An Analysis of Farmers' Awareness of Agricultural Extension Devolution and Preferences for Participatory Design of Agricultural Extension Programs in Kenya

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Declaration

This thesis is my original work and has not been presented for a degree in any other University.

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List of Acronyms

AERC	African Economic Research Consortium
AEP	Agricultural Extension Program
CBOs	Community Based Organizations
CE	Choice Experiment
CMAAE	Collaborative Maters in Agricultural and Applied Economics
CVM	Contingent Valuation Method
CS	Compensating surplus
ESP	Extension Service Providers
FFD	Farmer Field Days
FFS	Farmer Field Schools
ICT	Information and Communication Technology
RPL	Random Parameter Logit
MNL	Multinomial Logit
NALEP	National Agricultural and Livestock Extension Policy (Kenya)
NASEP	National Agricultural Sector Extension Policy (Kenya)
NGO	Non-Governmental Organization
IIA	Independence from Irrelevant Alternatives
RP	Revealed Preference
SP	Stated Preference
PMA	Plan for Modernization of Agriculture (Uganda)

T&V	Training and Visit
WTP	Willingness to Pay
WTA	Willingness to Accept

Abstract

In Kenya, agricultural extension has suffered various shortcomings including inadequate farmer involvement in development and designing of extension programs. The current County governance system in Kenya devolves agricultural sector to lower administrative levels with the aim of bringing services, such as extension service closer to the people. Lack of empirical evidence on farmersô preferences for agricultural extension programs (AEP) limit policy making on demand-driven extension. This study analyzed farmersô awareness of agricultural extension devolution and analyzes willingness to pay (WTP) for AEP by farmers in high and low potential agricultural zones of Meru County in Kenya. Primary data were collected through household surveys using a structured questionnaire. A binary logit model was employed to assess the possible determinants of the level of farmer awareness of agricultural extension devolution. Further, farmersô preferences for various AEP scenarios were estimated using a random parameter logit (RPL) model.

Results show that the awareness level of agricultural extension devolution is relatively low, about 44 percent. Farmer and farm factors found to influence awareness include attendance to farmer field days, tenure security (land title deed), income and education. The findings also show that farmers prefer an extension program, which focuses on the agricultural activities they engage in at the county level; where linkage support between the research, extension and farmers is provided; and regular monitoring and evaluation of the program is scheduled. However, farmers would like to be paid for their participation in developing the content of extension programs. Education, source of market information and tenure security were found to be the main sources of farmersô preference heterogeneity between the two zones. These findings have important policy implications for the design of AEPs for different categories of farmers.

Chapter One

1. Introduction

1.1 Background Information

In most agricultural policy debates, a consensus exists that agricultural extension is a key component in improving agricultural productivity. The term ógricultural extensionô is contextualized here to mean the entire set of organizations that support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills, and technologies to improve their livelihoods and well-being (GOK, 2012). This can include different governmental agencies (formerly the main actors in extension), private sector actors, Non-Governmental Organizations (NGOs), producer organizations and other farmer organizations. Extension was originally conceived as a service to óextendô research-based knowledge to the rural sector in order to improve the lives of farmers. Todayôs understanding of extension goes beyond technology transfer to facilitation; beyond training to learning, and includes assisting farmer groups to deal with marketing issues, and partnering with a broad range of service providers and other agencies (Davis, 2008).

Many countries in the world established their agricultural extension systems in order to realize their national food security goals (Swanson 2006; Hu et al., 2009). Through the combined efforts of international organizations and national governments, most Asian developing countries and some nations in other continents had successfully improved their food security by the 1980s (Swanson, 2006). However, budgetary constraints have forced many countries to reform their public agricultural extension system; in many cases downsizing due to reduced financial allocations (Umali and Schwartz, 1994; Feder et al., 1999). In Europe, these reforms took the form of privatization, while in some developing countries for instance in Uganda, they involved

decentralization and commercialization (Anderson and Feder, 2004; Rivera, 2004; Hu et al., 2009).

Previous studies have indicated that privatization had resulted in farmersô losing access to public agricultural extension services (Anderson and Feder, 2004). It is argued that, due to market and system failures, both buyers and sellers experience constraints in effecting transactions and establishing the necessary relationships to engage in demand-driven innovation processes (Klerkx and Leeuwis, 2008). According to Huang et al. (2001), commercialization reforms in countries like China had resulted to government extension agents selling more pesticides and fertilizers to farmers. Studies on decentralization reform in Chinaôs township extension system found that the reform had caused government extension agents to spend too much time on administrative affairs rather than dissemination of services (Hu et al., 2009).

The traditional view of extension in Africa was very much focused on increasing production, improving yields, training farmers, and transferring technology. Several approaches such as Integrated Rural Development Program, training and visit (T&V) extension approach, and to a certain extent, farmer field schools (FFS) have been used to empower farmers and deliver extension services in Africa. In general, studies have shown agricultural extension to have significant and positive effects on farm knowledge, adoption, and productivity. However, studies from Ghana and Mali raise a serious issue that the FFS may become an elite activity, excluding the poor and less educated (Davis, 2008).

In Kenya, agricultural extension dates back to the early 1900s, but its first remarkable success was in the dissemination of hybrid maize technology in the late 1960s and early 1970s under integrated approach and district projects. However, the integrated policy suffered from

ineffective management, poor co-ordination, lack of effective communication skills among project implementers and lack of community engagement. The T&V system of agricultural extension in Kenya succeeded in improving staff quality through training and the establishment of better extension linkages. However, the project was biased towards more educated farmers and more productive and better-off areas. The key institutional features were poorly developed; it failed to incorporate a mechanism to give farmers a voice, which led to lack of accountability and responsiveness to farmersô needs. Overall, there was no evidence of sustainable impact on agricultural productivity, and no positive return on the expenditure could be established (Gautam, 1999).

Following liberalization and structural reforms in 1992, funding and delivery of extension services in Kenya became a mix of public and private arrangements. This includes those that involve contracting of public extension workers with Non-Governmental Organization (NGOs), Community Based Organizations (CBOs), farmer associations and private commercial entities. The privatization or commercialization of extension may be useful, but in order to benefit resource-poor farmers, it requires testing strategies that are participatory, location-specific, and, most importantly, flexible to dynamic local stakeholder needs and resource limits (Davidson, 2007).

In realization of the importance of effective and efficient extension service to agrarian communities, governments are making concerted efforts to ensure agricultural extension is demand-driven. This inculcates the notion that the information, advice and other services offered by extension professionals should be tailored to the expressed demands of the clients or recipients of the service rather than the needs identified by various stakeholders such as government, corporations, scientists and extension professionals (Rivera, 2004). Studies show

that if reforms in agricultural extension are to be useful then they need to be designed to capture farmersô priorities and conditions (Davidson, 2007).

With the enactment of the revised Kenyan Constitution in the year 2010, agricultural sector particularly extension service is devolved to lower administrative levels in order to take the services closer to people and ensure they participate in improving the service delivery (GOK, 2011). The extension service in Kenya has suffered in various ways; - inadequate funding and staffing and lack of farmer involvement in planning as reflected in T&V extension system (Rivera, 2004). In the devolved system, County governments have the mandate to provide extension service and authority to levy taxes on the services they provide (GOK, 2011). With the reduced role of the central government in financing the extension services farmers will be required to contribute towards funding the extension program through paying for extension services. Among the preliminary factors for the extension to work effectively in the new structure include farmer awareness or access to information on the devolved extension framework as well as affordability of the extension service. Farmer awareness would help them understand the extension structure and what contribution or input is expected from them. Affordability of the extension enables farmer participation in the implementation of extension program by art of using the extension services.

1.2 Research Problem Statement

In Kenya, the agricultural extension system is characterized by a multiplicity of players and service providers. The main service providers include: public extension system, commercial and non-commercial extension service providers. Linkages between these actors and farmers are weak and each actor is driven by own motives and interest, some of which are conflicting (Munyua and Stilwell, 2007; GOK, 2012). For example, although the primary goal of public

extension is to ensure affordable and accessible extension to farmers, studies show that farmers who participate in agricultural extension program are possibly friends and relatives of the agricultural officers.

