 TRAINING AS A FACTOR INFLUENCING ADOPTION OF INNOVATIONS ALONG MANGO VALUE CHAINS IN MERU COUNTY, KENYA

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ABSTRACT
The study has used a descriptive survey design. The study was carried out in Meru County. The study area was limited to the lower part of Meru County whose climatic condition is suitable for mangoes production. This study adopted a probability sampling method to select the respondents for the study. Out of 13,442 farmers, traders and exporters, 447 farmers, 12 traders and 2 exporters were randomly selected for interview. Secondary data used in the study was collected from the Ministry of Agriculture Offices while primary data was collected from the respondents using a structured questionnaire with both open and close ended questions. In this study, both qualitative and quantitative data were used in the analysis. Quantitative data obtained from the field was analyzed using descriptive and inferential techniques. The descriptive techniques adopted were means and frequencies while the inferential technique used were regression and correlation to establish relationship between variables in the study and inferences made. Frequency tables and charts were used to present the findings.

The study found out that lack of training was an hindrance in innovation adoption. The more the training the more the adoption of innovation. Chi-square results show that training has a significant association with innovation in Mango value chain as shown by a value of 39.139 at (pd < 0.05). The researcher concludes that lack of organizations/institutions support has also undermined innovation adoption in mango supply chain. There is need to establish good linkages between farmers and research development systems which offer training on new technologies or innovations as well as assisting farmers in accessing markets for their products.

Key Words: Value chain, Training, agriculture, Mango, adoption, innovation.

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INTRODUCTION

About 80% of the population live in rural areas and thrive on farming. The growth in agriculture has been on the decline in recent years. This has affected fruit farming in the country, which has also continued to decline just as the country’s general economy (World Bank, 2007). The Government of Kenya has put in place and proposed a strategy for revitalizing agriculture, 2004 –2014 with the aim of raising the sector’s growth rate, reduction of unemployment and poverty. This revitalizing agriculture strategy aims at achieving the country’s Millennium Development goal of Poverty Reduction (HCDA, 2008).

However, the agricultural sector continues to face major challenges affecting the value chain mainly due to poor productivity, poor land use, lack of markets and value addition. The challenges are exacerbated by the unfavorable institutional framework currently governing the sector (Moturi et al., 2010).

To streamline the challenges in the sector, the Government through its policy document “Vision 2030” aims to promote an innovative, commercially-oriented, and modern agricultural sector through adding value to farm and livestock products before they reach the local and international markets. This will be accomplished through transforming key institutions in the sector to promote growth, increase productivity, introduce land use policies for better utilization of high and medium potential lands, developing more irrigative areas in arid and semi-arid lands for both crops and livestock, and improving market access for small holders through better supply chain management (Rok, 2008). These interventions should contribute to the adoption of innovations along the mango value chain driven by producers, agents, transporters, processors and traders as key actors in the chain.

The improved processes at all stages of the value chain, from the farm to the consumer, will make significant contributions to an efficient and effective enterprise, with increased profitability at the small-scale production level and at the same time avail quality and safe mangoes and mango products to the Kenyan consumers at affordable prices. According to the ROK (2009), value chain analysis can strengthen the innovation process by determining the contribution of each actor with a view to maximizing synergies and complementarities between actors.

According to Diederen, et al, 2002, agriculture progresses technologically as farmers adopt innovations. The extent to which farmers adopt available innovations and the speed by which they do so determines the impact of innovations in terms of productivity growth. It is a common phenomenon that farmers, like any other kind of entrepreneurs, do not adopt innovations simultaneously as they appear on the market.

Despite them being successful, the agricultural revolution is still dynamic and calls for new innovation systems on a constant basis (World Bank, 2006). Rapid adoption of innovations in developing countries is constrained by lack of credit, limited access to information, aversion to risks, inadequate incentives associated with land tenure arrangements, insufficient human capital, absence of equipment to relieve labor shortages (thus preventing timeliness of operations), chaotic supply of complementary inputs (such as seeds, chemicals and water) and inappropriate transportation infrastructure (Zilberman et al, 1985).

Vol. 7, No. 1, June 2013
Problem Statement

For the last forty years during mangoes harvesting season, the researcher has observed that a lot (39%) of mangoes in Meru County go to waste. This is also emphasized by DANIDA report (2010). However, technologies (innovations) exist to arrest this situation but farmers are yet to adopt these innovations.

