International Journal of Agriculture Innovations and Research
Volume 2, Issue 4, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received : 02/02/2014 | Accepted on : 18/02/2014 | Published : 22/02/2014

Pathways of Farmers Innovation, A Case Study of Pineapple Farmers in the Nsawam Municipal Assembly of Ghana

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Abstract **– Agricultural innovations systems are continuously evolving hence it is imperative to understand ways through which farmers innovate in developing country context. This study explores ways through which farmers innovate taking into account farmers belonging to farmer groups that received assistance in the form of training and financial credit from the Millennium Challenge Account (MCA) Ghana programme financed by the United States of America government. The study examined pineapple farmers in the Nsawam Municipal Assembly (NMA) of Ghana. The study employed a qualitative approach. This approach involved the use of Focus Group Discussions (FGDs) and key Informant Interviews (KIIs). Both groups of farmers innovate through experimentation, through training received from NGOs and government agencies, through observation, discussions, accidental discoveries and influence from big commercial farms. The key challenge to innovation for both categories of farmers was access to adequate financial credit to allow for more rigorous innovations. It can be concluded that MCA assisted group had better information to ways of innovating than the non-MCA assisted groups.**

Keywords **– Farmers, Fbos, Innovation, MCA Programme, Pineapple.**

I. INTRODUCTION

New bilateral and multilateral donors have emerged, new aid partnerships and a changing trend of countries such as Brazil, Russia, China and Saudi Arabia that hitherto used to be aid recipients have now become aid donors [36].Reference [7] indicated that the United States of America (USA)[1] remained the largest bilateral donor and dominant figure in the aid industry. President Bush on March 2002 put forth a novel and innovative programme that led to a paradigm shift in the way the U.S. administers economic assistance. This resulted in the institution of the Millennium Challenge Corporation (MCC) which is based on the core principle that economic development is most effective if it is linked to free market economies and democratic principles. The MCC is an autonomous body of all other existing agencies that administer U.S. aid. The MCC administers an aid programme known as the Millennium Challenge Account (MCA). The MCA is given to recipient countries that "govern justly, invest in their people and encourage economic freedom"[30].

Principally, MCC administers two main types of grants that are known as the compact and the threshold programmes. A compact is an agreement that has multiple years between the MCC and an eligible country to finance specific programmes aimed at reducing poverty and stimulating good economic growth to improve the lives of the people. Thresholds are smaller grants that are given to recipient countries that miss narrowly on marks set by the MCC and it is essentially meant to bridge policy gaps [21].

Ghana had a five-year compact that amounted to $547 million that was targeted at poverty reduction through improvement in farmer incomes that was led by the private sector. In tandem with this, the MCA Ghana programme emphasized boosting the productivity of high-value cash crops as well as food staple crops in some selected areas of Ghana. This was envisioned to eventually enhance the competitiveness of Ghana as a major export base in terms of horticultural and other lesser known traditional crops [22]. The MCA programme operated in 30 districts in Ghana. The districts were zoned into three namely: the Northern Agricultural Zone (NAZ), the Afram Basin (AB) and the Southern Horticultural Belt (SHB) [22].

The need to increase agricultural production and productivity of farmers engaged in a high value crop such as pineapple in developing countries has assumed priority on government development agenda. Increases in agricultural production can be achieved through the facilitation of innovation amongst various stakeholders involved in the production process. Reference [26] defined innovation as the successful application of new ideas, products and processes. Reference [32] also defined innovation as anything new that is successfully introduced into an economic or social process. This pre-supposes that, an innovation is not simply about implementing or trying something novel but the successful integration of a new idea, concept or product into a process that integrates social, technical and economic components. Innovation can be described as being neither technology nor science but the successful application of knowledge of varied kinds to achieve expected economic and social outcomes. Innovation is not just about global novelty but often about local indigenous creativity [24]. In these definitions of innovation, it can be deduced that the element of the final application of a new idea by the end users remains paramount. There are new ideas that are generated and facilitated by various agents in an economic, social, technical, policy, institutional and political context. Innovation can be a product which can be measured as adoption rates[27,28]. Innovation can also be seen as a process which can involve a new process for the

[1] USA and US are used interchangeably in the study.

generation of new ideas[13 and 14] or as new ways of doing things and people adjusting to situations [18].Current debates in innovation literature argue the need for farmers to be recognized and considered as an integral part of the knowledge generation and use [6].The processes that lead to innovation remain non- trivial. Studies have shown that farmers principally innovate through a process of experimentation[11,35,16, 17, 20] direct contact with experts[16] and accidental discovery [5, 9, 25]. It has been observed from literature that farmers are able to innovate on their own given little or no support [8, 16, 17].All these studies have indicated ways through which farmers innovate but there however appears to be scanty literature that explicitly put forth ways through which farmers innovate especially in the developing country context. This study therefore contributes the gap in knowledge in this direction and stimulates further studies in the developing countries on ways through which farmers innovate.