In addition, there are a myriad of challenges associated with each of the extension service providers. For instance, it is often argued that government-managed extension services suffer from bureaucracy; such programs normally fail to respond to the changing needs of the farming communities (Anderson and Feder, 2004; Snapp et al., 2003). The private extension system is profit-driven and is skewed towards high value crops. Pure private systems have often been criticized for their narrow standardized type of extension and inability to internalize public concerns. The NGOs often find that their strengths are in mobilization and organization of farmers and rural people, while they have inadequate technical skills in agronomy, entomology or other areas (Anderson and Crowder, 2000).

Of great interest to this study is the fact that across the multiplicity of agricultural extension service providers in Kenya, the overriding problem is inadequate local stakeholder consultation in developing and designing the extension program. It has been demonstrated in Uganda for instance, that extension clients can play their role as equal partners in extension management (James, 2010). The rationale is that increasing client participation in the planning and implementation of extension activities will lead to a stronger sense of ownership, responsibility and ensure that clientsô priorities are taken fully into account (Fleischer, 2002). Most stakeholders appreciate the need to tailor extension to agro-ecological zones (high-, medium-, and low- potentials areas) and socio-economic stratification of the extension clientele (GOK, 2012). In addition, the current governance system in Kenya focuses on devolving powers and encourages local participation in planning development program. The citizens have a statutory

duty to pay taxes for service delivery (GOK, 2011), and if farmers are to pay for extension services then it appears reasonable to design programs that fully address their specific needs.

Most previous research on extension has focused on farmers characteristics influencing participation in extension program and uptake of agricultural extension messages. One common response for non-participation was the feeling that the program was unprofitable. This has been attributed to the failure to integrate farmers in the process of designing the extension program (Baley, 2003; Davidson, 2007). The devolved administration system in Kenya presents an opportunity to deepen farmer participation and ensure extension program developed address their needs. However, the issue of farmer awareness of devolution of extension services and their preferences for extension program design has received limited research attention particularly in Kenya.

Studies on farmer awareness have focused on issues such as climate change (Mandleni and Anim, 2011) and crop insurance (Oyinbo et al., 2013). With respect to agricultural services, the attention is on awareness of issues such as agrochemical safety (Laary et al., 2012). To the best of my knowledge no study has focused on agricultural extension devolution in Kenya. Thus, this study in part, sought to investigate extension devolution awareness level among the farmers in Kenya as well as factors that would influence the awareness. The results will inform policy makers on strategies to make information available to farmers, which is crucial for their participation in development program within the devolved administration structure.

Various studies in developed countries have given attention on role of farmer participation in Agri-environment scheme design (e.g., Ruto and Garrod, 2009; Maria et al., 2010). A study on farmersô preference for the Plan for Modernization of Agriculture (PMA) program design in

Uganda highlights a crucial need to improve local engagement in decision-making (James, 2010). The current study focused on the role that AEP attributes (also referred to as AEP features or components) can have on the likelihood of farmer participation in extension program. This topic remains largely unaddressed in the available literature and this is the knowledge gap that the present study contributes to fill. This information will possibly enhance the formulation of supportive policies that encourage demand-driven extension and offer insights to the national devolution process in Kenya, especially in agricultural information institutions and services.

1.3 Purpose and Objectives of the Study

The purpose of this study was to evaluate farmersô awareness of agricultural extension devolution and preferences for participatory design of the agricultural extension program in Kenya. The specific objectives were;

1) To assess farmersôawareness of agricultural extension devolution.
2) To analyze farmersô willingness to pay for various components of a participatory agricultural extension program.

1.4 Hypotheses of the Study

The following hypotheses were tested, that;

1) Farmers are not aware of agricultural extension devolution in Kenya.
2) Farmers are not willing to pay for any agricultural extension program components.

1.5 Justification of the study

This study has policy implications in that, the call for demand-driven agricultural extension has existed for several decades. The diverse nature of Kenyan agro-ecological zones and broad range of socio-economic conditions in the rural population, calls for agricultural extension approaches

that are context- and situation-specific (Davidson, 2007). Devolution of extension services provides an opportunity for farmersô views and opinions to be considered during development of extension program (GOK, 2012). This study aims at investigating farmersô awareness of agricultural extension devolution as well as their ex-ante preferences for agricultural extension program attributes. This information will offer an important insight towards increasing farmer awareness of extension devolution and development and implementation of farmer-led extension program in the counties. Demand driven extension will enhance farmer acceptability and participation in the extension program (Belay, 2003), and hence reduce resource wastage minimizing chances of program rejection. Moreover, the study will provide empirical evidence to extension service providers on the importance of considering clientsô socio-economic and agro-ecological diversity in extension program design. The study will as well add to the literature on ex-ante analysis of agricultural extension program.

Most studies dealing with the agricultural extension program in developing countries are based on ex-post analysis of the program (e.g., Baley, 2003; Davidson, 2007; Munyua and Stilwell, 2009). The study of participation behavior comes after the program has been designed and the costs incurred. Such programs have often resulted in a low level of acceptance by the target group and a lower success (Bekele, 2004). New modes of reaching out to farmers within the county governments could have significant impact in Kenyan agriculture, as they might better reflect the local needs of farmers. Progress in poverty and hunger reduction crucially depends on the increased productivity and profitability of these farmers, which require successful delivery of agricultural extension (Ngomane, 2010).

1.6 Conceptual Framework

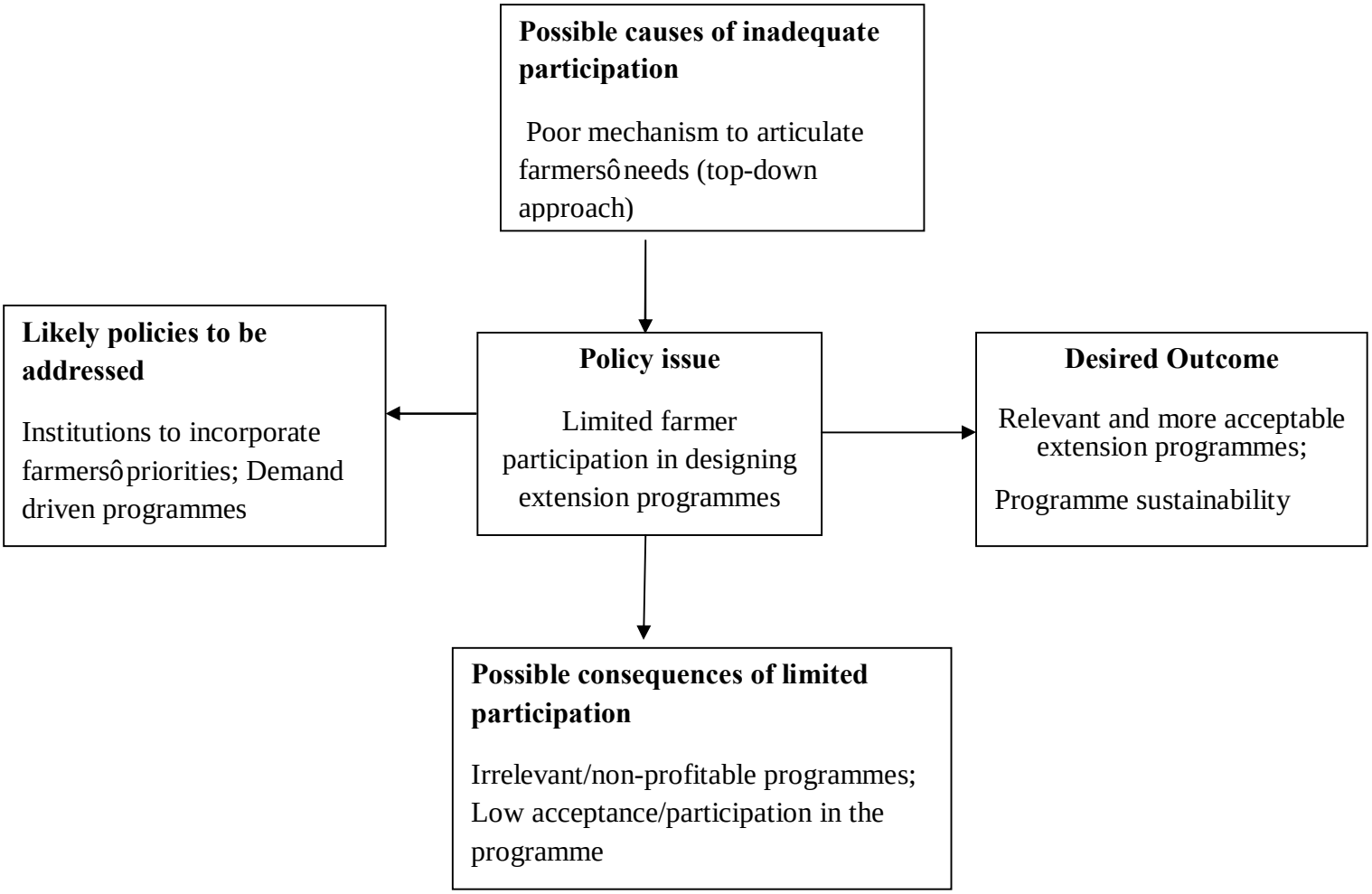
Community participation has been defined as a strategy that enables citizens, presently excluded from the political and/or economic processes, to be deliberately involved in determining how information is shared, goals and policies are set, tax resources are allocated, programs are operated, and benefits such as contracts and patronage are parcelled out. The main idea is redistribution of decision-making power to enable the excluded group play a role in shaping the future (Arnstein, 1969). In another instance, participation means peoplesô involvement in certain projects or programs that are aimed at improving their lives. Participation has been linked to efficiency in implementing social, economic and cultural interventions that affect peoples, lives (Burns et al., 1994)