Some of the innovations include: grafting of the indigenous varieties so that varieties which are marketable can be produced (HCDA, 2006), parasitic wasp and a combination of other Integrated Pest Management (IPM) techniques to control fruit flies which cause great damage to the mango fruit and thus give confidence to the market (Ejidiah, 2010), processing of mangoes like it is done in India by Coca Cola (mixing mangoes and milk) (BestMediaInfo Bureau, 2010).

According to FAO, capacity building of farmers on crop husbandry, technological application and overall farm management are key to the development of the chain in the long term. Studies by Mussei et al. (2001) in Tanzania, Getahun et al. (2000) in Ethiopia and Abd El-Razek (2002) found factors such as financial resources and training influenced technology adoption. This study therefore sought to investigate the factors that influence the adoption of innovations along the mango value chain in Meru county and consequently in Kenya.

Objectives

The purpose of this study was to:

i. To establish the role of TRAINING on adoption of innovations along the mango value chain in Meru County.

Research Hypothesis

$H_0$: Training is not associated with innovation, and

$H_1$: Training is associated with innovation.

Review of Related Literature

The Ministry of agriculture is the principal institution setting agricultural policy and planning and carrying out agricultural development programs to assist farmers in production (ROK, 2009). According to Feder and Slade (1984), training to farmers is mostly through agricultural officials such as extension/field officers or through veterinary officers. Information reduces the uncertainty about a technology’s performance hence may change individual’s assessment from purely subjective to objective over time (Caswell et al., 2001). Exposure to information about new technologies as such significantly affects farmers’ choices about it.

Feder and Slade (1984) indicate how, provided a technology is profitable, increased information induces its adoption. However in the case where experience within the general population about a specific technology is limited, more information induces negative attitudes towards its adoption, probably because more information exposes an even bigger information vacuum hence increasing the risk associated with it. A good example is the adoption of recombinant bovine Somatotropin Technology (rbST) in dairy production (McGuirk, Preston and Jones, 1992; Klotz, Saha and Butler, 1995). Feder and Slade (1984) assert that the right mix of information properties for a particular technology is needed for effectiveness in its impact on adoption.
Rogers (1983) after reviewing 156 studies had generalized that “Earlier adopters have more change agent contact than later adopters”, since 87% of all the studies he reviewed supported such a generalization. Other studies as well have found a significant positive relationship between extension contact and adoption of innovations. Examples of these studies were, Mussei et al. (2001), Getahun et al. (2000), Baidu-Forson (1999), Madhukar and Ram (1996), and Abd El-Razek (2002). However some studies found no relationship between the two variables. Examples of these studies were, Bulale (2000), Salama (2001), Getahun et al. (2000), Mussei et al. (2001), and Adesina and Baidu-Forson (2005).

Contact with veterinarian has a positive influence on the level of consciousness of farmers. A positive relationship between veterinarian contact and adoption of innovations has been reported by majority of studies. Examples of these studies were, Salama 2001, El-Melegi (2000), Hafz and Anwar (1999), Bali (1996), and Hafz and Anwar (1999).

Msabeni, et al; (2010) carried out an analysis of the organizational linkages along the mango value chain, Mbeere District Eastern Province, Kenya; they found out that while there were various stakeholders/actors along the mango value chain including producers, agents/buyers, service providers, input suppliers, processors, wholesalers, exporters and consumers (end users), their linkages were weak since they operated in isolation and lacked information at various levels along the chain. For example, the producers lacked information on markets, producer prices and appropriate agro-chemicals.

According to Msabeni, et al; (2010), lack of market information and prices is a loophole the agents are strongly exploiting, while lack of information on the appropriate agro-chemicals has resulted in the use of sub-standard chemicals thus affecting the quality and quantity of yields. The extension service providers also lack information on changing market needs and are not able to advise the producers appropriately. Bringing various stakeholders together through different forums would strengthen the linkages and improve information flow along the chain (HCDA, 2008).

**RESEARCH METHODOLOGY**

This research was guided by the methodology used by Nchinda and Mendi (2008) in the study of yoghurt technology adoption in the western highlands of Cameroon.

