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Barriers to Adoption of Sustainable Agriculture Practices Among Farmers in Tanzania, Case Study of Mbarali District

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Abstract
Current conventional agriculture systems of production lead to environmental degradation, economic problems, and even social problems. Despite having support from change agents, farm organizations, conservation organizations, or environmental groups, Commercial firms or dealerships, farmers in Tanzania are seldom adopting sustainable agriculture practices. This study was set to examine social economic factors influencing/hindering a farmer's adoption of sustainable agriculture in Mbarali district of Mbeya region in Tanzania. A binary logistic regression model was used to analyze such factors. It was established that the closer the farmer is from town, a farmer having training in agriculture, a farmer having an off farm income and a farmer having a huge farm are having positive influence on a farmer adopting sustainable agriculture. On contrary, a farmer being young does not motivate him to adopt sustainable agriculture. Nevertheless the finding on a farmer's age still needs further investigation as some literature suggests this not to be the case. It is therefore recommended to the government and other stakeholders to encourage farmers to have off farm incomes by providing credits and market access so as to motivate sustainable agriculture.

Keywords: Sustainable agriculture

Introduction
According to Gold (2015), the term sustainable agriculture as addressed by Congress in the 1990 Farm Bill, means an integrated system of plant and animal production practices having a site-specific application that will, over the long term: satisfy human food and fiber needs, enhance environmental quality and the natural resource base upon which the agricultural economy depends, make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls, sustain the economic viability of farm operations, enhance the quality of life for farmers and society as a whole.

Today's conventional or industrial agriculture is considered unsustainable because it is similarly eroding natural resources faster than the environment can regenerate them and because it depends heavily on resources that are nonrenewable (e.g., fossil fuels and fossil aquifers) (Horrigan et.al, 2002). Conventional agriculture goal focus on increased yield and decreased costs of production and are based on excessive use of non-renewable resources, encouraging specialization and economies of scale. (Norman, 1997) These goals are achieved through the use expensive off farm inputs, excess use of non-renewable resources thus carrying environmental degradation and promoting economically inefficient production system (Horrigan, 2002).

Despite the negative impact of conventional agriculture, the current economic and pricing market systems continue to promote farmers of this type of production (Norman, 1997). Low commodity prices governmental commodity prices support, subsides and poor farmer's economy are some of the pressures facing farmers. (Fazio, 2003) These economic pressures leads to concentration of production of forcing the small farmers to abandon their farms (Horrigan, 2002) where now day's peasant tend to use pesticides and inorganic fertilizers to increase production. The development of large farms has caused parches loss control over

inputs and processing and market of the products (Norman, 1997).

With such detrimental effects of the conventional agriculture, sustainable agriculture must be adopted so that can help farmer's survival in such system because it works with nature (Norman, 1997). Sustainable agriculture reduces the costs of production such as purchased inputs by utilizing farming techniques that incorporate biological cycles and the farmer's knowledge (Pretty, Hine, 2001). Also it helps the small farmers to go ahead operating via diversification and increase profits from alternative ways of marketing strategies.

Despite the great alternative the sustainable agriculture represents for many farmers, the spread of sustainable agriculture practices adoption is very limited.

Although there have been some government efforts to increase adoption of sustainable agriculture practices such as provision of economic incentives, subsides, and creation of organizations to provide support to sustainable agriculture practices, the impact of these efforts have not been realized.This implies that the strategies to speed up the adoption of sustainable agriculture practices are not being effective. Together with this fact most studies that find non-adoption of sustainable agriculture practices as a rational decision under certain circumstances (Nowak, 1991).

Therefore this study wouldmake a closer examination of the reasons that prevent many farmers from adopting sustainable agriculture practices. Most of barriers cited by researchers are; economic factors, land tenure, compatibility with current operation, knowledge and management skills, communication and information, policies, beliefs that the conventional system gives higher yield or work well were identified as a major barriers to sustainable agriculture practices, physical and social infrastructure, awareness change agents' beliefs and values and farmers' perception.

However, demographic factors such as sex marital status, age, size of the farm, level of education, type of the farm business, experience in the farming and others have not been deeply explored. This study is going to explore the role of these factors on adoption of sustainable agriculture.

The findings from this study are expected to identify barriers facing farmers on adoption of sustainable agriculture practices. To generate information to the community, government and researchers on skills and measures to mitigate the barriers of adoption of sustainable agriculture practices.

The studywill be done at Mbeya in Mbarali district. Even though limited in Mbarali district, the findings from this study are likely to be reflective of other places in Tanzania much as the farmers in Mbarali district face similar social economic characteristics as farmers in other parts of Tanzania.

2. Factors Influencing Farmers Adoption of Sustainable Agriculture

One of the issues most clearly voiced by farmers is the need for any practice they adopt to be compatible with their current systems of production (Drost et al., 1996). Compatibility in an agricultural sense means that any sustainable practice adopted must be adaptable to the geographical area and climate, the farmer's resources and capabilities, and the specifics of the farm itself (for example, weeds, soil type, terrain, erosion potential, and other site specific factors) (Cutforth et al., 2001).