II. METHODOLOGY

The study employed a qualitative study approach involving the use of Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs). Qualitative research presents the discovery of meanings that participants ascribe to their behaviour, ways through which they interpret situations in the social world and the way meanings are given to specific issues under research [37,29]. Five (7) MCA FBOs were randomly selected through lottery system from fourteen MCA FBOs that were present in the study site. Out of the five (5) MCA FBOs selected, farmers were randomly selected through a lottery system and engaged in Focus Group Discussions (FGDs). The FGDs involved 5 farmer groups made up of 6 members each for members belonging to MCA assisted groups (MCA Group) whilst 2 farmer groups made up of 6 members were also engaged for farmers that have not received any form of assistance from any agency (Non-MCA Group). The study was carried out in the Nsawam Municipal Assembly in Ghana. There exists a population of about 30,000 in the municipal. The municipal assembly stretches over 403 square kilometers and it is located 23 kilometers from the capital city Greater Accra [12]. The Nsawam Municipal constitutes a municipal noted for the commercial cultivation of pineapples for export. The MCA FBOs were

1. Biokoye Cooperative Pineapple Growers and Marketing Society
2. Pokrom Patriotic Cooperative Farmers Society Limited
3. Adonten Cooperative Pineapple Growers and Marketing Society
4. Fotobi Cooperative Pineapple Growers and Marketing Society Limited
5. Apesika Cooperative Pineapple Growers and Marketing Limited
6. Nsabah Cooperative Society
7. Bomarts Eurep GAP Pineapple Growers Cooperative Society.

The non-MCA FBOs that were also involved in the study were:

8. Oman Fruits and Vegetables Cooperative
9. Enkakyi Cooperative Society

All the above named FBOs are involved in pineapple production. Key informants were purposively selected. The KIIs involved a total 16 persons drawn from farmer groups, government agencies and agri-businesses.

2.1 Study sites

The study was conducted in Pokrom, Fotobi, Nsawam, Dobro and Ahodjo all in the Nsawam Municipal Assembly. The MCA FBOs were located in Pokrom, Nsawam and Fotobi respectively whilst the other two non-MiDA FBOs were located in Fotobi and Ahodjo.

2.2 Data analysis and interpretations

A digital recorder was used to capture all information involving conversation. The inputs were transcribed and saved as word documents in files and folders. These inputs were analyzed based on major themes that emerged. Further sub-themes were identified with the various statements that supported them from the FGDs and the KIIs for MCA and non-MCA FBOs. In presenting the analysis, direct quotes from the FGDs and KIIS in are cited wherever it found relevant.

III. LITERATURE REVIEW

3.1Ways through which Farmer Based Organizations' (FBOs) facilitate innovations

3.1.1. Building of social networks

FBOs enables farmers to form groups or unions which help them to build a social network first amongst its members and also amongst other farmer groups. The FBOs help to build social capital. The benefit of the social capital is exemplified in the sharing of technical information[3,4].The build-up of social capital affects the use and spread of innovation because social networks facilitate innovation dissemination [2]. Reference [19] indicated that FBOs help promote agricultural innovations. FBOs help get agricultural related innovations across to its members easily through its networking activities. Reference [10] in his study observed that FBOs helped in farmers adoption of sustainable technologies. [23] indicated that FBOs played a stronger role in the innovation system in Bolivia.

3.2 Ways through which farmers innovate

Reference [16] observed that farmers were able to innovate through direct contact with experts in the field or as a result of working as labourers on farms to gain requisite experience. The study of[16] further showed that farmers were able to adapt to agronomic practices and technologies learnt from experienced farmers to a new environment in which they found themselves in river valley fields in Kenya. Reference [9, 5, 25]noted in their studies that farmers innovate through accidental discovery and also borne out of curiousity. Reference [16] observed in their study that farmers on their own were able to start the cultivation of rice in Kenya with little prior knowledge in rice production. Reference [8,4] showed how farmers

converted a diesel pump-set into a mobile equipment by placing it on a bullock cart, adaptation of manually operated tubewells for irrigation in Bangladish and Bihar.This indicates that farmers innovate on their own given a conducive environment. Extension and research approaches are therefore encouraged to facilitate the generation, use and exchange of innovation by farmers and not give little recognition and attention to farmers.

Reference [20] indicated in their study that farmers innovate through a process of experimentation leading to exchange of farming practices from results obtained. Their study further indicated that farmers either made modifications to crops and practices that they were exposed to or followed strictly what they had been exposed to. Reference [35, 16] also indicated that farmers innovate through experimentation. Studies by [31, 34, 16] indicated that farmers innovate through years of careful observation. The study by[16] revealed that farmers through observation were able to discover a water level technique for the control of weeds and also make informed decisions about changes in rice varieties in Kenya.

In all these studies it has been observed that farmers principally innovate through a process of experimentation [11, 35, 16, 17, 20], direct contact with experts [16] and accidental discovery[5,9, 25]. Literature has shown that farmers are able to innovate on their own given little or no support [8,4, 16, 17].From literature, experimentation stands out as the main pathway through which farmers innovate, this study adds to the ways through which farmers innovate. The next section presents the findings of the study.

IV. Results and Discussion

Interviews from both FGDs and KIIs revealed that both MCA and non-MCA FBO farmers innovate in a variety of ways including training, accidental discovery, observation, discussions and influence from big commercial farms. Essentially, no significant difference existed in terms of the means through which both categories of farmers innovate. The principal ways through which both MCA and non-MCA FBOs innovate are as follows:

4.1. Through training received from Ministry of Food and Agriculture (MoFA) and NGOs

Farmers that were engaged in the FGDs indicated that they applied the training that they received from key institutions such as MoFA and other NGOs such as Technoserve, Care International, TIPCEE and GTZ/GIZ. MoFA has been the principal institution that has trained farmers in improved methods of pineapple production since the early 1970s. Farmers who received training from MoFA and other NGOs either applied particular innovations in totality or modified innovations to suit their farming needs. This was widely reported in lots of the FGDs. In relation to this a participant from a MCA FBO the Fotobi FBO said in a KII:

"I applied the knowledge from the training that Millennium Development Authourity (MiDA) exposed me to in my daily farming activities and this has allowed me to make modifications to suit my farming needs……an example of this is the use of N.P.K. fertilizer on my farm. I made a modification to the recommended dosage on some farmlands based on the level of usage of the land under cultivation"(Fotobi Cooperative, KII/3rd /February/ 2012).

