1 lists the climate smart practices and technologies integrated by farmers in their farming activities.

Climate Smart Practice/Technology	Frequency	Percent	Cum Percent
Terrace farming	21	8.8	8.8
Minimum (zero) tillage	18	7.6	16.4
Use of early maturing seed	36	15.1	31.5
Crop rotation	37	15.5	47.0
Planting trees	54	22.7	69.7
Seeking information of rainfall season	6	2.5	72.2
Insure crop	2	0.8	73.1
Rain water harvesting	3	1.3	74.4
Planting drought and pest resistant seeds	26	10.9	85.3
Apply organic fertilisers	33	13.9	99.2
use of crop calendar	2	0.8	100.0
Total	238	100	

Table 1: CSA Practices and Technologies Deployed by Farmers in the Study Area

From Table 1 one can see that farmers have traditionally been using CSA related practices and technologies. However, some of these practices and technologies are not typically CSA but rather conservation agricultural (CA) practices. Looking at the percentages, it seems that CSA practices and technologies are still used at low level. More support to the farmers by the government, private agribusinesses that have partnered with farmers and others development stakeholders is required. Furthermore, most farmers interviewed indicated to have substantial knowledge about environment and soil management practices. This is because the knowledge about environment management is relatively older than CSA.

Environmental Management Practices	Frequency	Percent	Cum. Percent
Zero or minimum tillage	36	15	15
Environmental conservation	43	18	33
Preserve soil fertility	26	11	44
Tree planting	48	20	63
Improve soil fertility	23	10	73
Controlled bush fires	32	13	86
Afforestation	33	14	100
Total	241	100	

Table 2: Environment Management Practices by Interviewed Farmers

The figures in Table 2 indicate that few farmers understand CSA and related practices. The agribusiness company and other stakeholders still have a great way to go in educating farmers about CSA practices and related technologies. The study further probed farmers to know if they knew the role of CSA in their daily farm operations activities. Generally, there were few farmers who knew the role of CSA in promoting resilience to climate change (Table 1).

Importance of Adopting CSA Practices	Frequency	Percent	Cum. Percent
Increased productivity	56	23	23
Moisture preservation	47	20	43
Water management	48	20	63
Land conservation	46	19	82
Soil preservation	44	18	100
Total	241	100	

Table 3: Farmers' Knowledge about Role of CSA in Creating Resilience to Climate Change

Despite having awareness of what CSA is, farmers indicated that they don't apply it due to a number of reasons including limited practical application due to limited availability of appropriate technologies which basically require capital investment which majority of farmers cannot afford. Field observation found that farmers were deploying a number of CSA practices, though on small scale. Farmers were using CSA practices and technologies such as farm yard manure, ridged, terraces, contours, cover plants, minimum/zero tillage, crop rotation and integrated pest management. The farmers reported that apart from the agribusiness company, they received CSA skills from various practitioners including NGOs (about 27%), government extension staff (25%), lead farmers (7%) and the remaining from their own practical farming experience. However, about 81.3% of farmers contracted by G2L indicated they have seen impact of the CSA practices and technologies after engaging in the farming contract with the company. These small fractions of farmers who know CSA indicated that a great deal of efforts is still needed to ensure that large number of farmers understands and practice of CSA.

4.6. Commonly Used CS Agro-Inputs and Technology

Results indicate that about 29.3% of farmers used fertilizers, 17.4% used pesticides (insecticides, herbicides and fungicides), and 17.2% improved seeds and 66.1% not using any CSA inputs. The farmers get CSA input and technology through local agro-dealers, Government agent and NGOs. Most of the contracted farmers receive these inputs in the form of loan to be paid during harvest. About 61.2% of farmers reported that they get access to CSA inputs and from agro-dealers who are linked to large suppliers such as Syngenta and Balton. In practice, majority of the agro-dealers visited were native to the respective villages, although some visited the villages from other places during time of input distribution. By interpretation these figures indicate low level of CSA activity in the study area, calling for more deliberate efforts directed at supporting farmers to build their capacity to practice CSA more effectively.