Agricultural extension programs provide farmers with important information related to production planning and management, disease control, farm produce prices and availability of new seed varieties. Through demonstrations, model plots and specific training, extension services improve the knowledge base of farmers on management practices with respect to livestock rearing, crop cultivation and marketing, and adoption of new technologies among others (Milu and Jayne, 2006).

However, continued lack of involvement of farmers in the process of developing extension programs may result into programs that are not consistent with farmersô needs leading to low acceptance by farmers. On the other hand, devolved extension structure presents an opportunity for the Counties to develop programs which are suitable to their specific situation. This may involve engaging farmers in setting extension priorities as well as in funding of the programs in order to enhance sense of ownership, responsibility and sustainability of the programs (GOK,

2012). Figure 1 below illustrates the policy issue addressed by the study inform of a tree diagram.

Figure 1: Problem tree diagram



Source: *Author's Compilation*

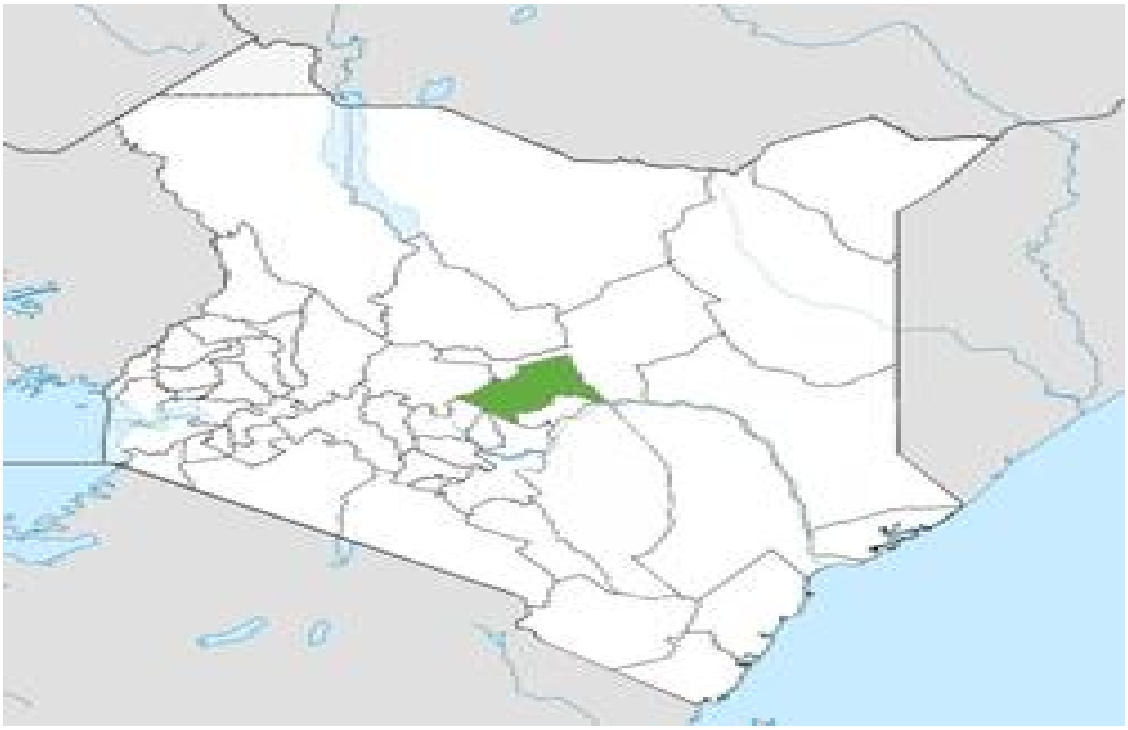
In the participation theories, people are expected to be responsible for themselves and should, therefore, be active in public service decision-making (Burns, et al., 1994).Therefore, this study sought to assess farmersô awareness of extension devolution and their willingness to pay for extension program components. Farmersô knowledge of extension devolution is important for their effective participation. The devolved extension is expected to be efficient and effective

which may require commercialization of the service hence important to understand what farmers would be willingness to pay for. Such information will be of paramount importance in formulation of policies that support demand-driven extension in the Counties.

1.7 Study Area

The study was conducted in Meru County in Kenya. Meru County was chosen because of its diverse climatic conditions. This characteristic of Meru County was envisioned to be important for the study as it would reflect different preferences and priorities for extension program. The areas near the escarpment of Mount Kenya are very fertile while semi-arid area borders Tharaka-Nithi County and the arid areas form the borderlands to Northern Kenya. This pattern enables the farmers to grow a wide range of crops and keep livestock for subsistence and commercial purposes. Cash crops such as tea, coffee, and food crops like maize, Irish potatoes, beans, bananas and a variety of fruits and vegetables are grown. The lowlands receive lesser rainfall and rely mostly on crops like millet, sorghum, groundnuts, green grams and cassava. The various agricultural extension service providers in Meru County include the government agents, private service providers, non-governmental organization as well as the community-based organizations (Monda, 2003).

Figure2: The Map of Meru County



Note: *Location of Meru County (Green)*

Source:*www.kenyaplex.com/maps/42-meru-county.aspx*

1.8 Thesis Organization

This thesis is organized into two papers; the first paper (chapter 2) addresses the first objective of the study which is assessing farmersô awareness of agricultural extension devolution in Kenya. The paper uses descriptive statistics to investigate the level of awareness and employs binary logit regression to assess farmer and farm factors that influence the level of awareness. The second paper (chapter 3) addresses the second objective of analyzing farmersô willingness to pay for extension program features/attributes. The paper applies the RPL model to determine the amount of money that farmers are willing to pay for different agricultural extension attributes as well as factors which explain heterogeneity in willingness to pay values. Chapter 4 summarizes

the results and draws conclusions and policy recommendations. Appendices are given thereafter. References are given at the end of each chapter for ease of reading.

References

Anderson, J. and Van crowder, L. (2000), ôThe present and future of public sector extension in Africa: contracting out or contracting in?ö *Public Administration and Development,* 20:373-384.

Anderson, J.R., and Feder, G. (2004), óAgricultural extension: Good intentions and hard realitiesö, *The World Bank Research Observer,* 19:41ï 60.

Arstein, S.R. (1969), óA ladder of citizen participationö, *The journal of American Institute of Physics, 216-224.*

Bekele, W. (2004), óAnalysis of farmersô preferences for development intervention programs: A case of subsistence farmers from Eastern Ethiopian highlandsö, *African Development and Poverty Reduction: the Macro-micro Linkage Forum Paper, 13-15 October,* Lord Charles hotel, Somerset West, south Africa.