Farmers use their own discretion when it comes to certain recommended practices such as fertilizer application. This is done by farmers because they do not see the need to apply recommended fertilizer rates in instances where the land has not been used or has been over cropped. Farmers belonging to the Apesika Cooperative reported this in an FGD:

"We as farmers do make adjustments to fertilizer application rates that MoFA introduced us to especially on virgin lands, lands that are already very fertile and farmlands that have been overused" (Apesika Cooperative, FGD/17th /April/2012).

There are a wide range of flexibility and diversification with innovation use amongst farmers. Farmers constantly engage amongst themselves to bring about innovations that make use of their scarce resource available.This finding is consistent with the findings of [2,10 and 19] indicated that FBOs helped in the spread of innovations amongst members.

The non-MCA FBOs that were engaged in the FGDs and KIIs indicated in contrast to the MCA FBOs that they received very little trainings from MoFA and NGOs in the past and present. Similar to their MCA FBO counterparts' non-MCA FBO farmers also made little modifications to the trainings that they received to suite their own farming needs. The non-MCA FBOs received training from institutions such as MoFA and NGOs such as Technoserve, Care International, TIPCEE and GTZ/GIZ. The same NGOs exist for both MCA and non-MCA FBOs. The only difference between the non-MCA FBOs and the MCA FBOs is the weak interaction that exists amongst the non-MCA FBOs and institutions such as MoFA and NGOs. This situation was widely reported in most of the FGDs and KIIs conducted. This result is consistent with findings by [24] that indicated that farmers belonging to FBOs benefit from capacity building programmes. The modifications that non-MCA FBOs made to innovations that they were exposed to either conformed to a scientific method of enquiry or not. It appeared however from the FGDs that limited use of the scientific method of enquiry was employed in farmers innovation. A non-MCA FBO participant in a FGD indicated that:

"We have mostly in the past received trainings from Care International and GIZ on various improved methods of pineapple production which we also constantly make modifications to suit our production needs" (Enkakyi Cooperative, FGD/6th/December/2011).

Another non-MCA FBO participant engaged in a KII also indicated that:

"We do not always accept wholly what we are being exposed to through training received from MoFA and NGOs but we also make modifications to suit our own farming needs. The new ideas essentially should cut down

the cost of production and yield good outputs" (Enkakyi Cooperative, KII/6th/December/2011).

Non-MCA FBOs just like their MCA FBO counterparts indicated that as a result of inadequate money in their farming activities they constantly explore new ways of farming which are efficient and cost effective. This reason serves as a motivation for looking for alternative ways of modifying innovations to suit their farming needs.

4.2 Through experimentation

An innovation before been accepted or generally applied by a large number of farmers goes through a period of experimentation. It was evident from the FGDs that some farmersbelonging to MCA and non-MCA FBOs allocated on their farms small portions of land to try out some pineapple innovations. The process of experimentation goes along with either success or failure. In the instance where farmers observe failure when they try some new ideas, they continually modify such failures to achieve success or completely abandoned such ideas. Most MCA FBOs reported in the FGDs that they experimented on a daily basis a lot of agronomic practices on their farms borne out of curiosity or accidental discoveries to ascertain the viability of such innovations. A key informant interview with an agronomist from Blue Skies Company indicated that:

"All that farmers think about is to expand and make money, they try anything and pick information from different sources, they do anything which will bring economic benefit to them" (Blue Skies Company, KII/8th/ February/2012).

A key informant interview from MoFA also indicated that farmers on their own experiment with a lot of ideas which come into their minds:

"Farmers generally try any idea which comes into mind all in a bid to maximize profit and reduce cost of production. All that is required is for that idea to work at least cost" (MoFA, KII/17th /April/ 2012).

It was reported in a KII with the representative with Blue Skies Company that there was a recommended fertilizer known as Yara fertilizer that the agribusiness company introduced farmers. The Yara fertilizer is a brand of the NPK fertilizer. It was observed that when farmers ran-out of the original NPK combinations they resorted to the use of YaraNetriball which was also another brand which was not used by farmers. This brand of fertilizer worked perfectly on the pineapple fruits and it was even applied on mangoes. This was unknown to Blue Skies Company but farmers shared this idea with the company after they tried out with the fertilizer and it worked.

Both the MCA and non-MCA FBO members have also through experimentation discovered that the MD2 pineapple variety does not necessarily require the use of plastic mulch for its cultivation. It was observed that MoFA and NGOs introduced farmers to the idea that the MD2 only thrives well with the use of plastic mulch but farmers on their own discovered that the MD2 can thrive well on the bare ground without the use of the plastic mulch. Farmers however observed that the MD2 cultivated without the use of the plastic mulch produced the same fruit size as the MD2 grown with the plastic mulch. Farmers however indicated that the MD2 cultivated without the use of plastic mulch required more effort to control weed growth hence more labour cost as compared to the use of the MD2 cultivated with plastic mulch. A MCA FBO farmer interviewed in a KII said:

"We as farmers have planted MD2 on the bare ground and it produced the same fruit size as the MD2 planted with the plastic mulch. We were initially made to believe that the MD2 only thrived well with the use of the plastic mulch" (Pokrom Patriotic Cooperative, KII/25th/ November/2012).

