Global Value Chains as a Stimulant for Innovation among Producers: Evidence from Avocado Farmers in Siha District Tanzania

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Abstract

This paper examines the role of the Global Value Chain (GVC) in strengthening Agricultural Innovation System through the case study of avocado farming in Siha District, Tanzania. It is informed by 100 avocado farmers from Siha District and 14 purposively selected key informants who were engaged through questionnaires, in-depth interviews and focus group discussions. The paper revealed that against the pricing challenges and beyond promotion of access to international markets, the GVC has linked all 100 researched farmers and other local agricultural innovation system actors to new and improved knowledge and technologies. Such linkages have contributed in improving farmers' capability and enabled them to produce the quality and quantity of avocado product needed by the market and as a result improved their income and livelihood. The paper recommends policy interventions to strengthen and harness the linkages between local innovators and their GVC counterparts in order to maximize technological capability building and strengthen the weak agricultural innovation systems like that of traditional avocado farming.

Keywords: *Global Value Chain, Agricultural Innovation System, Avocado, Technological Capability*

Introduction

Agriculture supports more than two-third of the population in Tanzania (URT, 2016). The sector is dominated by smallholder farmers who grow varieties of crops for cash and domestic consumption utilities. Generally, the contribution of agriculture in improving the livelihood and reducing poverty among those farmers remains relatively low (URT, 2015). This is attributed by a set of factors including farmers' disconnection from large urban and global markets. A large number of Tanzanian farmers operate informally and thus they are riskier and less efficient compared to formalized sectors (RIU, 2009). Moreover, farmers have failed to adequately produce the quality and quantity of products required by the local and international markets. The linkages between small-scale farmers and extension service providers as well as the R&D institutions are arguably weak (Wangwe, Diyamett, & Komba, 2009). Studies have also revealed a widening gap in performance and gains between smallholders and several key players in agriculture, including agro-processors, suppliers of agricultural inputs, credit facilities and suppliers of improved production technologies (Coulson & Diyamett, 2012).

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The Tanzanian Agricultural Innovation System (AIS) is dominated by subsistence farming (peasantry), and it is deprived of necessary services such as technology, information, and opportunities to participate in economic and learning activities effectively (Kangalawe & Liwenga, 2005; Makundi, 2017) Wetlands contribute in diverse ways to the livelihood of many people in Africa. One of the major constraints to the wise use of African wetlands is lack of knowledge by planners and natural resource managers on the benefits that they provide and techniques by which they can be utilised in a sustainable manner. This paper presents findings from a study undertaken in Kilombero Valley, Tanzania, on the dynamics and benefits of natural resource use in the wetlands. The paper specifically focuses on opportunities and challenges related to integrated water resource management. The study was conducted in two villages, Idete and Signali located in Kilombero District, Morogoro Region. Participatory assessment and household interviews were employed to obtain both qualitative and quantitative information, respectively, pertaining to biophysical, agronomic and socio-economic facts that influence community access to, and utilisation of the wetland resources.\n\ nThe findings show that Kilombero Valley has high potential for a diversity of livelihood activities. The wetland also serves as a source of water for farming, livestock, fishing and for domestic uses. Over the last two decades the use of wetlands for agriculture has increased because of increasing population of both pastoral and agro-pastoral communities, and hence the resultant need to produce more food.

However, there are environmental concerns associated with increasing use of wetlands for agriculture and other livelihood activities, including deforestation and trampling of soils by increasing livestock numbers, increased demand on the water resources and lack of elaborate institutional framework to facilitate the integration of the various sectoral and cross-sectoral uses of the wetland resources and among stakeholders. The main conclusion is that sustainable livelihood development of wetland communities requires multidisciplinary and integrated efforts in addressing constraints in the various sectors such as agriculture, natural vegetation use, water resources and fishing."

Drawing from the case of rice farming, Makundi (2017) showed that the sector needs technological improvements (including agro-inputs, crop varieties, and mechanization tools), better farming systems and an effective linkage to local and global agricultural value chains. The value chain approach will assist in creating linkages between farmers and other actors including the public and private sector players for interactive learning processes, generation, dissemination, and application of knowledge, and technologies that will eventually bring new products, new processes and new forms of organization into economic use (World Bank, 2006).

Along the value chain thinking, Pietrobelli and Rabellotti (2011) introduce the Global Value Chain approach (GVC), constituting full range of activities carried out by different firms/producers that form part of the network located in different countries but coordinated by a lead firm through provision of guidelines on the quality standards of the products. GVCs are claimed to link-up the local firms/

farms with foreign firms, non-governmental organizations, and the governmental actors with a goal of fostering the circulation of knowledge with a view to ultimately bring diverse resources needed to support producer's capabilities building in different countries (Pietrobelli & Rabellotti, 2011; OECD, 2015).