**Research Design**

This study assumed participatory action research to develop innovative technologies and products associated with mangoes. Baseline survey was done. The study districts included the former Meru Central and Meru North Districts currently known as Meru County. The County lies to the east of Mt. Kenya whose peak cuts through the southwest border of the County. To the North East it borders Laikipia County, to the West it borders Nyeri and Kirinyaga counties, TharakaNithi county in the south and Isiolo county to the north.

**Participant (Subject) Characteristics**

The study was concentrated on seven divisions, which are highly productive in mangoes as shown in Table 1.
Table 1: Study Areas (Survey figures, 2010)

<table>
<thead>
<tr>
<th>Meru County Study Areas</th>
<th>Area Under Mango per Ha</th>
<th>Production in Mt (2010)</th>
<th>Number of Farmers</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imenti North</td>
<td>275</td>
<td>2,586.97</td>
<td>910</td>
<td>30</td>
</tr>
<tr>
<td>Meru Central</td>
<td>1289</td>
<td>14,553.97</td>
<td>4,347</td>
<td>144</td>
</tr>
<tr>
<td>Imenti South</td>
<td>73</td>
<td>1,011.11</td>
<td>516</td>
<td>17</td>
</tr>
<tr>
<td>Igembe South</td>
<td>278</td>
<td>3,120.14</td>
<td>4,023</td>
<td>134</td>
</tr>
<tr>
<td>Igembe North</td>
<td>71</td>
<td>637.37</td>
<td>2,176</td>
<td>72</td>
</tr>
<tr>
<td>Tigania West</td>
<td>106</td>
<td>783.06</td>
<td>1,074</td>
<td>36</td>
</tr>
<tr>
<td>Tigania East</td>
<td>31</td>
<td>170.34</td>
<td>396</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>2,123</td>
<td>22,862.96</td>
<td>13,442</td>
<td>447</td>
</tr>
</tbody>
</table>

Source MOA, 2010

The study area was limited to the lower part of the County whose climatic condition favors the production of mangoes. The population of the study included individual mango farmers, traders and exporters in Meru County. The mango farmers are approximately to be 13,442, traders are 120, while exporters were 12 (MOA Survey, 2000). Therefore, the target population for the study was 13,574 traders, farmers and exporters.

**Sampling Technique**

The Population of Mango farmers in the county was estimated at 13,454. Since the population is large (above 10,000), the following formula was adopted to calculate the sample size of farmers.

\[
N = \frac{N}{[1 + Ne^2]}
\]

A sample size of 447 mango farmers/growers was established.

A stratified random sampling technique was used to get a sample size of traders and exporters since the target population was not homogeneous. The researcher therefore subdivided it into groups or strata in order to obtain a representative sample. From the above population of thirteen thousand five hundred and seventy four, 10% from both traders and exporters, giving each item in the population an equal probability of being selected. This generated a sample size of 461 respondents from whom the study sought information. Table 2 below gives summary of the sample size.

Table 2: Sample Size (MOA, 2010)

<table>
<thead>
<tr>
<th>Sections</th>
<th>Population (Frequency) (N)</th>
<th>Sample Ratio</th>
<th>Sample (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traders</td>
<td>120</td>
<td>0.1</td>
<td>12</td>
</tr>
<tr>
<td>Exporter</td>
<td>12</td>
<td>0.1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>13,574</td>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>
The questionnaires were then distributed through the ministry’s division headquarters. Out of the target population, 447 questionnaires were administered to 447 farmers, 12 traders and 2 exporters. Out of the 418 questionnaires distributed, 296 questionnaires were returned with 283 coming from farmers, 12 from traders and one from an exporter.

**Measures and Covariates**

Primary data (mainly information on factors influencing adoption) were collected from the respondents through questionnaires. Structured questionnaire with both open and close ended questions were the key instruments used in collecting primary data from the respondents. The questionnaire was pre-tested before being administered to the respondents.

Quantitative data obtained from the field was coded using the SPSS and analyzed using descriptive and inferential techniques. Descriptive techniques were adopted using frequencies to show the tendency of occurrence between study variables. Inferential techniques like regressions were used so as to establish the relationship between variables in the study and inferences made.

A logit analysis was used to determine whether adoption of innovation is influenced by entrepreneurial, financial, marketing and training skills. Logit regression is used to determine the probability of occurrence of an event with the presence of its determinants by fitting the data on a probability curve. A Logit model was found suitable by Nchinda and Mendi, (2008) who used the same approach to investigate the factors influencing adoption of milk technology in Cameroon.