According to Nowak (1991) and Drost et al., (1996), farmers have been shown to be unwilling to adopt sustainable practices that do not fit well with current production strategies. A farmer has normally reached this system of practice through trial and error over a period of years, and knows better than anyone what works on his or her farm. An individual farmer's system is not easily changed; thus, any sustainable practice must be compatible before adoption can take place. Farmers have reported that compatibility barriers include increased labor requirements, inability to utilize current equipment, environmental practices that reduce flexibility, lack of time, climactic and farm specifics, and specificities of commodities or markets In contrast, a farmer wants productive and efficient practices that do not require excessive labor or personal time and that adapt to market and weather changes.

According to Arellanes and Lee (2003), farmers with greater erosion potential and poor soil quality on their farms were much more likely to adopt sustainable practices than farmers who did not have these concerns. In addition, farmers with the capability to irrigate were four times more likely to adopt a sustainable practice. Similarly, Wandel and Smithers (2000) concluded that conservation tillage practices fit the production systems of some farmers much more than others...

According to Nowak 1991; Norman et al., 1997; Souza Filho, 1997, The notion that sustainable practices are more management intensive than conventional practices often serves as an adoption barrier. Nowak (1991) asserted that some farmers are unable to adopt sustainable practices simply because they lack the necessary management skills. For example, adoption of many sustainable practices, such as utilization of cover crops, requires a high degree of management of the farm's biological resources (Diver, 1996). Nebraska farmers surveyed by Cutforth et.al (2001) articulated that they felt comfortable managing the conventional corn and beans rotations, but might not be willing or capable of handling the management of new crops or more diverse rotations.

According to Drost et al., 1996, compatibility and sustainable practice adoption, it seems appropriate to revisit the issue of knowledge requirements for adopting these practices. If, as the literature indicates, sustainable practices require a substantial amount of knowledge to be gained by the farmer prior to implementation, then it stands to reason that a farmer will need to spend considerable time amassing this knowledge.

Pretty and Hine (2001) propose that sustainable agriculture minimizes the use of non-renewable inputs while maximizing natural and on-farm inputs, uses the knowledge of farmer and social capital to solve problems, is locally adapted, and creates numerous public goods, such as clean water and air, safe and plentiful food, and healthy rural communities.

Importantly, Arellanes and Lee (2003) discovered that farmers who owned their land were four times as likely to adopt sustainable practices. According to Antle and Diagana (2003) and Arellanes and Lee (2003) found that lack of secure land tenure was a significant barrier to adoption of sustainable practices from the farmer's perspective. Many property owners, on the other hand, view their land from a solely economic perspective,

especially those older property owners who rely on the rental income as a pension fund. Moreover, many property owners want their farms to have a clean, neat appearance, whereas sustainable techniques often leave visible weeds or ground cover. Problems were compounded by the finding that many tenant or landlord relationships were characterized by a dominant tenant or subordinate landlord approach, or vice versa.

3. Research Methodology

3.1 Research design and area of study

The research design was a cross section design where data from the farmers were collected at one point in time (Kothari, 2004).The study was done in Mwera ward of Mbarali District in Mbeya region of Tanzania. The target populations for this study were small scale maize farmers who live in Mwera ward.

3.2 Sample size and sampling procedures

The sample consisted of 100 small scale farmers picked among the famers in Mwera ward. These farmers were selected using simple random sampling basing on the sampling frame provided by the Ward Chairman. The sample size was determined basing on the assertion by Bailey (1994), who argues that the bare minimum number of cases for a sample or sub-sample in which statistical data analysis is to be done is 30 and that in most cases 100 cases is taken. This study took a sample of size 100 which is consistent to Bailey (1994).

3.3 Data analysis

The study employed binary logistic regression to analyze barriers to adoption of sustainable agriculture in the area of study.

4. Results and Discussion

4.1 Demographic Characteristics of Respondents

This section looked at the gender, age, education level marital status Extension services., Distance from Town center to home, Distance from home to farm, off income generating activity, Member of agriculture organization, Agricultural training and farm sizes.

The results of the analysis of demographic characteristics showed that 78 (80.4%)

of the 97 respondents were males while19 (19.6%) were females. Part of the reason for male dominance among the respondents is due to the fact that in most families, males are the head of the families and often answerable to the survey.

It was also found that of the 97 respondents, 20.6% were between 18 – 32 years old, 34.0% were between 32 –42 years old, 25.8% were between 42-54 years old, 19.6% were between 54 – 66 years old. The majority of the farmers were between 32 and 42 years. Majority of the farmers (80.4%) were of the age between 18 years and 54 years, which reflect the productive age.

The results show that 3.1% of the farmers didn't attend to school, 50.5% of the farmers attained primary school education, 33.0% of the farmers had attained secondary school education, 10.3% of the farmers had attained college level education, and 3.1% of the farmers had attained university level education. These results indicate that most graduates do not engage themselves in agriculture. The study revealed that majority of the farmers had attained basic up to college level education.