The non-MCA FBOs similar to their MCA FBO counterparts also discovered the cultivation of the MD2 without the use of plastic mulch. It emerged from the FGDs that non-MCA farmers carried out field experiments on their farms in coming out with their own innovations. Similar to the MCA FBOs, the non-MCA FBOs also had in mind that the MD2 only thrived well with the use of plastic mulch but they discovered otherwise through the cultivation of the MD2 without the use of the plastic mulch like their MCA FBO counterparts. It was observed that the similarities observed in terms of agronomic practices were due to the communal living arrangement found in the pineapple communities. A non-MCA FBO member indicated in a FGD that:

"I planted on the MD2 on the bare ground without the use of the plastic mulch. I however applied more weedicides to control weed growth and this yielded the same output as the MD2 planted with the use of the plastic mulch. The only issue was with the higher production cost that was associated with the cultivation of the MD2 on the bare ground" (Enkakyi Cooperative, FGD/6th/ December/ 2011).

It was noted from the FGD that the use of the MD2 was only cultivated by a very small number of non-MCA FBOs. This was generally as a result of the high cost of production associated with the production of the MD2. Most of the non-MCA FBO members that cultivate the MD2 do so without the use of plastic mulch. In the case of the MCA FBOs, the MCA programme helped facilitate the supply of the MD2 pineapple suckers to the farmers thereby making it widespread among the MCA FBOs. It was observed that both MCA and non-MCA FBO members did acknowledge the fact that the application of indigenous knowledge helped to shape the ways through which they innovate. Both categories of farmers reported in FGDs that the application of indigenous knowledge helps them to experiment with new ideas and also test and modify existing practices.

An individual farmer with the Oman Cooperative, a non-MCA FBO indicated that he had experimented with the use of cassava peelings as mulch on his farm and it proved to be an effective means of smothering weeds and also enriching the soil. This practice is however not widely practiced. The low level at which this innovation is practiced can be due to individual effort and accomplishment on the part of the farmer. The findings concur with studies by [20, 35, 16, 11, 17].

4.3 Through observation

Both MCA and non-MCA FBOs innovate through observations that they make on their farms regarding agronomic practices. It emerged from the FGDs that most MCA FBO farmers during their experience in farming do observe certain happenings on their farms and undertakes further informal enquiries to unearth the reasons why such agronomic activities occur on their farms. MCA FBO farmers interviewed through FGDs and KIIs indicated that when they take off the basal leaves of the pineapple suckers especially of the Smooth Cayenne pineapple variety, it induces growth of the suckers. Removal of basal leaves encourages pineapple suckers to root within 2 weeks instead of about 2 months. Farmers got to know about this innovation through observation made on their farms.

A MCA FBO farmer with the Nsabah Cooperative observed on his farm that suckers that had their basal leaves taken off had a higher rate of germination and vigour as compared to suckers that had their basal leaves not taken off. Both categories of farmers are however not practically able to take off all the basal leaves from a large proportion of pineapple suckers before planting. This innovation was discovered by farmers themselves. This shows that farmers with or without assistance from some actors still innovate on their own. This finding is consistent with [18] that indicated that farmers innovate on their own with little or no assistance from extension agents. MCA FBO members belonging to Adonten and Fotobi FBOs stated in FGDs that:

"When you take off the basal leaves of the suckers, it induces growth of the suckers. Within 2 weeks roots just appear instead of about 2 months. We got to know this through observation on the farm" (Adonten Cooperative, FGD/20th /April/2012).

"The removal of the basal leaves of the suckers help to hasten the growth of the pineapple suckers in the cultivation of the smooth cayenne pineapple variety. It is however a difficult task to undertake for over 20,000 pineapple suckers" (Fotobi Cooperative, FGD/3rd/ Febraury/2012).

Other observations made by farmers included the placement of suckers in the soil during planting of suckers. Some groups of farmers from the FGDs observed that when a sucker is planted in soil with stones underneath, it changed the colour of the pineapple. The Adonten Cooperative questioned why suckers were of different colours this occurred and found out that when they uprooted the suckers from the soil and dug down they hit a shallow layer.

The major challenge confronting the cultivation of the MD2 is the issue of rotting, farmers as a result of seeking solutions to the problem have been able to observe that the MD2 thrives better on well drained soils than on clayey soils. This observation was made by all MiDA FBO farmers engaged in the FGDs. In a FGD it emerged that:
"The MD2 thrives well on sandy soils than clayey soils. It rots in clayey soils. This was seen through observation" (Nsabah Cooperative, FGD/9th /December/2011).

MCA FBO farmers belonging to the Nsabah Cooperative reported in a FGD that they observed that the use of Ammonia fertilizer in clayey soils leads to lots of water retention in the soil. Nsabah Cooperatives farmers indicated that:

"In clayey soils Ammonia fertilizer leads to lots of water retention in the soil, so we do not apply lot of Ammonia in clayey soils" (Nsabah Cooperative, FGD/9th/ December/ 2011).