Belay, K. (2003), óAgricultural extension in Ethiopia: The case of participatory demonstration and training extension systemö, *Journal of Social Development in Africa,* 18(1):49-84.

Burns, D et al (1994), The politics of decentralisation, London: Macmillan.

Davidson, A.P. (2007), ôParticipation, education, and pluralism: towards a new extension ethicö, *Development in Practice,* 17(1):39-50.

Davis, K., Franzel, S., Hildebrand, P., Iran, T., and Place, N. (2004), ôExtending Technologies among Small-Scale Farmers in Meru: Ingredients for Success in Farmer Groupsö, *Journal of Agricultural Education and Extension,* 10(2):53-62.

Davis, K.E. (2008), ôExtension in Sub-Saharan Africa: Overview and assessment of past and current models, and future prospectsö, *Journal of International Agricultural and Extension Education,* 15(3):15-28.

Feder G., Willett, A., and Zijp, W. (1999), óAgricultural Extension ï Generic Challenges and Some Ingredients for Solutionsö, *World Bank Policy Research Working Paper no. 2129,* Washington D.C.

Fleischer, G., Waibel, H., and Walter-Echols, G. (2002), õTransforming top ï down agricultural extension to a participatory system: A study of cost and prospective benefits in Egyptö, *Public Administration and Development,* 22:309-322.

Gautam, M., and Anderson, J. R. (1999), õReconsidering the evidence on returns to Training and Visit extension in Kenyaö, *policy Research Working Paper (WPS2098).*

GOK (Government of Kenya) (2005), õPublic service allowancesö, *Government press.*

GOK (Government of Kenya) (2010), õKenya law reportsö, National council for Law Reporting, *www.kenyalaw.org.*

GOK (Government of Kenya) (2011), õInterim report of the task force on devolved government: A report on the implementation of devolved government in Kenyaö, *Task force on devolved government (TFDG) consultation document.*

GOK (Government of Kenya) (2012), ôNational agricultural sector extension policy (NASEP): Ministry of Agriculture; Ministry of Livestock and Fisheries Development and Ministry of Cooperative Development and Marketing, *Government printers.*

Hu, R., Yang, Z., Kelly, P. and Huang, J. (2009), ôAgricultural extension system reform and agent time allocation in Chinaö, *China Economic Review,* 20:303ï 315.

James, P. (2010), ôUsing farmersô preferences to assess development policy: A case study of Ugandaö. *Development Policy Review,* 28(3):359-378.

Klerkx, L. and Leeuwis, C. (2008), óinstitutionalizing end-user demand steering in agricultural research and development: farmer levy funding of research and development in the Netherlandsö, *Research Policy*, 37(3):460ï 472.

Laary, J. K. (2012), ôDry-season farming and agrochemical misuse in Upper Region of Ghana: Implication and way forwardö, *Journal of Agricultural, Food and Environmental Sciences,* 5(1):1-10.

Mandleni, B., and Anim, F.D.K. (2011), óClimate change awareness and decision on adaptation measures by livestock farmersö, *85th Annual Conference of the Agricultural Economics Society*, Warwick University.

Maria, E.G., Jesus, B.H., and Ruto, E. (2010), ôWhat do farmers want from an Agri-Environment Scheme design? A choice experiment approachö, *Journal of Agricultural Economics,* doi: 10.1111/j.1477-9552.

Monda, E.O. (2003), ôFrench beans production constraints in Kenyaö, *African Crop Science Conference Proceedings,* 6: 683-687.

Munyua, H. and Stilwell, C. (2009), óA mixed qualitative-quantitative-participatory methodology: A study of the agricultural knowledge and information system (AKIS) of small-scale farmers in Kirinyaga district, Kenyaô, *Library management,* 31(1):5-18.

Ngomane, T. (2010), ôFrom a deficit-based to an appreciative inquiry approach in extension programs: Constructing a case for a positive shift in the current extension intervention paradigmô, *Journal of International Agricultural and Extension Education,* 17(3):57-68.

Oyinbo, O., Abdulmalik, R.O., and Sami, R.A. (2013), ôDeterminants of crop farmersô participation in agricultural insurance in the federal capital territory, Abuja, Nigeriaô, *Greener Journal of Agricultural Sciences,* 2(3):21-26.

Rivera, W. (2004), ôDemand-Driven Approaches to Agriculture Extension, Case Studies of International Initiativesô, *Agriculture and Rural Development Discussion Paper 10.*

Ruto, E. and Garrod, G. (2009), ôInvestigating farmersô preference for the design of agri-environment scheme: A choice experiment approachô, *Journal of Environmental Planning and Management,* 52(5):631ï 647.

Snapp, S. S., Blackie, M. J., and Donovon, C. (2003), ôRealigning research and extension to focus on farmersô constraints and opportunitiesô, *Food Policy,* 28:349ï 363.

Stoker, G (1997), ôLocal Political Participationô in Hambleton, R et al (1997) New Perspectives on local governance: reviewing the research evidence, York: Joseph Rowntree Foundation, pp. 157-196

Swanson, B. E. (2006), ôExtension strategies for poverty alleviation: Lessons from China and Indiaô, *Journal of Agricultural Education and Extension,* 12(4):285ï 299.

Umali, D.L., and L. Schwartz. (1994), "Public and private agricultural extension: Beyond traditional frontier", *World Bank discussion paper no. 236,* Germany.

Chapter Two

2. Farmers' Awareness of Agricultural Extension Devolution in Kenya

2.1 Introduction and Research problem

Awareness-raising means providing the public with detailed background information on policy issues regarding development. The aim is to empower the public to be aware of and to understand global and national development concerns and the local and personal relevance of those concerns, and to enact their rights and responsibilities by affecting change for a just and sustainable world (Omolo, 2010). Thus, the right to information or the right-to-know enables citizens to make informed decisions on issues relating to their development.

Access to information has been widely recognized as a basic human right and an essential attribute of democracy. Meaningful public participation in decisions on matters of public interest requires that relevant information be provided in a timely manner, that the procedures to obtain information be simple, that the cost to citizens be reasonable, and that it be available across boundaries (Burton et al., 2006). Public participation has been defined as the process whereby stakeholders influence policy formulation, alternative designs, investment choices and management decisions affecting their communities (Okello et al., 2008). It is a basis of responsible democratic governance as well as a fundamental prerequisite to achieve sustainable development. Public participation moves beyond traditional methods of public consultations by creating opportunities for the open exchange of ideas, transparency, mutual learning, and informed and representative decision-making processes (Buckle et al., 2003).

Public participation can contribute to an accounting of the social, economic and environmental impacts of a policy or program and how the costs and benefits will affect different segments of

society. Therefore, public participation helps to ensure that governments and other authorities are accountable for their actions and responsive to public interests (Odhiambo and Taifa, 2009). By linking the public with decision-makers, citizen confidence in and support of development program are strengthened. Engaging the public in development decisions can minimize both the number and the magnitude of social conflicts arising over the course of the implementation of program or policies (OôLoughlin and Weqimont, 2007).

Public demand for access to information is increasing. This is associated with the growing public use of freedom of information legislation and the revolution in information technology (OôLoughlin and Wegimont, 2007). Kenya has taken important steps towards recognition of the right to information in the new Constitution where article 35 (1) and article 35 (3) states that every citizen has right to access information held by the state and that the state shall publish and publicize any important information affecting the nation (Omolo, 2011). The use of communication technology such as mobile phones, emails, satellite communications and geographic information systems has generated an extraordinary level of interconnectedness. This has helped to raise citizensô awareness of development issues such as climate change through presentations and dissemination of information. Media outreach, which is the main source of news and public information is a wide-reaching way to inform citizens on development matters. Public awareness and educational program have also been widely used to inform citizens. These are said to be more comprehensive and enable deepening public awareness due to in-depth consultation (African Development Bank, 2007).