The literature has shown that some farmers in various parts of Tanzania are already connected to the various existing GVCs. Some GVCs come with challenges towards poor farmers in the south, particularly in terms of exploitative pricing models. At the same time, the GVC has also contributed positively in improving the welfare of poor farmers through access to diverse markers and benefit. Against the backdrop of such contributions there is a dearth of evidence on the impact of GVCs on Agricultural Innovation Systems (AIS), particularly with reference to technological capabilities building among small producers (Morrison, Pietrobelli & Rabellotti, 2008). In order to close this knowledge gap, this study was designed to assess the extent at which GVCs have contributed in improving learning and upgrading of the avocado sector in the Northern Tanzania. This paper intends to address three main research questions: First, on the history of avocado farmers participation in the GVC; second, the modalities and extent at which the avocado GVC has stimulated the multi-actor linkages for the benefit of farmers in terms of learning; and third, the acquisition of knowledge and application of the learning process in upgrading farmer-driven innovations.

The paper is informed by evidence from the Hass avocados farmers in Siha District, Kilimanjaro Tanzania, who supply international markets in France, Belgium, German, Holland, UK and Spain. The paper is structured as follows: The first part is an introductory section, while Section 2 provides literature review, and Section 3 discusses the research methodology. This is followed by Section 4 which presents data on the small-scale avocado farmers sampled. Section 5 deals with discussion of the findings. The last section provides implications of the GVCs in Tanzania.

Literature Review and Theoretical Framework

Agricultural Innovation Systems

Through the work of scholars such as Malerba (2002); Rajalahti, Janssen & Pehu (2008), the concept of Agricultural Innovation Systems (AIS) has evolved a sector-specific component of the National Systems of Innovation (NSI). Freeman (1987) defines National Innovation Systems as the network of institutes in the public and private sectors whose activities and interactions initiate, import, modify, and diffuse technologies. In the empirical work by Lundval (1992), country economies are classified according to their low or high capabilities to diffuse the economically useful knowledge, leading into the concepts of emerging and mature NSIs respectively. Scholars in the field of economic geography, have also presented evidence to suggest the sector-level variations in terms of innovation in a given economy or geographical locality. Such variations emphasize the role of specializations, and the importance of the Sectoral Systems of Innovation

(SSI) concept.

In the agricultural sector, AIS is treated as the SSI composed of several agricultural entities including individual farmers, and farm-related organizations, guided by a set of common habits, norms, routines, established practices, rules and laws that regulate their relations, linkages and interactive learning processes for generating, disseminating and applying the economically useful knowledge. Such related actors include among others, policy makers, education providers, credit offering facilities, R&D institutions, input suppliers, storage facilities and marketing companies (Arumapperuma, 2006). It is worth emphasizing the need for all stakeholders to work together towards innovation for development (Heemskerk & Wennink, 2006).

Concept of GVCs

A value chain concept is described as a full range of activities performed by firms and workers in bringing a product from its conception to consumption and beyond. Against the backdrop of international trade barriers, "globalization" has facilitated the value chains, through a division of labor and disintegration of production activities across firms from different parts of the world as part of a global network. GVCs can either be producer-driven or buyer-driven, depending on the type of actor that exerts the most significant influence over the product. The producer-driven value chains tend to be dominated by large manufacturing firms, which play the central role in coordinating the production network (Gereffi, 1999). These firms tend to be dominant in capital and technology intensive firms such as computer and phone manufacturers (e.g. Apple, Samsung), automobile (e.g. General Motors, Mercedes-Benz) and aircrafts (e.g. Boeing, Airbus) industries.

Under the buyer-driven GVCs, the "buyer" is usually a large retailer (e.g. Wal-Mart) or a branded-manufacturer (e.g. Nestlé, Unilever), which plays a vital role in setting up decentralized production networks in a variety of exporting countries, typically located in the third world countries (Gereffi, 1999). In buyer driven value chains, producers are responding to buyers' functions of design and marketing, especially when retailing and brand reputations matters. Most of the global agricultural value chains fall under this category, where product specification, including how the product should look like and how they should be handled or transported, is defined by big retailers in developed countries, and these product specifications are implemented by several actors within the value chain. As Gereffi (1999) puts it, "production is generally carried out by tiered networks of third world contractors that make finished goods for foreign buyers".

GVCs in Strengthening AIS through Learning among Producers

Studies have shown that interactions between global buyers and local producers in developing countries within a GVC tend to stimulate learning and upgrading capabilities in AIS (Gereffi, Humphrey & Sturgeon, 2005). There are a number of ways in which participation in GVCs among the local producers provides opportunities to learn and improve their technological capabilities. The local producers' entry into the GVCs is normally embedded with pressure to adhere

to stringent international standards related to production, products quality, and delivery among other quality requirements imposed by the lead firms. Consequently, in their attempts to meet these requirements, the local producers have to learn and innovate (Pietrobelli & Rabellotti, 2011). This is either stimulated by the lead firms through direct investments into local firms by providing training and explicit technology transfer to local firms, as well as providing feedback through continuous interactions.