4.6.1. Common Bean Varieties Grown in the Study Area

Interviewed farmers mentioned three common bean varieties grown in their farms. These varieties include Uyole Red, Uyole yellow, which was planted by majority of farmers; Uyole 96 which was generally grown by contracted farmers. Uyole yellow was grown by about 55% of farmers interviewed, followed by Uyole Red and Uyole 96 (about 27% and 18% of farmers respectively). Other varieties of common beans reportedly grown by farmers were known by vernacular names such as Kablanketi, Sawelo, Lungemba, Masusu and Kabanima. Majority of contracted farmers reported that they currently don't use indigenous seeds due to low yield, late maturity, high susceptibility to diseases and pests, low drought resistance and low market price. They have adopted climate smart seeds which have generally shown to thrive well in the changing climate. Uyole yellow, Uyole Red and Uyole 96 have shown more climate smartness in terms of higher drought resistance, increased yield per acre, higher resistance to diseases and pests and attract better market prices than the indigenous cultivars. Furthermore, these varieties are easily available from seed suppliers (agro-dealers).

The varieties have been developed through improvements of indigenous seeds by the Uyole Agriculture Research Institute (ARI Uyole). Despite good characteristics shown by these improved varieties farmers reported that they are reluctant to adopt them due to a number of reasons including limited availability, high price, late distribution by agrodealers and some indicated that they are less demanded by consumers at the market. Some farmers still reported that

they are so used to growing indigenous varieties and are worried that the growing of new varieties demands them to buy new seeds every season, which they don't like. They reported that they are not prepared to lose indigenous varieties which have successfully been grown for years. However, there were a number of other reasons why farmers were not using CS seeds (Table 4).

Reasons	Frequency	Percent	Cum. Percent
Ready availability of traditional seeds	23	10	10
High price of CS seeds	32	14	23
Traditional practice	21	9	32
Unaware of CS seeds	56	24	56
Limited availability	71	30	86
Low consumer demand	6	3	89
Late distribution	26	11	100
TOTAL	235	100	

Table 4: Reasons for Non-Use of CS Seeds

Table 4 shows that the major reasons for non-use of CS seeds among farmers are limited availability, limited awareness, and high price of CS seeds. Other causes reported by farmers in FGD were ready and easy availability of stored traditional seeds, low demand of CS seeds by consumers at marketplace, late distribution by agro-dealers and that they are used to indigenous varieties. This basically calls for improving quantity of seeds supplied to the farmers and conducting deliberate education/awareness creation campaigns to increase uptake of CS seeds among farmers.

4.7. Forms of Support Offered by Agribusiness Company to Shfs Groups

It was found out that the farmers organized in groups receive different forms of support including in-kind and monetary forms. About 40% of farmers received support in terms of farm inputs (CS seeds, fertilisers and inoculants). G2L officials reported that it was easier to distribute farm inputs to farmers when they are organised in groups than when they work individually. The company is therefore also engaged in organising smallholder farmers into groups using its extension staff deployed in districts it operates. The organised farmers groups gave the company a reliable mechanism to reach farmers with training programmes on CSA, providing CS farm inputs and appropriate extension services to the end that it gets easy bulking of the produce during harvest season.

4.7.1. Fertilizers and Inoculants

Majority of farmers (86.2%) indicated a general misconception that common beans don't need fertilizers. Nevertheless, interviews with extension staff indicated that the crop needs some fertilisers especially phosphate derivatives which are required in the early formation of roots and flowers. Literature review on agricultural productivity in different soils also indicates that the crop also needs nitrogenous fertilisers depending on the nature of soils (Mijajna, et al, 2006; Alhrout et al, 2016; Wondimu and Tana, 2017). This is mainly because some soils lack N-fixing micro-organisms (Rhizobia) (Mijajna, et al, 2006; Kouki et al, 2011). The major reasons reported by farmers for non-use of nitrogenous fertilizers were the traditionally transmitted knowledge that the common bean plant fixes its own nitrogen from the atmosphere (only few farmers 11.4% indicated that the fertilisers could also be used). Other reported reasons for non-use were limited availability (22.3%), low affordability among them (66.3%) and late distribution by agro-dealers (33.2%). However, majority of farmers 67.3% were aware that phosphate fertilizers such as DAP, NPK and locally produced rock phosphate (Minjingu) could be used during planting of common beans.