Devolution in Kenya, which constitutes delegating power over agricultural extension services from central government to county governments, came with the passing of the revised Constitution of Kenya in 2010 whose implementation is at the very initial stage. Devolution

refers to the distribution of powers (political, administrative and fiscal) to semi-autonomous territorial and sub-national units (Kibua and Mwabu, 2008). Among the objects and fundamentals of devolution in Kenya is enhancing participation of people in making decisions affecting them and the recognition of communitiesô rights to manage their own affairs and further their development (GOK, 2011). This dimension of public participation is administrative centric and relates to the involvement of the public in decision making related to service delivery (Yang and Callahan, 2005), such as agricultural extension service. However, little is known on local communitiesô awareness and understanding of extension devolution. The awareness is pertinent in the realization of the benefits of devolution related to community participation and the establishment of appropriate agricultural extension institutions. Achieving the goals of devolution requires vitalization of local communityôs role not only in raising resources but also in demanding participation in planning as well as accountability from their leaders (Kukamba, 2010).

Literature shows that, lack of farmer awareness on issues that affect agricultural production on their farms has led to the increased establishment of awareness program especially in developing countries. A study done in India showed that, as much as 60 percent of farmers know little or nothing about climate change phenomenon and its impacts (Chakravarty, 2012). According to Laary et al. (2012), some farmers in Ghana are unaware of hazardous and inappropriate agrochemical products banned by government authorities and continue to use and handle them without protective measures. In Kenya, studies show low knowledge of the regulations and specifics of the public program. A study conducted by the Institute of Economic Affairs on Constituency development Funds (CDF) program, which targeted constituency level development projects reported that communities were unaware of the costs of projects and

disbursed amounts (IEA, 2006). Similarly, another study showed that the majority of the respondents were not aware of the Local Authority Service Delivery Action Plan (LASDAP) that required local authorities to constructively engage local communities on matters of planning and development (LRFT, 2009).

Other studies dealing with awareness focus on climate change. Education was found to negatively affect awareness on climate change (Bayard et al., 2007; Mandleni and Anim , 2011). The reason given was that educated farmers had alternative income earning opportunities thus do not concern themselves with agricultural issues. However, this was contrary to Deressa et al. (2009 & 2010) who reported education to increase probability of climate change awareness. Access to formal extension have also been found to positively and significantly affect awareness (Hassan and Nhemachena, 2008; Apata et al., 2009). It was noted that extension agents share climate change information with farmers. Literature shows that married farmers and farmers who acquired land through inheritance to have more knowledge on climate change. This result was attributed to the possibility that the farmers had lived in the area for a reasonable amount of time hence able to observe changes in the climate (Kabubo-Mariana, 2005).

This study sought to investigate the awareness of agricultural extension devolution among farmers and examine factors that influence the level of the awareness. Understanding of agricultural extension devolution amongst farmers would empower them and foster effective involution in designing policies or program suitable to their specific local situations. It is expected that the findings from the study would influence policy formulation and guide strategies for enhancing community awareness in order to achieve meaningful local public participation in development issues.

2.2 Methodology

2.2.1 Data Collection

This study was conducted in the Meru County of Kenya, which was purposefully selected due to its wide range of climatic conditions that favor a variety of agricultural enterprises (Monda et al., 2003). Meru County is located in the Eastern part of Kenya and constitutes seven constituencies; namely, Igembe, Ntonyiri, Tigania West, Tigania East, North Imenti, Central Imenti and South Imenti. Due to budget constraints, the study was done in North Imenti constituency which was purposefully selected since it is where the Countyøs agricultural offices are located and also one of the most populated constituencies in the County ï according to the national census of the year 2009, the constituency is estimated to have a population of about 149, 144 (GOK, 2009).

The study employed multi-stage cluster sampling approach to select respondents for the survey. This is a probability sampling procedure which permits subsequent sampling of elements of the population in their naturally occurring groupings (clusters) hence ensures representation. This approach was preferred to other methods such as simple random sampling because as sampling procedure moves from secondary to the primary sampling unit, the sampling unit becomes more homogenous and the sampling error is minimized. The method is also more appropriate where a comprehensive sampling frame does not exist like in this case (Allen et al., 2002).

Within North Imenti Constituency, two divisions were randomly selected. From each division, two locations were selected and then five villages were randomly selected from the list of villages in each location. The primary sampling unit for the survey was a household where the respondent within the household was an adult and 288 respondents were randomly selected for the interview. According to the central limit theorem, sampling distribution of the sample mean will approach normality as the sample size increase. It is often suggested that a sample size of

thirty will produce an approximately normal sampling distribution (Hays, 1994) hence, 288 farmers were deemed statistically a big sample given the budget and time constraints.

The data were collected using semi-structured questionnaires through a face-to-face interview. Face to face interview has its strength in that immediate follow-up and clarification are possible unlike in the mail or telephone surveys where problem of non-response is prominent (Mertens, 2005). The questionnaire captured data on farmer characteristics (age, education and gender, income), land assets (size and title deeds), farm enterprises for 2012/13 cropping season, farmer knowledge of extension devolution, use of agricultural extension and access to institutional services (credit, markets and community group membership).

2.2.2 Theoretical Framework

Regression analysis is a statistical tool for estimating the quantitative effect of the causal variables upon the variable that they influence. The most commonly used regression models include: linear probability models; logit models and probit models. Linear probability models assume the response variable to be continuous in nature and thus not appropriate in cases where the response variables are categorical and in particular binary, that is, it can assume only two values (a yes or a no; 1 or 0). In addition, these models incorporate assumptions such as the normal distribution of the error term, constant variance and that expected value of the response variable lies between 1 and 0 which do not hold for a dichotomous dependent variable (Hosmer and Lemeshow, 2000; Tabachnick et al., 2001).

There is little distinction between logit and probit models as they yield essentially identical results, which differ approximately by a factor of proportionality of about 1.8. However, the probit model assumes normal distribution of the error term while the logit assumes logistic

distribution. The two models of logistic distribution include: binary logistic regression and multinomial logistic regression. Binary logistic distribution is used when the dependent variable is dichotomous and the independent variables are either continuous or categorical variables. Multinomial logistic regression is an extension of binary logit and is used when the dependent variable is comprised of more than two cases-polytomous (Hosmer and Lemeshow, 2000).

Given that the dependent variable in this study is discrete and dichotomous- aware of extension devolution or not, binary logit model was considered to be most appropriate. Binary logit regression examines the relationship between one or more independent variables and the log odds of the dichotomous outcome by calculating changes in the log odds of the variable (Menard, 2002; Harrell, 2001). The use of the log odds ratio provides a most simplistic description of the probabilistic relationship of the variables and hence more rich information can be drawn.

2.2.3 Empirical Model Estimation

Let y_i be the binary response, assuming only two values that are coded as one or zero.

$$y_i = \begin{cases} 1 & \text{[illegible]} \\ 0 & \text{[illegible]} \end{cases} \quad \text{é .. (1)}$$

Assume the probability of y_i taking the value of one and zero is π_i and 1- π_i respectively. These probabilities depend on a vector of explanatory variables x_i hence; the probabilities can be expressed as a linear function of the explanatory variables as shown below:

$$\pi_i = x_i'\beta \quad \text{é .. (2)}$$

Equation 2 is a linear probability model often estimated using ordinary least squares (OLS). This model is transformed to overcome the assumption that, the response variable is continuous in nature. The transformation involves moving from probability to odds which is defined as the ratio of the probability to its complement then taking the logarithms of the odds to get the logit or log-odds (see Equation 3). This allows the logits to take any value in the entire real line.

$$\text{logit}(\pi_i) = \frac{\pi_i}{1-\pi_i} \quad \text{..... (3)}$$

The logit is then modeled as a linear function of the explanatory variable.

$$\text{logit}(\pi_i) = \beta_0 \quad \text{..... (4)}$$

Taking the exponents of Equation 3 and solving for probability π_i results to Equation 5. The resulting coefficients give multiplicative effects which are helpful in that they allow deal with a more familiar scale while retaining a relatively simple model.

$$\pi_i = \frac{\exp(\beta_0)}{1+\exp(\beta_0)} \quad \text{..... (5)}$$

Empirically, the binary logit model for investigating factors that influence probability of farmersô awareness of extension devolution was modeled as follows:

$$\text{Awareness} = 1 = \frac{\exp(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3)}{1+\exp(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3)} \quad \text{..... (6)}$$

where *Aware* is state of awareness of i^{th} farmer (1=aware, 0=not aware); x denotes a vector of farmer and farm characteristic that are hypothesized to influence farmersô awareness of extension devolution; β represents the vector of parameters to be estimated.