In some cases, local firms or farmers are compelled to make their own investments in building the capabilities in order to maintain or upgrade into higher position in the value chain (Pietrobelli & Rabellotti, 2011). Furthermore, learning opportunities also arise from formal and informal interactions with other GVC actors through meetings, seminars, workshops and other networking opportunities. Such interactions tend to result into greater diffusion of knowledge, technology, and know-how to the local producers, and may lead to spillovers to the rest of the economy (Kowalski *et al.,* 2015).

Effects of Learning from GVCs to AIS in terms of Upgrading

The learning environment and absorption of skills under the GVC account for improved productivity of local producers through innovation. In this process, producers are able to broaden and deepen their technological capabilities while exploiting opportunities for various forms of technological upgrading. Upgrading within the context of GVC refers to the acquisition of technological capabilities and market linkages which enable firms to improve their competitiveness and move into higher value chain activities (Kaplinksy & Morris, 2001). The upgrading process is therefore characterized by dynamic movement within the value chain where producers shift between different stages of the chain. Gereffi *et al* (2005) identify the four types of firm upgrading within value chains. These include the first form – *product upgrading* which involves moving from simpler towards more sophisticated products either through introducing new products or improving old products. The second form – *process upgrading* entails an enhanced efficiency of the internal process either through the introduction of superior technologies or reorganizing the production process. The third form is *functional upgrading* involves increasing the value added by changing the mix of activities or acquiring superior functions or abandoning the current low-value function. And fourth form is the *inter-chain upgrading* occurs when firms apply the newly acquired competences in a particular function that allow them to move into a new chain.

Evidence on GVCs' Role in Strengthening AIS in Developing Economies

Dolan and Humphrey (2000) studied the trade of fresh temperate vegetables including peas and beans from Kenya to the UK market. The two scholars found that the business involved complex relationships whereby small traders bought products from local farmers at the farm gate or in wholesale markets in Kenya and channeled them through import agents in the United Kingdom, who again supplied the British wholesale food markets. The Food Safety Act in the United Kingdom placed a requirement on import agents to show "due diligence" in their

manufacturing, transportation, storage and preparation of food. This enforces the Kenyan producers to upgrade their capacity and production quality under a regular monitoring process. The new produces for export are developed in cooperation between exporters, importers and producers. Consequently, the emphasis on quality and freshness induces a strong coordination and adaptive learning along the value chain to ensure that the products meet the standards stipulated under the United Kingdom Food Safety Act.

A similar study was conducted by Minten *et al.,* (2009) on smallholder farmers that were producing French beans in Madagascar, and supply for supermarket chains in France, Belgium, U.K and Netherlands through Lecofruit, a foreign invested enterprise that operates in Madagascar. Lecofruit signs a contract annually with clients in Europe to supply them with fruits at a stated quantity, the delivery conditions and product specifications for a whole year (minimum quantity, prices, time of delivery, and payment schedules). In meeting food safety and agricultural health standards imposed by European supermarkets, Lecofruit started to train farmers on how to make suitable fertilizers in a compost form using a mixture of manure, vegetables and some industrial fertilizers. An extension agent is assigned by Lecofruit to every 30 farmers, and at least five trained assistant agents must be in the villages during the crop production cycle. On average, each smallholder farmer must be visited more than once per week by one of the firm's representatives, who would sometimes carry out specific activities, for example, applying pesticides on the crops, so as to ensure that it is rightly done because the contractors would only pay for the products that fulfilled the quality standard agreed upon. Also, Lecofruit invited auditors to Madagascar to follow-up on these conditions and for inspection, at least once a year. Researchers consider these quality-control mechanisms as a trigger for technological capability building among farmers (Minten *et al.*, 2009; Kowalski *et al.,* 2015).

A similar case of GVC driven technological capability building is reported by Perez-Aleman (2011) on dairy producers of Nueva Guinea in Nicaragua. Dairy farmers in this region lost their foreign market in 1998 after failing to meet HACCP standards. The study notes that dairy producers failed to control cattle diseases such as tuberculosis, brucellosis and mastitis simply because they lacked local microbiological laboratory test in the rural areas. As a result, local producers, governments, and NGOs in collaboration with trading agencies in the value chain responded to this problem by creating infrastructure development and training on improved dairy production methods among rural producers.

In another study, Norton *et al.,* (2003) reported about rejections of snow pea from Guatemala at US ports in 1990 because pesticide residues and pests were detected. In response, the Guatemalan government responded by engaging in developing Integrated Pest Management (IPM) research and technical assistance programs to reduce pesticide use, to eliminate residues on snow peas, and to enhance product quality. The IPM program has on-farm research and training components that cover practices such as pest identification and monitoring, trap cropping, and soil disinfection.