The non-MCA FBO members unlike the MCA FBO members could not report a lot of examples to illustrate how they innovate through observations made on their farms. Members of the non-MCA FBOs indicated that they had through observation discovered some agronomic activities that happen on their farms. They cited that they have been able to identify the ideal number of times that one has to weed a farm in order to achieve desired outputs. An individual farmer belonging to the Oman non-MCA FBO gave personal examples to illustrate innovating through observation. This member indicated that he got to know about the use of cowpea in replenishing lost nutrients on his farmland through an observation he made on his farm. He had in mind that every crop that is nutritious possessed nutrients in its seed as well and the plants. He observed on his farm that there were always numerous insects and maggots that fed on the cowpea plant and this gave him an indication of the usefulness of the cowpea plant. He gave it a try on his farm and it worked. This farmer further made an observation with the use of Neem tree leaves as an insecticide on his farm. The use of Neem tree leaves was explained by the farmer that it could be used generally on all crops including pineapples. He said in a KII that:

"I once placed Neem tree leaves on banana fruits at a portion of my farm and I observed that no farm animal or insect tasted the fruits, I observed this for a while and applied it to my harvested tomatoes and I realized that no animal tasted the tomato fruits as well" (Oman Cooperative, KII/8th/ February/2012).

He further gave another illustration of the use of the Neem tree leaves innovation through an observation that he made on his pawpaw farm. He indicated in a FGD which was further confirmed in a KII that:

"I observed on my farm where a Neem tree was planted close to a pawpaw plant that the mealy bug disease was minimal. This was a result of the Neem tree being close to the pawpaw tree and because the Neem tree constantly shed its leaves in preventing the mealy bug disease from attacking the pawpaw plant" (Oman Cooperative, KII/8th/ February/2012).

The use of these three innovations were however not widespread even within his own FBO. This could be as a result of weak cohesion within the non-MCA FBO. It was observed that both MCA and non-MCA FBO farmers undergo various observations through field trials on their farms before coming up with their own individual and collective innovations. Farmers innovating through observation mirrors findings observed by [31, 34, 16].

4.4 Through discussions[2]

MCA FBO members widely engaged in FGDs indicated that there is a wide consultation amongst farmers through discussions on a daily basis concerning their pineapple production activities. These discussions are around an array of issues ranging from social, political, family, religious and farming activities. There are detailed discussions concerning the problems that farmers face. In most cases such discussion affords farmers the opportunity to bring up some of their agronomic problems and find solutions to them. These discussions are mostly informal and can take place anywhere farmers find themselves. It could be at the market place, church auditorium, formal meetings and informal meetings of the FBO members in any part of the town where members accidentally meet. This practice was consistent findings of [4] that indicated the sharing of technical information amongst farmers. Farmers who engage in this type of discussions do not necessarily need to belong to farmer associations or groups. A farmer from a MCA FBO Adonten Cooperative indicated in a FGD that:

"We discuss amongst ourselves our problems. You do not even need to belong to a group to participate in this type of discussion. Once you talk about your problems with other colleague farmers you get to solutions" (Adonten Cooperative, FGD/20th/April/2012).

Another farmer from a MCA FBO Apesika Cooperative also indicated in a FGD that:

"We as farmers share various agronomic ideas about pineapple production amongst ourselves" (Apesika Cooperative, FGD/17th/ April/ 2012).

Representatives from MoFA also emphasized that generally farmers always conferred amongst themselves on various information regarding their farming activities. They reported that in some circumstances where some members were not very certain about some ideas in circulation they asked MoFA staff. They also stated that representatives from MoFA were not aware of the scientific basis for ideas in circulation and have conducted further research on them where financial resources have been available. A KII with a representative from MoFA indicated that:

"Farmers always discuss information regarding their farming activities amongst themselves and also share with us at MoFA to ascertain whether such information conforms to theory or research findings" (MoFA, KII/3rd/April, 2012).

The sharing of technical information was consistent with the findings by [4]. Farmers also generally visited other farmer's farm to compare and see for themselves at first hand the results of certain recommended practices that their colleague farmers discussed with them. This helps them to make an informed decision of whether or not to accept an innovation discussed. Members of the Pokrom Patriotic Cooperative, a MCA FBO indicated in a FGD that:

"We sometimes visited our other colleague's farm to ascertain for ourselves how to practically undertake certain new ideas and also to help us at first hand to observe the outputs of those new ideas that our colleague farmers discuss with us" (Pokrom Patriotic Cooperative, FGD/22nd/April/2012).

The non-MCA FBOs share ideas in an identical way as the MCA FBOs. Ideas concerning their farming activities are shared through both formal and informal ways. The formal ways include association meetings whilst the informal ways take various forms such as informal chats surrounding pineapple production. Generally when farmers encounter problems on their farms they share with other farmers in order to gain insights into their problems and get solutions to their problems. The frequency and urgency in engaging in chats through the sharing of ideas is enhanced depending on the urgency and the type of problem encountered on the farm by farmers. A non-MCA FBO farmer indicated in a FGD that:

"In farming no one can claim to be an expert so we find out other ways to employ to achieve better results and when a farmer runs into difficulty we do exchange ideas amongst ourselves and we sometimes meet as a farmer group to have discussions" (Enkakyi Cooperative, FGD/6th/December/2011).