Marginal effects were estimated to measure the effects of changes in any explanatory variable on the predicted probability of awareness of agricultural extension devolution, holding the rest of explanatory variables constant. The marginal effects for continuous variable and dummy-coded variables were computed as shown in equation 7 and 8 respectively.

[illegible] é . (7)

[illegible] 1[illegible] [illegible] 0é é é é é é é é é é é é é é é .. (8)

The study used NLOGIT software to estimate both the binary logit model and the marginal effects.

To test the hypothesis that farmers are not aware of agricultural extension devolution, mean level of awareness was estimated in SPSS and a t-test performed. The hypothesis would be rejected if mean awareness is statistically not equal to zero.

2.3 Results and Discussion

2.3.1 Farmer Characteristics

The socio-economic, demographic and institutional characteristics of the respondents are presented in Table 1. The respondents comprised about 58 percent female and the rest male

persons, with a mean age of 41 years. The youngest respondent was 27 years old while the oldest was 66 years old, which shows that the sample of farmers are within the active and productive group in the community thus can participate in development matters. The result indicates that the farm size of the respondents ranges between 0.25 and 20 acres with a mean of about 1.9 acres which may suggest small holder farming system. This is consistent with the estimates of the African Development Bank Group that smallholder farming accounts for over 75 percent of agricultural production in Kenya (Salami et al., 2010).

The mean monthly income of the respondents is approximately Ksh 12,677 with about 55 per cent of the respondents having attained secondary level education and above. Perhaps the low level of income among the farmers is due to low level of commercial farming-according to Omiti and others (2007), only 50 percent of rural smallholder farmers participate in commercial farming. In terms of tenure rights, around 56 percent have land title deeds to prove ownership of their farm land. About 68 percent of the respondents had access to extension services in regard to crop farming while 32 percent had access to livestock advisory services. The literature has shown distance to the extension services from households to negatively influence farmersô access to extension services. The lower level of access to livestock extension may indicate that the service is not easily available, may be due to few extension service providers in the region. Moreover, the distance from farmer in the coastal lowlands was found to be as far as 11 km on average from crop and livestock extension (Muyanga and Jayne, 2006).

Table1. Some characteristics of farmers in Meru County

Characteristics	Sample Households (n=288)
Household(HH) size (average number of adults)	3
Gender (% of female respondents)	58.3
Access to extension services in the past year (% of HHs)	72.9
Use of crop extension services in the past year (% of HHs)	68.4
Use of livestock extension services in the past year (% of HHs)	32.3
Attend farmer field days in the past year (% of HHs)	54.9
Farmer field days are held at experimental station (% of HHs)	61.4
Average farm size (in acres)	1.9
Percentage of farmers with title deed for their farm	55.9
Commercial farming of tea and bananas (% of HHs)	31.2
Percentage of farmers who sold crop produce	69.4
Livestock keeping (% of HHs)	84.7
Percentage of farmers in dairy farming	66.0
Percentage of farmers who sold milk in the past year	58.3
Average monthly income of the respondent (Kshs)	12677
Average age of the respondent (in years)	41.2
Secondary education and above (% of respondents)	55.2
Main occupation is farming (% of respondents)	86.1

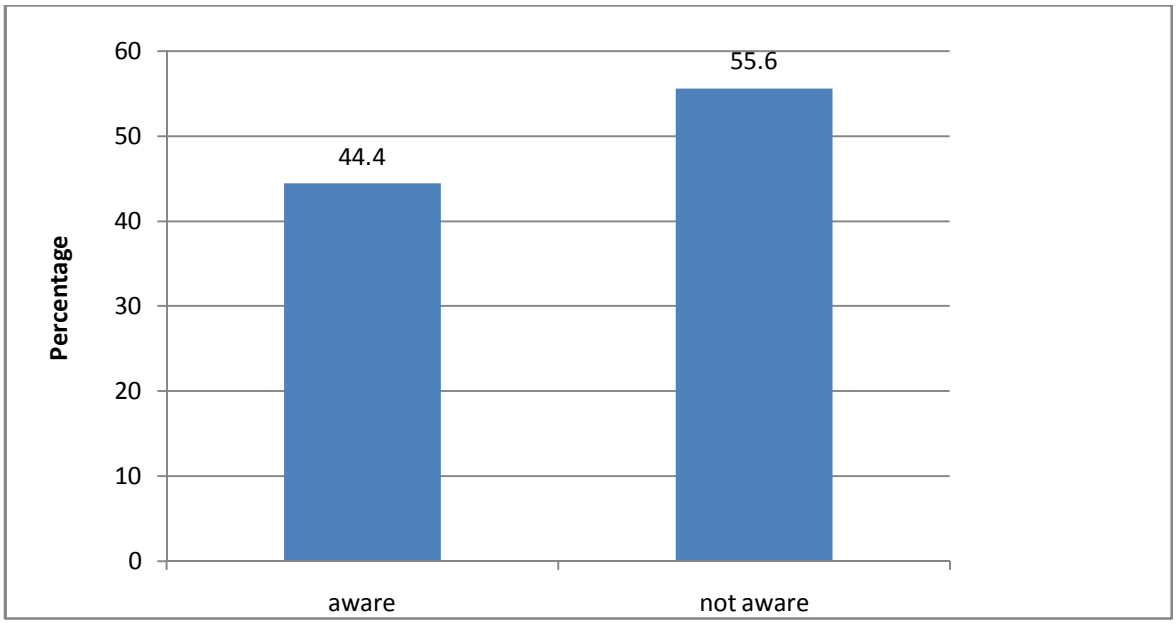
Source: Own compilation from survey data (2013)
Exchange rate at time of survey (USD 1= Kshs 85)

2.3.2 Awareness of Agricultural Extension Devolution

Due to existence of various sources of information (Radio, Television, extension staff, political rallies), about 44 percent of the respondents were aware that in the current devolved government system issues of agricultural extension will be handled at the county level. This shows that although most people in Kenya voted for the devolved government system (IEA, 2010), majority of them might not understand or know what it entails. In order for the devolved system to

achieve its objective, participation of the locals and accountability of the leaders is needed. This result shows the need to sensitize and educate farmers on their role in achieving development in the agriculture sector within a devolved administration system. A t-test for the mean awareness with a critical value of 15.15 at 95 percent level of confidence supported rejection of the null hypothesis and it was statistically concluded that, farmers are significantly aware of agricultural extension devolution.

Figure3. The level of awareness of extension devolution (%)



Source: Survey data (2013).

The variables hypothesized to influence awareness of agricultural extension devolution and their expected signs are presented in Table 2. Much of the research on awareness demonstrates that Variables capturing access to extension service, farm size, tenure rights, income and education are expected to positively influence awareness. Simtowe et al. (2012) reported that farmers with larger land holdings have a higher chance of being exposed to improved varieties than those with smaller land holdings. On the other hand, it is possible that smaller land holdings mostly found in

high potential areas are more productive, hence farmers may be more aware of agriculture related issues. Tenure security may have a positive effect on awareness. This is supported by the findings of Asrat et al. (2004) who reported that tenure insecurity had a negative effect on awareness and willingness to pay for soil conservation measures. It has also been found that people with higher income and education are more likely to be aware and express a positive attitude towards organic product (Gracia and Magistris, 2007; Aryal et al., 2009). Proxy variable for access to the agricultural extension increases probability of farmers being aware of new issues in agriculture since the dissemination of information and technologies is mostly done during the farmer field days (Simtowe et al., 2012).

Literature on awareness shows that gender might have either a positive or negative effect. The negative effect was found in a study on awareness of improved pigeon pea varieties (Simtowe, 2012), which indicated that women had a higher propensity to being exposed to improved agricultural technology. Although older farmers may be more experienced, which could have a positive effect on access to information, younger farmers may have a longer planning horizon hence vibrant in searching for information (Faye and Deininger, 2005).