From these studies, it may be concluded that GVCs have facilitated interaction between global, indigenous private and public actors, and created the local AIS which is capable of building producers' capabilities. Such capabilities influenced improvement in production efficiency by the producers. It is evident that the GVCs plays a very important role in strengthening AIS in developing countries, by setting technologically advanced production standards and by collaborating in their fulfilment.

Historical Background to the Hass Avocado Farming in Kilimanjaro Region

History shows that avocado trees were introduced in Kilimanjaro in the late 19th or early 20th century by Germany missionaries with different purposes including for food, medicinal, animal feeds, shading for coffee plantations and for timber production (Mwakalinga, 2014). Research findings revealed that until 2000s, there were no improvements in avocado varieties in the region as some of the trees were found to be over a hundred years of age. It was further revealed from the field that since the year 2000 farmers have been adopting new/improved avocado varieties. Research found that 70 (70%) of the farmers sampled have adopted improved avocado tree varieties particularly triggered by commercial motivation (Field survey, 2018). Farmers reported that before the year 2000, they were pruning avocado trees intensively to feed cattle and goats. The value of avocado fruits was elevated by an emergence of a new international market. Since then, farmers have changed their perception about avocados, considering them as an income generating crop rather than merely food and animal feed (Farmers' interview, 2018).

In particular, it was not until 2007 when smallholder farmers in Kilimanjaro were informed by the government of Tanzania and an export agent called Africado about the high demand of Hass avocado variety in the European markets. Markets for Hass avocados were reported to be abound in France, Belgium, German, Holland, UK and Spain. Smallholder farmers were advised to adopt the Hass varieties in order to benefit from the available markets in abroad and many were positive on this. However, Africado informed smallholder farmers about the requirement of certification from Good Agricultural Practices (GAP), the International Management System of Hazards Analysis and Critical Control Points (HACCP) and the ISO 9000 management standards system for the food products exported to Europe (Interview with Africado staff and farmers, 2018).

Under traditional farming system, the avocado producers do not pay attention to the good agricultural practices given a weak emphasis on standards and grading system from the Tanzania Bureau of Standards (TBS). For example, harvesting has been done through shaking of avocado branches, thereby forcing fruits to fall down. This kind of harvesting is characterized by poor hygiene, under this method avocados are likely to crack, deform or acquire contaminants as they hit the ground. After harvesting, farmers use poor packaging materials such as storing them in polythene bags, which make the products vulnerable to spoilage. Market handling of avocado has also tended to be unhygienic. For instance, the fruits are spread on the ground on top of a thin layer of grass. In some cases,

fruits are smeared with clay soil to prolong their shelf life (Field observation, 2018).

The need to produce of Hass avocado to enhance export market induces a set of improved technological capabilities among smallholder producers. This includes the adoption of irrigation, manure and fertilizer application, mulching, pests and disease control, chemical application, harvesting and pre- and post-harvest handling. This has become a continuous learning process for the farmers and other actors in the sector. This has mobilized a network of several actors ranging from extension services, R&D, universities, development supporters, logistics, quality assurance, input supplies and policies and regulations (Interview with researchers from Tengeru Research Institute, 2018).

In Tanzania avocado fruit grows well in Kilimanjaro, Mbeya, Kagera, Arusha, Manyara and Tanga (Juma *et al.,* 2019). Until 2008 the country produced less than 7,500 metric tons (mt) of avocado (Mwakalinga,2014). However, after 2008 there has been a steep upward trend, output increased from 7,500 mt to 19,449 mt in 2016/17 (NBS, 2016). The rise of avocado production in Tanzania was stimulated by the increase of global demand of avocado from 2.71 million metric tons in 2000 to 5.92 million metric tons in 2017 (World Avocado Production, 2017). Since then, avocado farming in Tanzania started to be viewed as a source of new business for export. This was in line with the adoption of improved Hass avocado variety, which is favorite for the export market (Mwakalinga, 2014). Thus, in 2008 Tanzania emerged as an exporter of avocado- exported to Kenya 100mt, in 2009 it exported 6mt to UK, in 2010 it exported 29 Mt to Kenya and 20mt to Zimbabwe. In 2012 exports were 628 Mt of which 610 went to Kenya and 17 Mt directly to UK. In 2018, Tanzania exported 2,304 Mt of avocados valued at US$ 2.8 million to the Netherlands, 3,133 mt was exported to France and 1,193 was exported to the UK (Shirima, 2019).