Members of a non-MCA FBO the Oman Cooperative also indicated that the process of sharing ideas amongst farmers is a practice that is commonly done amongst group members and also members outside the group. This process of innovation is just the same as the MCA FBO members. The geographical location of the non-MCA and MCA FBOs might have an impact on the similar ways through which both categories of farmer groups innovate. This similarity can be attributed to the similarity observed in the social and cultural norms within the farming communities where pineapple is cultivated. The non-MCA FBOs indicated in FGDs that:

"We also share ideas about our farming activities amongst ourselves on an as-and-when-needed basis through formal and informal means" (Oman Cooperative, FGD/24th /April/2012).

"We as farmers constantly discuss farming and other social issues amongst ourselves, it is usually very intense when we are faced with problems on our farms (Enkakyi Cooperative, FGD/6th/December/2011).

Farmers also paid follow-up visits to other colleague farmer's farms to observe for themselves how certain recommended practices that they applied on their farms worked for them. Members of the non-MCA FBO Enkakyi Cooperative indicated in an FGD that:

"Any time a colleague farmer informed me about an innovation that he found out on his farm, I visited him to ascertain for myself how that particular innovation worked" (Enkakyi Cooperative, FGD/6th/December/2011).

Farm visits by non-MCA farmers were generally widespread amongst the non-MCA FBOs that were engaged in FGDs and KIIs. It was generally observed that FBOs serve as a very good channel for the dissemination and use of innovation. Farmers have trust and learn easily amongst themselves if it is at their own peer level. Recognition is therefore encouraged to fully discover the

[2]Discussion is also known as peer learning.

potentials in the use of peer learning or farmer discussion as a means of an extension and research approach.

4.5 Through accidental discovery

MCA FBO farmers in the course of their farming activities discover certain agronomic ideas accidentally. They try their hands on such accidental discoveries to ascertain whether it will produce desired results, and if it does, they discuss with other colleague farmers. A farmer with a MCA FBOApesika Cooperative reported in a KII that he discovered on his farm accidentally that a portion of his farmland where Moringa plant grew had no incidence of rotting observed within the MD2 grown at that particular portion. The MCA FBO farmer observed that the other portion on the same land area where the Moringa plant was absent recorded the incidence of rotting of the MD2 grown there. This farmer intentionally inter-planted on his farm the Moringa plant with the MD2 and discovered that the portion to which had the Morinaga plant inter-planted did not record any form of rotting. This farmer indicated in a KII that:

"The use of the Moringa tree in 2006/2007 farming year help stopped rotting of the MD2 pineapple variety on my farm (Apesika Cooperative, KII/17th/April/2012).

On slopping lands farmers grow smaller suckers at the base and have the bigger suckers at the top of the slopes with the medium suckers mid-way. MCA FBO farmers realized this on their farms when they planted the suckers without taking into account the gradient of the land surface, some categories of the graded suckers planted recorded delayed growth. Farmers' found out that the bigger suckers planted at the apex of the base did well whilst the bigger suckers at the base of the slope equally grew well. This triggered the farmers to try to see the effect of planting the bigger suckers at the apex of the slope, with the medium suckers at the mid base of the slope with the very small suckers at the base of the slope. This was done on the assumption that during the course of rainfall soil nutrients drain off to the base which facilitates the run-off of nutrients to the very small suckers at the base to get the needed nutrients to grow faster to catch up with the already bigger suckers at the apex of the slope. This result is consistent with the findings by [17]that indicated that farmers on their own adapt innovations that are not originally introduced to them by other stakeholder. Members of the Adonten Cooperative indicated in a FGD that:

"On slopping soils we plant the very big sized suckers at the apex of the slope with the medium suckers at the mid base of the slope whilst we plant the very small suckers at the base of the slope" (Adonten Cooperative, FGD/20th/April/2012).

Both MCA and non-MCA FBO farmers indicated from FGDs that the shooting up of "volunteers[3]" on one's farm gives an indication that it is an appropriate time to undertake the forcing of the pineapple fruits once the suckers are of good sizes. Both categories of farmers discovered this accidentally on their farms and decided to use this as an indication to force their fruits. MCA FBO farmers belonging to the Pokrom Patriotic Cooperative indicated in FGD that:

"Usually once you see the volunteers on your farm then it serves as an indication of the appropriate time to force your pineapple fruits" (Pokrom Patriotic Cooperative, FGD/25th/November/2011).

Members of the Enkakyi Cooperative, a non-MCA FBO indicated in a FGD that:

"The presence of volunteers on your farm even though we acknowledge that it is not reliably a good measure of forcing helps to give once an indication of that it is time to force your pineapple fruits" (Enkakyi Cooperative, FGD/6th/December/2011).

Non-MCA FBO members indicated that they made certain discoveries when they passed by other colleague farmer's farms. Sometimes non-MCA FBO members come across this discovery on the way to their farms and enquired further from the owners of such farms how ideas that they practiced can be replicated on other farms. The findings from this study is consistent with findings [5, 9, 25] of that shows that farmers innovate through accidental discovery.

4.6 Through contacts with big commercial farms

It emerged from the FGDs that big commercial farms such as Combine Farms and*KokobenFarms* in the early 1980s were already exposed to more improved ways of farming in pineapple production. Farmers in the vicinity were employed as farm-hands. In the course of working on the big commercial farms as farm-hands farmers became aware of certain innovations in pineapple production. After a certain period when farmers working as farm-hands felt that they had gained considerable knowledge in pineapple production they left the big commercial farms to start their own small scale farming. A farm manager for Combine Farms said in a key informant interview that:

"Combine Farms in the past did employ a lot of farmers in the surrounding communities who worked for us as farm-hands and through that process gained a lot of practical hands-on agronomic skills from our farm. These workers leave us with time to start their own small-scale farms" (Combine Farms, KII/19th/June/2012).