Table 2: Description of variables used in the binary regression model

Variable	Description of the variable	Expected signs
Attenff	Attend farmer field days (1=yes, 0=no)	+
Farmsize	Farm size in acres	+/-
Docofown	Tenure right (1=yes, 0= otherwise)	+
Income	Farmer monthly income (Ksh)	+
Education	Respondent level of education (1=secondary level and above, 0= primary and below	+
Gender	Gender of the respondent (1=male, 0=female)	+/-
Age	Age of the respondent in years	+/-

Source: Survey data (2013)

To ascertain the absence of multicollinearity between the explanatory variables used in the binary logit regression (see the variables in table 2), variance inflation factor (VIF) was computed for each of the variables which involved estimation of the ordinary least squares (OLS) regressions. Each variable (as a dependent variable) was regressed against the rest of the variables as independent. The VIF was calculated as:

$$VIF_i = \frac{1}{1 - R_i^2} \quad \text{é é} \quad \text{.....(9)}$$

Where VIF_i is the variance inflation factor for the i^{th} explanatory variable and R_i^2 denotes the R^2 of the regression with i^{th} independent variable as a dependent variable. The VIF results are shown in table 3 and according to Maddala (2000), variables that have VIF<5 are considered to have no multicollinearity.

Table 3: Variance inflation factor (VIF) for the variable

Variable	VIF
Farmsize	1.30
Docofown	1.21
Education	1.16
Income	1.15
Attentff	1.12
Age	1.12
Gender	1.09
Mean VIF	1.15

Source: Survey data (2013)

2.3.3 Determinants of Farmers' Awareness of Agricultural Extension Devolution

The parameters of binary logit regression were estimated using NLOGIT software and the results are shown in Table 4. The Chi square statistic of 219.38 ($p< 0.1$) showed that the model gave a good fit for the analysis. The coefficients indicate the effect of each variable on the likelihood of a farmer being aware of agriculture extension devolution. On the other hand, the marginal effects show how a change of each variable influences the farmersô awareness.

Table 4: Binary Logit estimates for factors influencing awareness

Variable	Coefficient(ϐ)	ϐ p-value	Marginal effect ($ϐ_m$)	$ϐ_m$ p-value
Constant	-1.34***	0.00	-0.33***	0.00
	(0.16)		(0.04)	
Attenff	0.46***	0.00	0.11***	0.00
	(0.07)		(0.02)	
Farmsize	-0.01	0.84	-0.001	0.84
	(0.03)		(0.01)	
Docofown	0.33***	0.00	0.08***	0.00
	(0.08)		(0.02)	
Income	0.0003***	0.00	0.00008***	0.00
	(0.00005)		(0.00001)	
Educatio	0.22***	0.00	0.05***	0.00
	(0.08)		(0.12)	
Gender	-0.02	0.77	-0.01	0.77
	(0.07)		(0.12)	
Age	-0.002	0.61	-0.0005	0.61
	(0.004)		(0.0009)	

Source: Survey data (2013)

Note: *** indicate that the variable is statistically significant at 1%. Corresponding standard errors are shown in parentheses.

The result shows that, attendance to farmer field days (Attenff) is significant in influencing farmersô awareness of the extension devolution. A high percentage (73 percent) of farmers had access to extension services mostly from sources such as public agent, company agents and media. Farmers have also participated in Government spearheaded extension program such as Smallholder Horticulture Marketing Program (SHOMaP) and Mt. Kenya East Pilot Project (MKEPP) for natural resource management (MoA, 2007; Livingstone, 2008). Hence, this result can be explained by exposure to extension agents who might have played a role in informing farmers about agricultural extension devolution. Previous research on awareness (e.g., Hassan

and Nhemachena, 2008; Apata et al., 2009) indicated that access to extension services had a strong positive influence on awareness on climate change. Extension service appears to be a good tool to be used to increase awareness about agriculture related issues.

Ownership of the farm with title deed (Docofown) increases the probability of farmers being aware of extension devolution. As the literature shows that farm title deeds motivates farmers to do more permanent farm enterprises, Majority of the farmers in the survey were engaged in commercial farming of tea and bananas. These are more permanent investments which might have made the farmers want to follow up the updates and new issues concerning agriculture and farming enterprises. This result agrees with the findings by Hassan and Nhemachena, (2008) and Mandleni and Anim (2011) who reported that farmers with tenure security were more aware of climate change and invested in climate change adaptation methods.

Another variable found to have a significant positive effect on farmersô awareness of agricultural extension devolution is income. A majority of the respondents (86 percent) are farmers by occupation who grow crops and keep livestock for domestic as well as marketing purposes (average quantity of milk sold per month is 126.7 litres). It is therefore possible that a good percentage of respondentôs income come from farm related enterprises hence expect them to be more aware of issues concerning their source of livelihood (agriculture). Also, studies show people with higher income (from higher social class) to be more aware of new developments in different economic sectors (e.g., Munyua and Stilwell, 2009).

Another factor expected to increase the probability of farmers being aware of the extension devolution is education. The result may be explained by the fact that the majority of the respondents (55.2 percent) had attained at least secondary school education level. A higher level

of education is expected to increase farmerôs ability to get, process and use information (Ulimwengu and Sanyal, 2011). Most of the devolution information is printed in newspapers and aired on radios and televisions in English or Kiswahili language and a secondary level education could enable one read and may be understand. Finally, gender, age and farm size are not significant implying that male or female farmers of any age are likely to be aware of agricultural extension devolution conditional on availability of the information. Other studies also reported that gender had no effect on the awareness of climate change (Mandleni and Anim, 2011).

The Marginal effect estimates shows that attendance to field days has the highest influence (11 percent) on farmersô awareness of extension devolution. In Kenya extension information has been passed to farmers mostly through on-station field demonstrations and through information and communication technologies such as radio, mobile phones and televisions (GOK, 2012). This result shows that extension arenas are important source of information for farmers hence incorporating information on devolution in the extension forums would enhance agricultural extension devolution awareness. The Constitution allows County governments to create awareness and promote understanding of the devolved governance in regard to development issues such as agriculture (GOK, 2012). Therefore, it is important to develop relevant policies that support such institutions which avail information on agricultural development issues to farmers.

2.4 Conclusions

The study concluded that the level of awareness of agricultural extension is low among the farmers. In order for devolved agricultural extension system to achieve its targeted goal of providing appropriate services to clients, concerned stakeholders including farmers need to know

and understand their role in achieving the goal. Therefore, the study suggests more efforts to focus on improving awareness and understanding of the devolved agricultural extension system.

References

African Development Bank (2007), ôMain streaming sectoral statistical system in Africaö, http://www.Paris21org/documents/2959.pdf.

Allen, M., Kilpatrick, D., Armstrong, M., Briggs, R., Course, G. and Perez, N. (2002), ôMultistage cluster sampling design and optimal sample sizes for estimation of fish discards from commercial trawlersö, *Fisheries Research,* 55(1):11-24.

Apata, T.G., Samuel, K.D and Adeola, A.O. (2009), óAnalysis of climate change perception and adaptation among arable food crop farmers in South West Nigeriaö, *Paper prepared for presentation at International Association of Agricultural Economists conference,* Beijing, China.

Aryal, K. P., Chaudhary, P., Pandit, S. and Sharma, G. (2009), óConsumers' Willingness to Pay for Organic Products: A Case from Kathmandu Valleyö, *The Journal of Agriculture andEnvironment*, 10:12-22.

Asrat, P., Belay, K., and Hamito, D. (2004), ôDeterminants of farmersô willingness to pay for Soil Conservation Practices in the Southeastern Highlands of Ethiopiaö, *Land Degradation and Development,* 15:423ï 438.

Bayard, B., Jolly C.M., and Shannon, D.A. (2007), ôThe economics of adoption and management of alley cropping in Haitiö, *Journal of Environmental Management*, 85:62-70.