Research Methods

The main objective of this paper is to determine how the linkages established under the Global Value Chain contribute to the technological capacity building among the avocado farmers in Siha. Specifically, the paper intends to establish the linkages between GVC and innovation systems through empirical evidence from avocado farmers and the various inter-linked actors across the system/chain. To achieve these objectives, the paper adopts a descriptive approach, which is complemented by qualitative in-depth interview to investigate the influence of GVCs towards collaborations and interactions among actors in the avocado innovation system and stimulate flow of information and resources necessary for building technological capabilities of farmers. The case study approach was preferred for its potential to offer a deeper understanding and detailed empirical data on this topic. In this design, qualitative and quantitative approaches were employed in collecting empirical data. A simple random sampling procedure was used to obtain a sample size to represent the total population at confidence level of 90% and level of precision of 10%, as derived from Yamane (1967) formula where: n is the sample size; N is the population; e is the level of precision

(Sampling error) = 10%. From the population of 2028 farmers and a sample size involved 95 farmers. However, the study drew out 100 farmers who could be easily managed and draw inferences from. Purposive sampling was used to obtain key 14 informants from the government, training institutions, farmers associations, external agents, NGOs, universities, R&D and funders. Data were collected from primary and secondary sources using interviews, open and closed questionnaires and reports. The sources of data are summarized on Table 1.

Table 1: List of respondents who informed the research in 2016 and 2018

S/N	Primary data	Number of actors contacted for questionnaire and interview
1	Smallholder farmers	-100
2	NGOs	-2 staff from Forester -2 staff from a Catholic Church
3	Government	-2 staff from Horticulture Development Council of Tanzania (HODECT)
4	University	-2 researchers from Sokoine University of Agriculture (SUA)
5	R&D	-2 researchers from Tengeru Research Institute
6	Funders	-1 staff from USAID -1 staff from NORAFUND
7	Export agents	2 staff from Africado

The fieldwork was conducted in Siha district, Kilimanjaro region in Tanzania. Most of the interviews were conducted in 2016 and 2018 a follow up fieldwork was executed to deepen five previous interviews, add five new interviews based on the questionnaire data, and four focus group discussions involving four farmers each. A participant observer approach was also used to experience the processes and technologies employed of avocado farming in the field.

Descriptive statistical methods including frequencies, cross tabulations and percentages were applied in analyzing the quantitative data. Results are presented in a form of graphs and charts. Qualitative information was subjected to content analysis.

Research Findings

5.1 GVC and Multi-actor Linkages on Farmers Learning to Adopt the Hass Variety Avocado

The Hass variety was introduced in Kilimanjaro Tanzania by the Africado Company limited from South Africa which pioneered the importation of planting materials and seedling. USAID and NORAFUND supported the program by

financing the various related services including promotion adverts, production recording books and subsidies to support extension services to smallholder farmers. The donor agencies were more interested in the environmental conservation aspects of avocado farming. Researchers were informed that, most of the farmers in Kilimanjaro lacked the proper skills to grow and manage the Hass avocado variety at the time of their introduction. Thus, Africado (which later on became the exporter) collaborated with experienced researchers on horticulture from Tengeru Research Institute and Sokoine University of Agriculture (SUA) to build the capacity of smallholders. The training covered the farming-related topics, including the proper sites selection for avocado cultivation, seedling, nursing and planting, irrigation techniques, mulching, pests and diseases control, pruning, compaction, and post-harvest handling. The collaborations between Africado, Tengeru Research institute and SUA enhanced the farmers' access to improved seeds, new skills, farming equipment and extension service support (Interview with researchers from Tengeru Research Institute, staff from USAID and NORAFUND, 2018). The collaboration involved co-financing, research and training services to university students. Moreover, an environmental conservation NGO namely Forester was also supportive in nursing and distribution of Hass avocado seedling to smallholder farmers

The Catholic Church also played an important role in disseminating information on the Hass variety of avocado and in building the capacity of farmers by conducting seminars using video shows in church masses. (Interview with staff from a Catholic Church, 2018).

Training courses were deployed to farmers through the various mechanisms such as seminars, workshops, demonstration model farm and information manuals (see Figure 1). The practical training was conducted on site in the demonstration farms and sometimes farmers were taken to Tengeru Research Institute found in Arusha Tanzania for further demonstration. For the farmers surveyed, in multiple responses, 100 (32.1%) informed that they had been receiving training through seminars, 3 (1.0%) workshops, 49 (15.7%) demonstration model farm model and 94 (30.1%) through information manuals and handouts. During the interview, farmers reported that training manuals with illustrations were more useful as most of them could follow the instructions given when conducting farming. Figure 6 below summarizes the key mechanisms through which farmers acknowledge the receipt of training.