It came up from a KII with two farmers belonging to the Adonten Cooperative, a MCA FBO that they deliberately worked as farm-hands with Combine Farms in order to gain the needed farming experience in pineapple production. They said:

"We worked as farm-hands at Combine Farms for a period of three years to gain the needed experience in pineapple production" (Adonten Cooperative, KII/20th/April/2012).

Non-MCA FBOs similar to the MCA FBOs also indicated in FGDs that a good number of the pioneer pineapple farmers belonging to their FBOs learnt from the big commercial farms mainly as farm-hands engaged in various pineapple production activities and thereby through the process learnt improved methods in pineapple farming from the commercial farms. The non-MCA FBOs indicated in FGDs that:

[3]Volunteers are pineapple plants shouting up its fruits formation. This gives farmers an indication that it is time to induce all the pineapple plants to fruit uniformly.

"I learnt from *Ata Mudzi* Farms grading, dipping and drenching, forcing and all agronomic practices relating to pineapple production when I first worked as a farm hand" (Enkakyi Cooperative, FGD/6th/December/2011).

"Some of the first pineapple farmers we knew also worked as farm-hands on big commercial farms such as *Koranco, Kokoben* and Combine Farms'' (Oman Cooperative, FGD/24th/April/2012).

It was widespread from both the FGDs and the KIIs that big commercial farms such as Combine, *Kokoben* and *Ahuntemu* farms helped to transfer farming skills in pineapple production to farmers. An innovation such as forcing [4] was learnt from big farms such as Combine and*Ahuntemu* Farms. Members belonging to the MCA FBOPokrom Patriotic Cooperative indicated that:

"Combine Farms first started with forcing then *Ahuntemu* Farms also took it up and practiced. The workers from these two farms introduced other farmers to forcing. During that time it was difficult to get pineapple suckers as a new entrant to start production" (Pokrom Patriotic Cooperative, FGD/ 25th/November/2011).

It also emerged from the FGD that MoFA also introduced farmers to forcing alongside the big commercial farms. A MCA FBO indicated in a KII that:

"Forcing was brought in by MoFA in 1989. Combine Farms started pineapple farming first in the Nsawam Municipal. Some of the experienced workers from Combine Farms helped to spread various technologies in pineapple production to other farmers" (Nsabah Cooperative, KII/ 9th/December, 2011).

MCA FBO members belonging to the Fotobi Cooperative indicated in a FGD that:

"We as farmers picked up most of the innovations associated with pineapple production from the big commercial farms at the initial start of pineapple production in the Nsawam Municipal" (Fotobi Cooperative, FGD/3rd/February/2012).

It is also of great interest to understand how farmers not belonging to the MCA FBOs innovate. There are great similarities in the way these two categories of farmers groups innovate. This could be as a result of the way in which farmers share ideas about the way that they innovate. Farmers do not need to belong to MCA groups to access information about their farming activities. Another reason could be the fact that the pineapple farming communities have a high level of communal living thereby facilitating information flow amongst farmers in general. The findings of the study confirms findings by [16] that show that farmers innovate through contact with experienced farmers.

V. Conclusion and Policy Recommendation

Both categories of FBOs innovate through the same (through trainings received from MoFA and NGOs, experimentation, observation, discussions, accidental discovery and contact with big commercial farms) ways nevertheless there were few differences that were observed with the ways through the MCA and non-MCA FBOs innovate. It must be noted that even though the MCA and non-MCA FBOs innovate through trainings received from MoFA and NGOs, the MCA FBOs had very strong interactions with MoFA and the NGOs present in the study area than the non-MCA FBO members. In the case of the non-MCA FBOs,Oman Fruits and Vegetable Cooperative Society recorded no association with NGOs whilst Enkakyi Cooperative Society also had very weak strength of association with MoFA and other NGOs with presence in the study area.

It was also observed that the MCA FBOs had more examples to illustrate the ways through which they innovate than the non-MCA FBOs a situation which gives a clue to the fact that the MCA FBOs were more innovative than the non-MCA FBOs. It was observed that the MCA programme encouraged farmers belonging to the MCA FBOs to innovate more than their non-MCA FBOs even though they both essentially innovate through the same ways. As a result of the communal living arrangements found in the study area, there is a tendency for a spill-over effect of programme interventions to farmers that do not directly benefit from the programme intervention. Agents in the innovation system therefore do not need to target all FBOs with a particular intervention especially in the case of budgetary resource constraints but target few FBOs that can be supported by a specific budget. The benefits of spill-over effect should be harnessed to achieve maximum use of innovation.A recognition of the various pathways through which farmers innovate is encourage to facilitate innovation amongst FBOs and other stakeholders in the innovation system and process.

[4] Forcing is the inducement of pineapple fruits to ripe early through the use of Calcium Carbide.

References

[1] August, B. T., et al. (2010). "Enhancing intergrated approaches learning systems using experiences from agroforestry." Scientific research and essays 5(16): 2179 – 2185.

[2] Bantilan, M. C. S. and R. Padmaja (2008). "Empowerment through social capital build-up: gender dimensions in technology uptake." Experimental Agriculture44(01): 61-80.

[3] Bernard, T., et al. (2007). When does community conservatism constrain village organizations? Mimeo. University of California, Berkeley.