Inoculants are other important substances used by farmers in the study area. Inoculants are micro-organisms applied to soils so as to stimulate microbial activity that transform nitrogen from the air into usable form in the soil. However, the use of inoculants was reported by very few farmers mainly due to limited awareness and unavailability of the substance from the local agro-dealers. By the time this study was conducted no farmer reported to have done soil testing to examine chemical composition essential for plant growth and need of any inoculants. This means that farmers are unaware of the nutrient needs of the soils. However, the agribusiness company (G2L) was aware after getting information from the research institutions that soils in the common bean growing areas need nitrogen because of excessive leaching. Therefore, the company distributes inoculants to few contracted farmers to initiate nitrogen fixation in their soils. Furthermore, large international fertiliser companies have done some soil tests and are distributing fertilisers that contain missing soil nutrients.

4.7.2. Training on Climate Smart Agriculture

The agribusiness company reported that it did a number of farmers' trainings. About 29.9% of interviewed farmers reported to have received training on CSA from G2L Company. The company organised training to few farmers, namely, lead farmers and government extension staff who were expected to cascade the knowledge and skills to the farmers on the ground. In training farmers, the company indicated that it used CSA capacity development manual which was developed by DFID-funded Vuna programme. With the framework of Making Markets Work for Poor (M4P), agribusiness companies now have access to donor funding – which among others help them develop tools for supporting CSA on the ground. For example, under the DFID-Funder project Vuna programme G2L Co Ltd was able to develop a CSA training manual for

smallholder soybean and common bean farmers. The manual was developed to be in line with government extension training guidelines. Farmers reported that they were trained on specific Climate Smart (CS) practices and technologies such as use of CS farm input such as early maturing seeds and drought resistant varieties; how to do climate smart cultural practices such as zero tillage, minimum tillage, early planting, appropriate spacing and how to use fertilisers, inoculants, and agrochemicals to address challenges brought by climate change.

Farmers were also trained on farm cultural practices such as crop rotation, intercropping, mixed cropping and other so as to enable them adapt to climate change. They were also trained on post-harvest management and farming as a business which basically aimed at changing the mind-set of farmers to adopt entrepreneurship skills in farming and become business-oriented farmers who could strategize to earn income for tackling climate change and relate challenges rather than remaining tradition production-centred farmers. Further to training, the company conducts field days as routine follow-up ensure that farmers put into practice the knowledge, they acquired during CSA training workshops. In these field visits the G2L staff and government extension staff assisted farmers with technical issues that needed immediate support, such as land preparation, how to plant (plant spacing), weeding and other CS agronomic activities. The company also established demo plots to showcase to the farmers on how CSA could practically be used to enhance their resilience to climate change.

4.7.3. Credit Services

The adoption of CSA practices requires smallholder farmers to invest in appropriate technology, appropriate seed varieties, right breeds and other inputs (FARA, 2015). This study learned that the agribusiness (G2L) facilitated farmers to get micro-loans from revolving fund scheme it manages and therefore were able to acquire climate smart technologies (mostly seeds). However, the number of farmers that had access to this facility was small and its coverage in terms support it provides is quite narrow in that it only supported farmers to buy CS seeds and inoculants. There is a need to expand the facility so that it can reach more farmers with more diversified support directed towards promoting SCA.

4.7.4. Information - Such as Early Warning

The G2L reported that they had been receiving CSA information from the national and regional institutions e.g. TMA on regular basis. Nevertheless, it was reported that there is no well-established framework for disseminating this information to farmers on regular basis. With this limited access to CS information and knowledge smallholder farmers have been denied opportunity to make appropriate decisions that could provide climate change resilience. The farmers' information needs include weather information related to growing seasons because with climate change these become shorter and less predictable. They need information on the disease outbreaks, and mechanisms to reduce post-harvest losses and market information.

4.8. Productivity Comparison: Contracted Vs Non-Contracted Farmers

The study compared yield and productivity of common beans under two scenarios. The first scenario was done by comparing productivity data before and after farmers were contracted by the agribusiness company (G2L) and the second scenario was done by comparing contacted versus non-contracted farmers during the time of study. A sample of thirty-seven (37) farmers was compared (before and after entering into contract with the company). Similarly, 37 pairs, each comprising of contracted and non-contracted farmer were compared using appropriate statistical techniques (t-test). Table 5 indicates yield data in the two scenarios describe above.