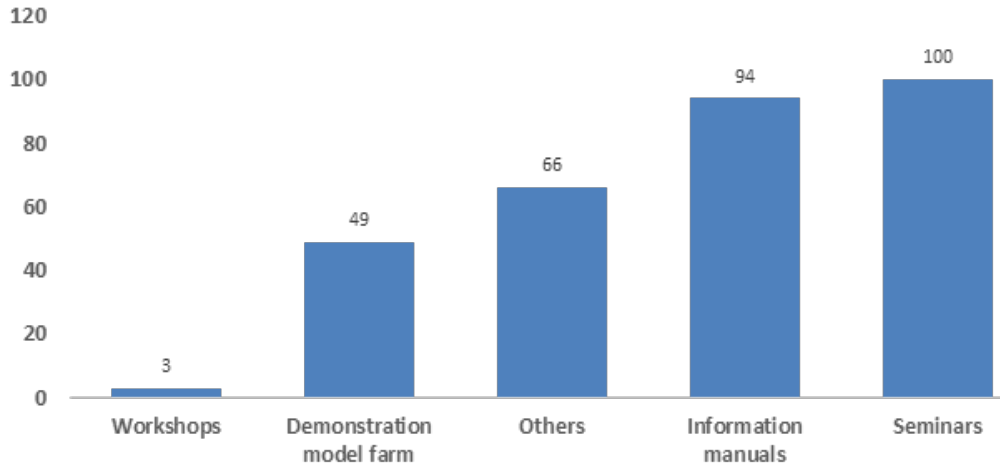


Figure 1: Mechanisms used in training of smallholder farmers (multiple responses)

Source: Field Data, 2018

GVC and Multi-actor Linkages on Farmers Learning Good Farming Practices

In order to meet market requirements, farming and harvesting of Hass avocado is subjected to Global Good Agriculture Practices (Global GAP) standards for safeguarding producers and consumers. Because most farmers had shortage of knowledge in Good Agricultural Practices, Africado engaged in training farmers in Siha on farm planning, planting and watering techniques. Through on-farm training, most farmers reported that they learned by observing the various tasks performed by the Africado agents in collaboration with extension officers. For example, farmers learnt that in planting the optimum space between trees is 5m by 6m. This enabled them to increase tree population to more than 120 trees per acre. They also learnt that avocado seedlings need a sufficient amount of water for proper growth at the average volume of 10 lts every day during dry season with proper mulching (Africado interview, 2018).

Farmers are compelled to adhere to some specific production standards to meet the requirement of international markets as emphasized by exporters. Among these standards include the adoption of species with large fruits, fruits with green skin, avoidance of fractures and spots on the fruit skin and a minimal application of chemical fertilizers and pesticides thus having organic fruits. Famers consider these standards to be a positive reinforcement to their production quality, which enabled them to compete and secure the market, particularly the European ones. Farmers acknowledged the receipt of services by researchers from Sokoine University of Agriculture and Tengeru including education on the risks and effects of skin contact and inhalation of chemicals such as pesticides. They also learned about the importance of using masks, gloves and dustbins so as to reduce direct contamination.

Towards the harvesting period, Africado performs a moisture test across the areas where the Hass avocados are grown. The maximum moisture required for harvesting is 70%. The Maximum Residue Level (MRL) of chemicals in the fruits is also conducted before harvesting to test for chemicals contamination and also fruit diseases. Furthermore, before harvesting, external auditors from European Union often come to Tanzania to inspect and verify that farming standards are observed. They do this by sampling some farmers for auditing. The farmers found not complying with some basic requisites, are given 28 days to do so. Later on, the agents from Africado make a follow up and send report to auditors showing improvements that farmers have made (Africado, 2018).

GVC and Multi-actor Linkages on Farmers Learning Good Harvesting and Post-harvest Handling Procedures

Under traditional farming system, farmers use poor skills in harvesting and post-harvest handling procedures. Harvesting is done through shaking of branches and forcing fruits to fall on the ground. Nevertheless, for the Hass avocados, the study found that Africado has trained farmers on best harvesting procedures and technology to be used. Farmers were using cutter and iron poles hooked with a clipper in harvesting. For the shorter or with low hanging fruits, harvesting is done through handpicking using cutters. On the other hand, iron poles hooked with a clipper were being used to harvest fruits from taller trees.

Hygiene has received a high level of attention. Items used in harvesting such as trails and clippers are now cleaned and sterilized using detergents. Africado staff conducts random inspections of the fruit picking among the out-grower farms in order to ensure their compliance to hygienic requirement by the International Food Safety Standards. The overall cleanliness of pickers is also examined.