[4] Bernard, T., et al. (2010). "When Does Community Conservatism Constrain Village Organizations?" Economic Development and Cultural Change58(4): 609-641.

[5] Biggs, S. D. and E. J. Clay (1981). "Sources of innovation in agricultural technology." World Development9(4): 321-336.

[6] Biggs, S. D. (1980). "Informal R&D." Ceres76: pp 23 - 26.

[7] Bishaw, Z. and M. Turner (2008). "Linking participatory plant breeding to the seed supply system." Euphytica163(1): 31-44.

[8] Brainard, L. (2007). Security by other means: foreign assistance, global poverty, and American leadership, Brookings Institution Press.

[9] Brammer, H. (1980). "Some innovations don't wait for experts: a report on applied research by Bangladeshi peasants." Ceres13(2): 24-28.

[10] Chambers, R., Ed. (1989). Reversals, institutions and change. In: Chambers, R., Pacey, A. and Thrupp, L.A (eds), Farmer first: farmer innovation and agricultural research. London, Intermediate Technology Publications.

[11] De Souza, F. H. (1997). The adoption of sustainable agricultural technologies. Ashgate, UK.
[12] Dyer, C., Ed. (1997). Medieval farming and technology: conclusion. In: Medieval farming and technology: The impact of agricultural change in northwest europe (eds G. Astill and J. Langdon). Leiden: Brill.
[13] Ghanadistricts (2013). "Ghana districts."
[14] Hall, A., et al. (2003). "From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research." Agricultural Systems78(2): 213-241.
[15] Hall, A., et al. (2004). "Innovations in innovation: reflections on partnerships, institutions and learning." I would also like to the Natural Resources Institute, University of Greenwich and particularly their director Dr Guy Poulter for sending me to ICRISAT and for letting me stay there for so long. And finally, I would like to thank my family for putting up with my constant absenteeism whilst I worked on the book.: 1.
[16] Klerkx, L., et al. (2010). "Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment." Agricultural Systems103(6): 390-400.
[17] Kamau, G. and C. Almekinders (2009). "From Strangler to Nourisher: How Novice Rice Farmers Turned Challenges into Opportunities." Innovation Africa: Enriching Farmers' Livelihoods: 297.
[18] Kuper, M., et al. (2009). "A crop needs more than a drop: towards a new praxis in irrigation management in North Africa." Irrigation and Drainage58(S3): S231-S239.
[19] Leeuwis, C. (2004). with Van den Ban, A.(2004) Communication for Rural Innovation: Rethinking Agricultural Extension, Blackwell Science, Oxford.
[20] Llewellyn, R. S. (2007). "Information quality and effectiveness for more rapid adoption decisions by farmers." Field Crops Research104(1): 148-156.
[21] Mazur, R. and S. Onzere (2009). "Social networks and status in adopting agricultural technologies and practices among small scale farmers in Uganda." Innovation Africa: Enriching farmers' livelihoods (PC Sanginga, A Waters-Bayer, S Kaaria, J Njuki, C Wettasinha eds.), Earthscan, London: 120-134.
[22] MCC. (2014). Retrieved 02/02/2014, from http://www.mcc.gov/pages/about. .
[23] MiDA (2013). Retrieved 25/09/2013, from http://www.mida.gov.gh/site/?page_id=184.
[24] Ortiz, O., et al. (2013). "Insights into potato innovation systems in Bolivia, Ethiopia, Peru and Uganda." Agricultural Systems114: 73-83.
[25] Rajalahti, R., et al. (2008). Agricultural innovation systems: From diagnostics toward operational practices, Agriculture & Rural Development Department, World Bank.
[26] Reijntjes, C., et al. (1992). Farming for the future: an introduction to low-external-input and sustainable agriculture, Macmillan.
[27] Roep, D. (2000). Vernieuwend werken: sporen van vermogen en onvermogen: een socio-materiële studie over vernieuwing in de landbouw uitgewerkt voor de westelijke veenweidegebieden, Circle for Rural European Studies.
[28] Rogers, E. M. (1962). "Diffusion of inovation." Free Pres, New York.
[29] Rogers, E. M. (1995). Diflusion of innovations, New York: Free Press.
[30] Silverman, D. (2000). Doing qualitative research: a practical handbook. London, SAGE.
[31] Soederberg, S. (2004). "American empire and ˜excluded states: the millennium challenge account and the shift to pre-emptive development." Third World Quarterly25(2): 279-302.
[32] Stolzenbach, A. (1994). "Learning by improvisation: farmer experimentation in Mali."
[33] Spielman, D. J., et al. (2009). "The art and science of innovation systems inquiry: applications to Sub-Saharan African agriculture." Technology in Society31(4): 399-405.
[34] Tesfaye, A. (2005). "Revitalizing market-oriented agricultural cooperatives in Ethiopia." ACDI-VOCA, Addis Ababa.
[35] Walley, C. J. (2002). "They scorn us because we are uneducated'Knowledge and power in a Tanzanian marine park." Ethnography3(3): 265-298.
[36] Waters-Bayer, A., et al. (2008). "Recognising and enhancing processes of local innovation." Innovation Africa: 239-254.
[37] Woods, N. (2008). "Whose aid? Whose influence? China, emerging donors and the silent revolution in development assistance." International Affairs84(6): 1205-1221.
[38] Woods, P. (1999). Successful writings for the qualitative researchers, London Routledge.

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