No	Yield before Contract (kg)	Yield after Contract (kg)	X-Y	Non-Contacted Farmers Yield (kg)	X'-Y'
1	305	596	-291	429	167
2	153	698	-545	139	559
3	369	701	-332	173	528
4	433	396	37	359	37
5	143	609	-466	294	315
6	356	711	-355	359	352
7	229	576	-347	192	384
8	412	479	-67	291	188
9	109	708	-599	112	596
10	311	707	-396	360	347
11	364	493	-129	225	268
12	188	668	-480	191	477
13	295	418	-123	150	268
14	309	469	-160	312	157
15	274	388	-114	307	81
16	196	702	-506	139	563
17	167	562	-395	170	392
18	154	694	-540	193	501
19	308	704	-396	408	296
20	163	713	-550	166	547
21	143	359	-216	397	-38

No	Yield before Contract	Yield after Contract	X-Y	Non-Contacted Farmers Yield	X'-Y'
22	152	546	-394	270	276
23	206	677	-471	209	468
24	189	283	-94	219	64
25	197	497	-300	304	193
26	150	784	-634	153	631
27	223	588	-365	148	440
28	356	697	-341	359	338
29	401	467	-66	185	282
30	265	596	-331	187	409
31	153	701	-548	231	470
32	223	710	-487	261	449
33	356	686	-330	201	485
34	184	692	-508	357	335
35	120	533	-413	229	304
36	231	369	-138	159	210
37	159	788	-629	411	377

Table 5: Productivity Data for Contracted and Non-Contracted Framers

The author generated a paired sample t-test to see if there were significant differences in yield of common beans between the contracted and non-contracted farmers. Results showed that, at 95% CI and 36 df the critical value for 2-tailed t test is 2.0281. However, the calculated value was 12.041. This, by interpretation, means that there was significant difference between common beans yields per acre before and after the farmers were recruited into contract farming by the Agribusiness Company (G2L). The possible explanation is that yield of the common beans increased when farmers were recruited in contract farming because they received climate smart support from the company. The difference in yield of common beans was further tested between non-contracted farmers during the time of study and yield data of the contracted farmers before they entered into contract with the company. Results indicated that there was no significant difference of common bean yield between the two groups of data ($t = 0.441$ at 95 CI and 36 df – two tailed test). Comparison of yields of common beans between contracted farmers (experimental group) and non-contracted farmers (control group) indicated that there was significant difference in yield ($t=12.657$). The possible interpretation for these two occasions is that contract farming brought difference in common bean yield.

4.9. Institutional Factors Hindering Effectiveness Of Contract Farming

Time –consuming process of CS seed certification and approval

Although Tanzanian legislation is reasonable in terms of intentions to achieve its ambitious targets on quality seed production and supply, the process of getting seed certified for use by farmers in is so cumbersome, bureaucratic and time-consuming and is reportedly the primary cause of high prices of CS seeds which farmers cannot afford to buy and use. Basically, the country has two legislations which ensure production and supply of quality seeds to farmers. These are the Seed Act of 2003 and the Seeds Regulations of 2007 which govern seed production and trade related issues. The law provides for a compulsory seed certification, laboratory seed testing, variety evaluation and registration under the control of the Tanzania Official Seed Certification Institute (TOSCI). The Institute is also responsible for testing Distinctness, Uniformity and Stability (DUS) and the National Performance Trials (NPT) which are necessary tests for variety release and registration. Under the system, locally bred varieties must be tested for three years/seasons before being released for commercialization. Varieties released in other Eastern African countries whose seed systems are harmonized with that of Tanzania, need one season of verification before being registered. This regulatory procedure, however, follows after years of research work to identify appropriate seed for particular process and does not exclude CS seeds which are highly demand in these days of changing climate.