During the survey, most farmers were provided with brochures and posters demonstrating and emphasizing on farm hygiene during farming and harvesting. After harvesting, avocado fruits are collected in plastic crates with carrying capacity of 60 pieces and transported to pack house for weighing, washing, brushing, treating with fungicide in water, size grading and re-weighing. After these processes, products are then refrigerated in the rooms kept at 60C ready for export. The packaging materials are imported from Kenya given the lack of companies that manufacture the same in Tanzania. AfriCert has a contract buying supermarket chains for certification of the products including field inspection and pack house approval using Global GAP standards. In sizing and grading of avocado, Africado uses trails that are numbered. For instance, trails with number 8, 10, 12, 14, 16, 18, 20 22 and 24 take first class avocados while those with 26, 28, 30 32 and 34 take second class Avocado. During sorting, special machine for grading is used that every fruit has to pass in and commanded to trail size based on the quality reached. The machine provides percentages of the kind of avocado harvested in a certain area. For instance, some machine could show that 80% of the avocado fruits harvested in area "A" were the first class, while 80% of those harvested in area "B" were the second class. Farmers with the first-class avocado get higher price than those with the second class (Information clarified

by Africado, 2018).

The Acquisition of Knowledge for Application and Upgrading

Upgrading among Smallholder Farmers

Previous parts of the analysis have repeatedly indicated that avocado smallholder farmers have been acquiring more capabilities through various linkages and interactions with other actors in the innovation system. This part describes the pathways in which the acquired capabilities are applied in terms of farming improvement techniques and product upgrading.

Improving Farming Practices

One respondent among Africado representatives reported that smallholder farmers were exposed to capabilities related to farm preparations, planting, pruning, fertilizer application, pest management, and disease control. It was clarified further by Africado that capabilities of farmers have been improved significantly, leading to reduced frequency of inspections per year. This was also confirmed by respondent farmers when they were asked to rate the annual inspection frequencies a in the past years. The questionnaire data revealed that 11 (11 %) of the farmers have been inspected 4 times per year, 40 (40%) 3 times, 44 (44%) 2 times and 5 (5 %) one time. Figure 2 below clarifies.

Figure 2: Frequency of inspections per year

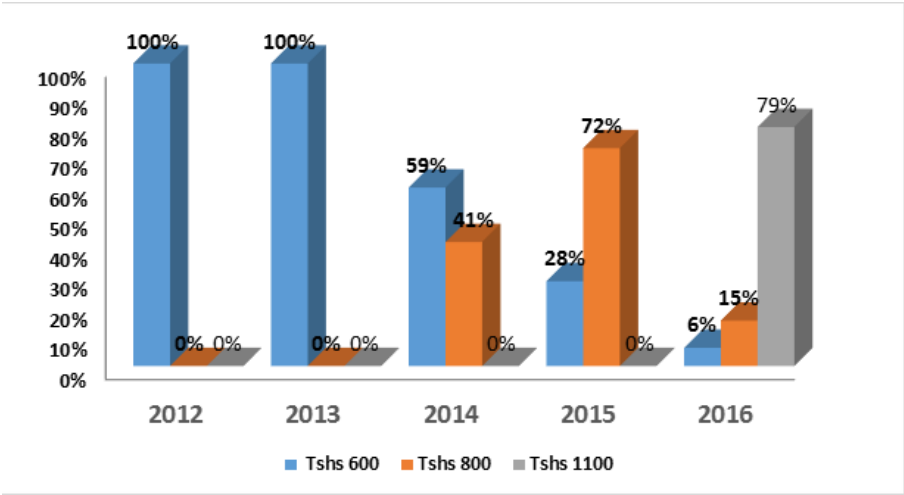
Source: Field Data, 2018

Product Upgrading

The Hass variety tends to offer higher yield and shorter production cycle compared to the traditional varieties. An improved market acceptability of avocado fruits was reported by export agents. This demonstrated improvements in the capacity to comply among the avocado farmers in Siha. Farmers were asked to state the extent to which their fruits have been rejected as a result of failure to meet Africado standards. About 20% said they had encountered experiences of harvests rejection because the grades were not met. This is prominent during their early seasons of entry into the contract farming. On the other hand, 80% said their products have never been rejected from the time they started Hass avocado farming. Researchers were informed that in 2016 most farmers improved their capabilities and complied to the required standards, which includes supply of green fruit without fractures, skin scratches or dots and which are organically rich

(with minimal chemical application). Most farmers also moved from supplying second class to first class fruits. Improvements in quality of fruits were confirmed by the sales records availed by Africado, covering the period between 2012 and 2016. Figure 3 shows that majority farmers sold their avocado at the rate of Tshs 600 per kg (approx. 0.3 USD), on average a kilo of Hass avocados have 3 to 4 fruits. According to Africado, low prices during the early years were not only because of inflation but also because the fruits were mostly rated grade C. In 2014 to 2015, the average price increased from Tshs 600 to Tshs 800 tallying with a decline of grade C fruits which were then replaced by grade B. And finally, 2016, 79% of producers were upgraded to grade A. This trend confirms the product upgrading capabilities among smallholder avocado farmers in Siha district. Figure 3 clarifies further.