The Logit model was conducted by transforming ‘innovation adoption’ variable into binary (1 = adopted innovation, 0 = has not adopted innovation). Logit regression was preferred as it is not affected by other factors such as serial autocorrelations and would, thus, have a better presentation of the prediction.

Innovation (I) was the dependent variable while training (X1), marketing skills (X2), respectively were the independent variables. These variables were measured based on the respondents’ agreement or disagreement with the variable indicators whereby agreement was accorded value 1 and disagreement value 0. The analysis was done on four independent variables as shown below:

\[
P(Y = 1|X_1, \ldots, X_p) = \frac{e^{a + \sum_{j=1}^{p} \beta_j X_j}}{1 + e^{a + \sum_{j=1}^{p} \beta_j X_j}}
\]

Where: Training (X1): (0=not trained, 1= have been trained)
Marketing skills (X2): (0=lack marketing skills, 1= have marketing skills);
I and X variables were converted into standard scores: ZY, Z1,Z2,…….Zn.
RESULTS

The study found out that majority (69%) of the mango growers in Meru County were trained on agronomy, while 31% were not trained. Out of the trained growers, 76.5% adopted innovations and 23.5% did not adopt. Out of the untrained growers, 1315% adopted innovations and 7485% did not adopt innovations. The growers indicated that the untrained learnt from their neighbours.

In regard to training on marketing, 63.3% of growers indicated that they were trained on marketing, 36.7% indicated that they were not trained. Out of the trained growers, 49% adopted innovations and 51% did not adopt. Out of the growers who were not trained, 6.7% adopted innovations and 93.3% did not adopt.

On training on processing, it was found out that only 8.8% of growers were trained on mango processing while, 91.2% were not trained. Out of the trained growers, 8% adopted innovations and 92% did not adopt the innovations. Out of the untrained growers, 1% adopted innovation and 99% did not adopt the innovation. Table 4.10a shows that there is less training on processing.

On training for traders, the study found out that 38.5% of traders/exporters were trained on agronomy while, 61.5% were not trained. Out of the trained traders/exporters, 40% adopted the innovation and 60% did not adopt. Out of the untrained, 13% adopted the innovation and 87% did not adopt the innovation.

The study found out that 84.6% of traders/exporters were trained on marketing while 15.4% were untrained. Out of the trained traders/exporters, 73% adopted marketing innovations but 60% out of the trained traders/exporters did not adopt innovations. Out of traders/exporters that were untrained, 50% adopted marketing innovations and 50% did not adopt innovations. Growers had low 8% marketing adoption rate for the trained and 1% for the untrained while traders/exporters had 73% marketing adoption rate for the trained and 33% for the untrained.

Logit Regression Results

That study shows that training would lead to a 0.319 increase in innovation adoption.

| Table 3: Logit Model Coefficients |
|-----------------|-----|-----|-----|-----|-----|
|                  | B   | S.E. | Wald | Df  | Sig. |
| Model 2: Grower  |     |     |      |     |     |
| Training         | .319| .306| 1.082| 1   | .298 |
| Constant         | -1.148| .776| 2.187| 1   | .139 |
| Model 2: Traders/Exporters |     |     |      |     |     |
| Training         | 19.817| 23210| 0     | 1   | .999 |
| Constant         | 42.365| 57340| 0     | 1   | .999 |

a. Variable(s) entered on step1: Marketing Skills and Training.

The Logit model shows that, when other factors are held constant, training would increase the same by 19.817.
Chi-Square Results

Chi-square test was used to determine whether an association (or relationship) between independent and dependent variables in the sample is likely to reflect a real association between these variables in the population. The null and alternative hypotheses for the chi-square test were:

Hypothesis One

- $H_0$: Training is not associated with innovation, and
- $H_1$: Training is associated with innovation.