4.10. Shortage of Seeds

Farmers reported that there was serious shortage of climate smart seeds (especially the early maturing and disease resistant common bean varieties) because those provided by the agribusiness Company were not adequate. For example, only 37.3% of contracted farmers reported to have received the seeds (early maturing variety) from the company. The agribusiness in turn reported that it could not reach all farmers with CS seed due to shortage of these from its sources (Uyole Agricultural Research Institute (Ari-Uyole) and multiplication companies such as Agriseed Co. Ltd). Nevertheless, the company made some effort to request the government to allow farmers to use Quality Declared Seeds (QDS) which basically have partly gone through Seed Certification process. The company was also liaising with the Uyole Agriculture Research Institute to engage farmers in the seed multiplication so as to get Quality Declared Seed instead of waiting for certified seeds. QDS are sold at affordable price and could readily be available to farmers.

4.11. Government Export Ban

Contractor (G2L) reported that they faced limited access to markets when the government-imposed protectionist regulations and actions. Export ban was reported to be one of the constraints that limited it to recruit more farmers in the contract arrangement. When cross-border trade is banned by the government the companies are not allowed to export selected commodities, such as grains to the neighbouring countries (Regional Market). With this government market

regulation company reported that they recruited few farmers just to meet demand in the local market; the company avoided recruiting farmers in excess of the demand in local market. Government imposes crop ban in a bid to encourage investment in agro-processing industries and as a way of preparedness against potential food shortage in the country and stabilising food prices in the country. Critics of this government export ban policy would like the government to impose the ban after it has set good arrangements for crop to move from excess to deficit areas within the country so that farmers could have access to markets. Currently, farmers affected by crop ban have limited marketing options except to store the crop until when local markets open up through local traders who move from one district to another in search of the crop usually setting low price.

4.12. Side Selling

Side-selling was reported to be one of the common challenges facing contract farming in the study area. As means to overcoming this challenge, the agribusiness company deployed extension staff in every district it had contracted farmers to help in monitoring the suspected moves of farmers. The staffs are deployed from time of planting to harvesting, storage and bulking of the produce from the farmers which done at collection centres. In so doing farmers who were tempted to side-sell their produce could not do so in fear that they would be identified by these officials. Furthermore, the company started bulking and buying the produce from contracted farmers early in June before many traders go in the villages. The company worked closely with local government authorities which help to monitor suspicious actions of farmers.

There is no specific legal framework in Tanzania for addressing issues of contract farming. The relationship in contract farming in the country mainly depends on farmer-contractor trust. Despite presence of witnesses during contract signing, the enforcement of contract is still hardly practical in the country due to lack of the legal framework. Defaulters such as side sellers are usually dealt with under the general law which might not be friendly to one party participating in the contract. For example, when contractors delay to distribute climate smart inputs such as seed to farmers, farmers have no option except to take the seeds even when it is too late to apply in the farm. Likewise, Agribusiness Company may not be able to sue large number of side-sellers due to number of reasons including limited capacity of farmers to pay cash penalties.

5. Conclusion

This study has demonstrated that contract farming helps farmers become more resilient to climate change. It does so mainly through the support services it provides to the contracted farmers including training, provision of CS inputs, enhancing farmers' access to climate smart technologies, finance, CS practices and information such as early warning. Government should create enabling environment for agribusinesses and smallholders to collaborate using this business model. However, a substantial proportion of farmers seem to have little understanding of CSA, which calls for investment of deliberate efforts and resource to build farmers knowledge and skills on CSA practices and technologies. Further research is required in the area on factors that hasten farmers' adoption of CSA in local contexts. Research institutes need to conduct in-depth studies aiming at producing varieties that suit different changes brought by climate change in specific localities.