Figure 3: Product upgrading from 2012-2016



Source: Field Data, 2018

The study also found that farmers' capabilities were demonstrated by the attainment of international certification provided by the firm named GLOBALG.A.P. For instance, according to Africado, in 2014, 26 farmers received certificate from GLOBALG.A.P. In 2015, the number rose to 228 farmers and in 2016 all the farmers in Siha who produce Hass avocado were certified as the best producers of the year. This performance was exemplary, as the farmers in Siha outperformed their counterparts from other countries such as Mexico and South Africa.

Discussion

The study revealed the various approaches through which the GVCs influenced AIS by imposing standards and facilitating resource mobilization for their fulfillment and as a result upgrades the technological capabilities, using the case of small-scale avocado producers in Siha district Tanzania. Opportunities brought in by

GVCs and the exploitation of such opportunities among smallholder producers contributed in improving their technological know-how and eventually high-quality avocado fruits needed in the European markets have been discussed. This was possible through the alliances formed that allowed collaboration between the smallholder farmers the exporting agency and other stakeholders including the Tanzania Horticulture Association (TAHA), USAID, NORFUND, SUA, Africado, Tengeru Research Institute, Extension officers and input suppliers, supplies of packaging materials and the avocado farmers association of Siha namely MVIWAPASI.

Findings have shown that these networks have facilitated the creation of avocado farming systems that supported technical services, training programs and financial infrastructure which are deemed necessary for building technological capabilities of avocado smallholder producers. For instance, training and research activities conducted by SUA, Africado and Tengeru Research Institute were commended by farmers. Such training session have covered a wide array of topics which includes among others to the proper application of fertilizers, avocado planting spaces, adoption of organic manure, record keeping, harvesting procedures, pests and diseases control, and thus enabled farmers to improve production methods and successfully meet standards required by buyers. It was further discovered that, the networks which were forged between Africado and development supports such as USAID and NORFUND were instrumental in facilitating resource mobilization to support the extension services and farm inputs among smallholder farmers. These findings are reinforced by similar studies by Dolan and Humphrey (2000), emphasizing that GVCs facilitate the flow of knowledge from different parts of the world. Being part of these networks, small producers are empowered to overcome isolation, identify resources and build their capabilities. Perez-Aleman (2011) adds that the coordination of multiple actors is among the necessary prerequisite for resources mobilization and infrastructural capacity development farmer-services, training, laboratories, and acquisition of on-farm techniques and processing methods.

In connection to the AIS model, this study revealed that GVCs forces played an important role in reinforcing the learning process by small-scale farmers and therefore improves their capabilities. Learning from the training services, farm inspections and enforcement of the required standard exemplifies the forms of capacity that were found to be experienced in the study areas. The underlying interactive learning, learning by doing between farmers and other actors have been observed in this regard. Lundvall (2016) pointed out that interactions in the innovation system are essential for building capability of other system actors, particularly those in the lower end of the GVC. Illustrative examples of capacity building agencies include SUA, Tengeru Research Institute and the export intermediary agency Africado. These interactions are in the form of skills training and knowledge disseminations during seminars, training and collaborative projects. This has proven to be successful as farmers eventually manage to prepare their farms, planting, pruning, fertilizer application, pest management, and disease control. Most farmers have also been able to upgrade their products into grade "A" and received the certification from the GLOBALG.A. P.

Conclusion and Policy Recommendations

In Siha, the research revealed approaches by which the GVCs have influenced AIS, particularly in terms of technological capabilities building for small-scale producers of avocado. This was achieved through facilitated networking and peer learning among the smallholder farmers and with other system actors. The networks stimulated farmers to acquire the capability of producing the quality and quantity of products needed by the market. Farmers were able to upgrade their avocado in terms of shifting from less simpler products towards more sophisticated products and improved packaging standards through adopting new/improved Hass avocado variety as well as capable of upgrading from grade "C" to "A". The key inference derived from these patterns is that the concept of Agricultural Innovation System (AIS) framework which emphasizes interactions among the key actors to enable farmers to get access to technologies is relevant to the case of Siha avocado farming. Small-scale farmers' access the services developed by other actors through interactions and participation in different learning activities that are enabled by the GVCs.

The analysis in this paper has implications on both for theory developments in the field of innovation system research as well as policy in the Tanzanian context. In terms of theoretical development, the paper has assisted in linking innovation systems concept with GVCs while examining upgrading and technological capability building among the local innovators. The complementarity of the two concepts includes the analysis of capability building under the AIS while the GVC unpacks the role of networks and interactions by different actors in the value chain. By promoting such networks an important bridge can be built to reduce some many weak linkages between different actors in Tanzanian innovation systems.

In connection to that, GVCs create high degree of production standards to farmers, which ultimately is seen as potential channel for promoting inclusive growth in Tanzania in terms of technology transfer, increased productivity, and consequently an improved socio-economic condition of smallholders. This implies that encouraging GVCs framework in Agriculture could be an alternative policy remedy for smallholder farmers in Tanzania.

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