Table 4: Chi-Square – Innovation and Independent Variables

<table>
<thead>
<tr>
<th>Model</th>
<th>Training</th>
<th>Value</th>
<th>Degrees of Freedom (df)</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Training</td>
<td>Pearson Chi-Square</td>
<td>39.139d</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Likelihood Ratio</td>
<td>41.166</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Linear-by-Linear Association</td>
<td>.010</td>
<td>1</td>
</tr>
<tr>
<td>Model 2</td>
<td>Training</td>
<td>Pearson Chi-Square</td>
<td>14.300</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Likelihood Ratio</td>
<td>17.323</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Linear-by-Linear Association</td>
<td>.672</td>
<td>1</td>
</tr>
</tbody>
</table>

Chi square results on growers shows that, a chi-square value of 39.139 was established at $p=0.006$ ($p<0.05$) on training. The null hypothesis is thus rejected and alternative hypothesis accepted. However, a linear by linear association was found to be insignificant at $p = 0.920$ ($p>0.05$).

In traders/exporters perspectives; on training, a chi-square value of 14.300 was established at $p=0.026$ ($p<0.05$). However, a linear by linear association was found to be insignificant at $p = 0.412$ ($p>0.05$).

DISCUSSION

The study further sought to establish whether training influences innovation adoption. Formal education was a factor in innovation adoption. The survey found out that the growers who attained primary education (14.4%) had higher innovation adoption rate than those who did not have any education at all (3.9%). This is in line with Ronson (2007) and Nchinda and Mendi(2008), who established that education was a factor influencing adoption of innovation.

It was established that 69% of growers and 38.5% of traders/exporters were trained on agronomy, and their adoption rate was 57.6% and 23% respectively. That is why production was not a major problem. The major problem observed was marketing and processing. Although 63.3% growers and 84.6% traders/exporters were trained on marketing, only 33.6% of growers, and 69.3% of traders/exporters adopted marketing innovations. This explains why traders/exporters could make better informed decisions than growers. The findings also reveal that out of 8.8% of growers and 76.9% of traders/exporters, who were trained on processing, 1.4% growers, and 30.9% traders/exporters adopted processing. This also explains why there were very few new
Training as a Factor Influencing Adoption of Innovations Along…

ventures. The study established that there was only one group which was in the process of starting a processing plant. This indicates that training influences innovation adoption.

According to Caswell et al., 2001, acquisition of information about a new technology reduces the uncertainty about a technology hence may change individual’s assessment from purely subjective to objective over time hence promoting adoption of such a technology. This explains why majority of the growers had higher (76.5%) agronomy adoption rate than trader/exporter whose adoption was 40% for the trained. Agronomy as a technology is more applicable to farmers than to traders; this explains why farmers who had adopted agronomy were more than the traders.

CONCLUSION

Lack of organizations/institutions support has also undermined innovation adoption in mango supply chain; Organizations would have been established as the best linkages between farmers and innovations and the research and development systems. Organisations would also help develop innovation programs creating a communication channel between governments, farmers and development of agricultural projects. They could equally take various roles in the mango supply chain including, offering trainings to farmers on farming practices, enlightening farmers on new technologies or innovations as well as assisting farmers in accessing markets for their products.

On the influence of training on innovation adoption, the findings show that there was low training on processing. This shows that there should be deliberate attempts by the Ministry of Industries (Strategic plan 2010/2015) to come up with business incubation program targeting counties to facilitate local processing for the local and international markets. This can only succeed if it is backed by policy framework enacted by the same Ministry through treasury to give tax holiday for those investors who put processing ventures into the rural areas on condition that they use 65% locally produced raw materials. At the same time, in order for this to succeed, there should be deliberate policy framework enacted by the government to protect local industries through enactment of high tariff to bar similar competing goods. The incoming goods should pay high tax making them be sold at high prices in the local market. This would facilitate wealth and job creation.

The study recommends intensification of training by value chain members and stakeholders, that is the Ministry of Agriculture, NGOs and private sector on the areas of price, place, promotion and negotiation so that growers could be better equipped in marketing skills.

Acknowledgements

I would like to thank the Almighty God for giving me good health and the opportunity to study. Secondly, I am grateful to my supervisors Dr. C.Ombuki and Dr. D.Mbogori for their ever timely advice. Their insightful comments helped immensely in shaping this thesis. However, I hasten to all that any shortcomings are solely mine. (I take responsibility for all the shortcomings). I am equally extending my gratitude to the M.T. Kenya University for administrative assistance. Worthy mentioning too are the men and women who helped in typing, editing and printing this document. To all I return every bit of thanks. Finally, I salute the members of my family for moral, material and financial support.

Global Journal of Business Management
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Vol. 7, No. 1, June 2013