6. References

- i. ActionAid (2016) 'Hotter Planet, Humanitarian Crisis: El Nino, the 'new normal' and the need for climate justice'
- ii. Ahmed, M., Maclean, J., Gerpacio, R.V. and M.A. Sombilla (2011) Food Security and Climate Change in the Pacific: Rethinking the options. Asian Development Bank
- iii. Barrett, C.B., M.E. Bachke, M.F. Bellemare, H.C. Michelson, S. Narayanan, and T.F. Walker (2012). Smallholder Participation in Contract Farming: Comparative Evidence from Five Countries. *World Development* 40 (4): 715–30.
- iv. Bellemare, Marc F. (2012), As You Sow, So Shall You Reap: The Welfare Impacts of Contract Farming, *World Development* 40(7): 1418-1434.
- v. Bijman, J. (2008) Contract Farming in Developing Countries: An overview. Policy Brief. Wageningen International Wageningen University and Research Centre
- vi. Blignaut J.N., Ueckerman L. and Aronson, J (2009) Agriculture production's sensitivity to changes in climate in South Africa. *S. Afr. J. Sci.* 105 61-68.
- vii. ESRF (2014) Country Update: How to Boost Agro-processing while Facing Climate Change: Views on the NDC and the Way Forward
- viii. FAO (2011) Role of Women in Agriculture. Working Paper Series No. 11-02
- ix. FAO (2013) Sustainable Forest Management in a Changing Climate. FAO-Finland Forestry Programme – Tanzania: Indigenous Knowledge, Practices and Customary Norms of Fire Management in Tanzania - A Study in Nine Villages
- x. FAO (2016) Contract farming for improved farmer-to-market linkages. Sub-regional office for the Caribbean. Issue Brief.
- xi. FAO (2017) Climate-Smart Agriculture: Managing Ecosystems for Sustainable livelihood
- xii. FAO (2018) Climate Smart Agriculture {<http://www.fao.org/climate-smart-agriculture/en/9>}. (accessed on 17/9/2018)
- xiii. FARA (2015). Barriers to scaling up/out climate smart agriculture and strategies to enhance adoption in Africa