37% had received training in sustainable agriculture while 63% had not. 77% had an off farm income activity while 33% had not. 9 % were member of an agricultural organization while 91%were not. The results also shows that 88.7% of the respondents were married and 11.3% were not married. 29% were accessible to extension services while 71% were not accessible.

4. 2 Results from Binary Logistic Regression

A binary logistic regression model was used to analyze the factors influencing adoption of sustainable agriculture with dependent variable as binary response. That is a farmer has either adopted or not adopted sustainable agriculture (Yes=1 and No= 0). There were a number of independent variables including age, education, distance from home to town, size of the farm and others. The model regression results are given in Table 1.

The results show that the model is highly significant (p=0.000) and the pseudo R square tests, Cox & Snell=R square and Negelkerke R square show that the model has a good explanatory powers guaranteeing its usefulness in explaining factors influencing a farmer to adopt sustainable agriculture. Besides, the Hosmer and Lemeshow test does not reject the null hypothesis of equality (p=0.335) between the actual observed data and the data predicted by the model, further confirming the reliability of the model.

Table 1: Binary Logistic Regression Results on Factors Influencing Adoption of Sustainable Agriculture

Variables	Parameter estimate	S.E.	Wald	df	Sig.	Exp(B)
Age			5.199	3	.158	
Age(1)	**-3.099**	**1.391**	**4.967**	**1**	**.026**	.045
Age(2)	-.665	1.137	.342	1	.558	.514
Age(3)	-.947	1.124	.711	1	.399	.388
Farm			7.507	3	.057	
Farm(1)	3.496	1.855	3.552	1	.059	32.986
Farm(2)	.423	1.416	.089	1	.765	1.526
Farm(3)	**5.354**	**2.219**	**5.823**	**1**	**.016**	211.513
Training	**4.402**	**1.567**	**7.895**	**1**	**.005**	81.602
Town			**7.888**	**3**	**.048**	
Town(1)	1.992	1.592	1.567	1	.211	7.331
Town(2)	**4.803**	**1.936**	**6.153**	**1**	**.013**	121.921
Town(3)	1.864	2.037	.837	1	.360	6.447
Income	**1.947**	**.953**	**4.177**	**1**	**.041**	7.006
Member	-1.046	1.736	.363	1	.547	.351

	Status	3.457	2.073	2.781	1	.095	31.715
	Services	1.037	.831	1.558	1	.212	2.820
	Constant	-11.126	3.884	8.206	1	.004	.000

P-value=0.000, Cox & Snell=R square=0.529, Negelkerke R square=0.725
Hosmer and Lemeshow test (chi-value=9.088, df=8, p=0.335)

Table 1 show that the variable age 2 is negative and significant. Age 2 consisted of respondents with age of 18 – 32, the youngest group. This implies that young farmers are not inclined to adoption as compared to old farmers. This observation is consistent with Boahene (*et al.,* 1999) who found that age may not be significant or may be negatively related to adoption.

The variable farm 3 was significant (p=0.016) with positive influence on adoption. Farm 3 represented farmers owning farms of size between 10.75 acres to 15.75 acres, the largest among all farm sizes, implying that the larger the farm size the higher the possibility of adoption.

Another key factor for adoption was whether a farmer has received training in agriculture. The results shows that having training in agriculture is significant (p=0.005) with positive influence suggesting that training in agriculture has positive influence towards adoption of sustainable agriculture. This is obviously so because a framer who knows the importance sustainable agriculture is more likely to adopt than the one who is not trained.

Distance from home to town also matters a lot for adoption of sustainable agriculture. From Table1, results shows that Town 2 is significant (p=0.048) with positive influence on adoption. Town 2 represents all farmers whose distance from homes to town is within the range of 5.75 km to 10.75 km, the second shortest. Its significance implies that the closer the distance is from home to town the higher the chance for a farmer to adopt sustainable agriculture. Being closer to town makes a farmer being easily accessible to agricultural inputs, market and sources of information in agriculture All this makes easy for a farmer to adopt sustainable agriculture.

Having an off farm income activity is another key factor in adoption to sustainable agriculture. From Table 1, the results show that having an off farm income is significant (p=0.041) and having positive influence. This could be because having an off farm income gives a farmer an extra income to take care of necessary inputs required in sustainable agriculture even in the event of poor weather performance.

Conclusion and recommendation

The study was all about factors influencing farmers to adopt sustainable agriculture in Tanzania. The study has stablished the factors hindering farmers' adoption and those motivating them to adopt. Being a young farmer hinders adoption, while having received an agriculture training, being closer to town, having a large farm size, having an off farm income motivate farmers to adopt. Given the said scenarios, the government apart putting efforts in the promotion of SAP through agents, need to see how it can manipulate the discussed factors which hinders or motivate adoption. It should strengthen training of farmers in agriculture; send inputs to remote areas as well encouraging farmers to have off farm income generating activities especially during off farm season.

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