- xiv. Farid, K. S., Tanny, N. Z. and P. K. Sarma (2018) Factors affecting adoption of improved farm practices by the farmers of Northern Bangladesh. Department of Rural Sociology and ¹Bangladesh Agricultural University Research System, Bangladesh Agricultural University
- xv. Gulati, A. (2008). Fragmenting Bottom and Consolidating Top: India's Changing Food System and Implications for Small Holders, in India: Some aspects of Economic and Social development (eds.) S. Mahendra Dev and K.S. Babu. Academic Foundation, India. 2008.
- xvi. Henson, S., Maskure, O. and D. Boselie. (2005). Private food safety and quality standards for fresh produce exporters: The case of Hortico Agrisystems, Zimbabwe. *Food Policy*, 30(4), 371–384.
- xvii. Kalamkar, S.S. (2012). Inputs and Services Delivery System under Contract Farming: A Case of Broiler Farming, *Agricultural Economics Research Review* 25: 515-521.
- xviii. Kinyangi, A.A. (2014) Factors Influencing the Adoption of Agricultural Technology Among Smallholder Farmers in Kakamega North Sub-County, Kenya
- xix. Kothari, C. R. (2009) "Research Methodology: Methods & Techniques" (Second Revised Edition), New Age International Publishers, New Delhi.
- xx. Kouki, S. Abdi, N., Hemissi I., Bouraoui M. and B Sifi (2016). Phosphorus fertilization effect on common bean (*Phaseolus vulgaris* L.)-rhizobia symbiosis. *Journal of New Sciences*. Volume 25 (1).
- xxi. Kumar, J. (2008). Contract Farming: Problems, Prospects and its Effect on Income and Employment. *Agricultural Economics Research Review*. Vol. 21: 243-250.
- xxii. Leung, P., S. Sethboonsarng and A. Stefan, (2008). "Rice contract farming in Lao PDR: moving from subsistence to commercial agriculture," No. 90, ADB Institute Discussion Paper.
- xxiii. Mashingo, M., (2010): Vulnerability Assessment on Pastoral Livestock and Pasture Development to the Extreme Climatic Events in Tanzania
- xxiv. Mbilinyi, A., Saibul, G.O. and V. Kazi (2013) Impact of climate change to small scale farmers: Voices of farmers in village communities in Tanzania. Discussion Paper 47, ESRF
- xxv. McLeman, R.A. and L.M. Hunter, (2010) Migration in the context of vulnerability and adaptation to climate change: insights from analogues. *Wiley Interdisciplinary Reviews: Climate Change*, 1(3), 450-461.
- xxvi. Mendelsohn, R. and Dinah, A., (2005) Exploring Adaptation to Climate Change in Agriculture: The Potential of Cross-Sections Analysis. ARD, World Bank. Issue 1.
- xxvii. Michelson, Hope C. (2013), Small Farmers, NGOs, and a Walmart World: Welfare Effects of Supermarkets Operating in Nicaragua, *American Journal of Agricultural Economics* 95(3): 628-649.
- xxviii. Mirjana, J., Zdravković M., Simonida, D, and Damjanović M. (2006) Response of beans to inoculation and fertilizers. Faculty of Agriculture, Novi Sad, Serbia and Centre for Vegetable Crops, Smederevska Palanka, Serbia
- xxix. Miyata, S., Minot, N., and Hu, D. 2009. "Impact of Contract Farming on Income: Linking Small Farmers, Packers, and Supermarkets in China." *World Development* 37(11): 1781–1790.
- xxx. Mohammed, B. T.* and Abdulquadri, A. F. (2012). Comparative analysis of gender involvement in agricultural production in Nigeria. Human Resources Development Department, National Centre for Agricultural Mechanization (NCAM), P.M.B. 1525, Ilorin, Nigeria.
- xxxi. Mubaya, C.P., Nyuki, J., Liwenga, E., Mutsavangwa, E.P., and Mugabe, F.T., (2010) Perceived of Climate change related Parameters. *Journal of Sustainable Development in Africa*. Vol. 12 (5) 170-186.
- xxxii. Ntshangase, N.L. Muroyiwa, B. and Sibanda, M. (2018). Farmers' Perceptions and Factors Influencing the Adoption of No-Till Conservation Agriculture by Small-Scale Farmers in Zashuke, KwaZulu-Natal Province
- xxxiii. Ramsundar, B. & Shubhabrata, S. (2014) Problems and Prospects of Contract Farming in India. *Global Journal of commerce and management*, Vol.3(6):12-17
- xxxiv. Sanga, C. and Kalungwizi, V.J. (2013) Building agricultural extension services system supported by ICTs in Tanzania: Progress made, Challenges remain. Sokoine University of Agriculture, Tanzania.
- xxxv. Simmons, P., P. Winters, and I. Patrick. (2005). An Analysis of Contract Farming in East Java, Bali, and Lombok, Indonesia. *Agricultural Economics* 33: 513–25.
- xxxvi. Simmons, P., P. Winters, and I. Patrick. (2005). An Analysis of Contract Farming in East Java, Bali, and Lombok, Indonesia. *Agricultural Economics* 33: 513–25.
- xxxvii. UNCTAD (2009), World Investment Report 2009 on Transnational Corporations,
- xxxviii. UNDP (2004) Meeting the Climate Challenge Sustaining Livelihoods: Lessons for the Future. United nations Development Programme and Global Environmental Facility.
- xxxix. UNFCCC (2007) Climate Change: Impacts, Vulnerability and Adaptation in Developing Countries. Climate change Secretariat. UNFCCC. Bonn.
- xl. Vicky, M. (2017). Baseline Survey of Support in Out-grower Scheme Development. A report submitted to DFID-funded VUNA
- xli. Wainaina, W., Okello, J., Nzuma, J. (2012). Impact of contract farming on smallholder poultry farmers' income in Kenya, Selected paper for presentation at the International Association of Agricultural Economists, Foz do Iguaçu, Brazil, 2012.
- xlii. Waithaka, M., Nelson, G.C., Thomas, T.S. and Kyotalimye, M. (2013) East African Agriculture and Climate Change A Comprehensive Analysis
- xliii. Wang H.H, Y. Wang, and M. S. Delgado (2014). The Transition to Modern Agriculture: Contract Farming in Developing Economies. *American Journal of Agricultural Economics* 96 (5): 1257-1271.

- xliv. Weber, A. S (2011). The role of education in knowledge economies in developing countries. *Procedia Social and Behavioural Sciences* 15 (2011) 2589–2594
- xlv. William, P.W. (2009) Climate change impact in agriculture sector in Tanzania and its mitigation measure. Tanzania Meteorological Agency, Department of Climatology and Climate Change, Dar es Salaam, Tanzania. IOP Conf. Series: Earth and Environmental Science 6 (2009) 372049 doi:10.1088/1755-1307/6/7/372049
- xlvi. Wondimu, W and Tana T. (2017) Yield Response of Common Bean (*Phaseolus vulgaris* L.) Varieties to Combined Application of Nitrogen and Phosphorus Fertilizers at Mechara, Eastern Ethiopia. *Journal of Plant Biology & Soil Health*; Vol.:4, Issue:2