Buckle, P., Marsh, G., and Smale, S. (2003), ôThe development of community capacity as applying to disaster management capabilityô, *Emergency Management Australian Research Project 14/2002 Report.*

Burton, P., Goodlad, R., and Croft, J. (2006), ôHow would we know what works?: Context and complexity in the evaluation of community involvementô, *Evaluation* , 12(3):294-301.

Chakravarty, R., Upadhyay, R.C., Singh, S., Ranga, J., and Ashutosh (2012), ôFarmersô awareness program on climate changeô, *National Initiative on Climate Resilient Agriculture (NICRA) project,* National Research Institute (Deemed University) ICAR, Karnal-132001, India.

Deressa, T.T., Hassan, R.N., Ringler, C., Alemu, T. and Yesuf, M. (2009), ôDeterminants of farmersô choice of adaptation methods to climate change in the Nile Basin of Ethiopiaô, *Global Environmental Change,* 19:248-255.

Deressa, T.T., Hassan, R.N. and Ringler, C. (2010), ôPerception and adaptation to climate change to climate change in the Nile Basin of Ethiopiaô, *Journal of Agricultural Science, Cambridge University Press pages 1-9.*

Faye, I., and Deininger, K. (2005), ôDo New Delivery Systems Improve Extension Access? Evidence from Rural Ugandaô, *Paper presented at the American Agricultural Economics Association Annual Meeting,* July 24ï 27, Providence, RI, US.

GOK (Government of Kenya) (2011), ôDraft session paper on devolved government in Kenya: Developmental devolved government for effective and sustainable countiesô, *Government printers.*

GOK (Government of Kenya) (2012), ôNational agricultural sector extension policy (NASEP): Ministry of Agriculture; Ministry of Livestock and Fisheries Development and Ministry of Cooperative Development and Marketing, *Government printers.*

Gracia, A., and Magistris, T. (2007), ôOrganic food product purchase behavior: a pilot study for urban consumers in the South of Italyõ, *Spanish Journal of Agricultural Research,* 5(4):439-451.

Harrell, F.E. (2001), *Regression modeling strategies: with applications to linear models, logistic regression, and survival analysis*, Springer Verlag, New York.

Hassan, R and Nhemachena, C. (2008), ôDeterminants of African farmersõ strategies for adaptation to climate change: Multinomial choice analysisõ, *African Journal of Agricultural and Resource Economics,* 2(1):83-104.

Hosmer, D.W., and Lemeshow, S. (2002), *Applied logistic regression*, second edition, Wiley-Interscience.

IEA (Institute of Economic Affairs) and Kenya National Commission on Human Rights (2006), ôKenyanõs Verdict: A Citizens Report Card on the Constituencies Development Fund (CDF)õ, IEA *Research Paper No. 7.*

IEA (Institute of Economic Affairs) (2010), ôDevolution in Kenya: prospects, challenges and the futureõ, *IEA research paper, series No. 24.*

Kibua, T.N. and Mwabu, G. (2008), ôDecentralization and Devolution in Kenya: New Approachesõ, *University of Nairobi Press*, Nairobi.

OõLoughlin, E. and Wegimont, L. (2007), ó Global education, public awareness-rising and campaigning on development issuesô, *Paper prepared for informal experts' workshop*, March 19-20, Bonn, Germany.

Omiti, J., McCullough, E., Otieno, D., Madelon, M., Nyanamba, T., and Murage, A. (2007), óParticipatory prioritization of issues in smallholder agriculture commercialization in Kenyaô, KIPPRA *discussion paper no.64.*

Kukamba, U. (2010), óLocal government citizen participation and rural development: reflection on Ugandaôs decentralization systemô, *International Review of Administrative Sciences*, 76(1): 171-186.

Laary, J. K. (2012), óDry-season farming and agrochemical misuse in Upper Region of Ghana: Implication and way forwardô, *Journal of Agricultural, Food and Environmental Sciences,* 5(1):1-10.

LRTF (Legal Resources Trust Foundation) (2008), óProposed ñWho pocketed My Money? LASDAP, Whose Priority?ò A report on LATF/LASDAP in Kenya: the Place of Citizens Participation in a Local Service Delivery Enterprise. Nairobi: LRTF.

Maddala, G. S. (2000), *Introduction to Econometrics*, third edition, Prentice-Hall Inc., Upper Saddle River, New Jersey.

Mandleni, B., and Anim, F.D.K. (2011), óClimate change awareness and decision on adaptation measures by livestock farmersô, *85th Annual Conference of the Agricultural Economics Society*, Warwick University.

Menard, S.W. (2002), A*pplied logistic regression analysis*, second edition, Sage.

Mertens, D. M. (2005), *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods*, second edition, Thousand Oaks, CA: Sage.

MOA (Ministry of Agriculture, Kenya) (2007), Smallholder horticulture marketing program, *Government printers.*

Monda, E.O. (2003), ôFrench beans production constraints in Kenyaõ, *African Crop Science Conference Proceedings,* 6:683-687.

Munyua, H. and Stilwell, C. (2009), óA mixed qualitative-quantitative-participatory methodology: A study of the agricultural knowledge and information system (AKIS) of small-scale farmers in Kirinyaga District, Kenyaõ, *Library management,* 31(1):5-18.

Muyanga, M. and Jayne, T. S. (2006), óAgricultural extension in Kenya: Practice and policy lessonsõ, *Working paper No. 26*, Tegemeo Institute of Agricultural Policy and Development, Nairobi.

Odhiambo, M. and Taifa, A. (2009), Devolved Funds Development: A Handbook on Participation. Nairobi: Clari Press

Okatch, F.O. (2012), ôDevolved government statutes that guides the workings of county government (Kenya): The county government act. *Governor public affairs committee at association of professional societies in East Africa.*

Okello,M., Oenga,I. and Chege,P. (2008), ôParticipatory Urban Planning Toolkit Based on the Kitale Experience: A guide to Community Based Action Planning for Effective Infrastructure and Services Deliveryõ, Nairobi: Practical Action.

O'Loughlin, E. and Weqimont, L. (2007), "Global education, public awareness-raising and campaigning on development issues: An overview of evaluation practice and policy", *Background paper prepared for informal experts' workshop hosted by the Germany Ministry for Economic Co-operation and Development*, 19-20 March, Bonn.

Omolo, A. (2010), "Devolution in Kenya: A Critical Review of Past and Present Frameworks in Devolution in Kenya, Prospects, Challenges and the Future", Mwenda *(ed). IEA Research Paper No. 24.*

Omolo, A. (2011), "Policy proposal on citizen participation in devolved governance in Kenya", *The Institute for Social Accountability (TISA), Nairobi*.

Otieno D.J., 2012. Market and non-market factors influencing farmers' adoption of improved beef cattle in arid and semi arid areas of Kenya. *Journal of Agricultural Science, 5 (1): 32-43.*

Salami, A., Kamara, A.B. and Brixiova, Z. (2010), "Smallholder agriculture in East Africa: Trends, constraints and opportunities", *African Development Bank Working Paper no. 105.*

Simtowe, F., Muange, E., Munyua, B. and Diagne, A. (2012), "Technology awareness and adoption: the case of improved pigeon pea varieties in Kenya", *Paper presented at the International Association of Agriculture Economists (IAAE) triennial conference*, Brazil.

Tabachnick, B. G., Fidell, L.S. (2001), *Using multivariate statistics*, fourth edition, Needham Heights, Mass: Allyn and Bacon.

UNDP (United Nations Development Program) (2009), óStrengthening the capacity of Kenyan Civil society to participate more effectively in democratic governance reforms and in deepening democracy in Kenyaô, Civil society democratic governance facility, *Amkeni wakenya progress report.*

Ulimwengu J. and Sanyal P. (2011), óJoint estimation of farmers, stated willingness to pay for agricultural servicesô, *discussion paper 01070,* International Food and Policy Research Institute, Nairobi.

World Bank (2001), óAttacking povertyô, *World development report 2000/2001*: Washington DC.

Yang, K. and Callahan, K. (2005), óAssessing Citizen Involvement Efforts by Local Governmentsô, *Public Performance and Management Review,* 29(2):191-216.

Chapter Three

3. Farmers Willingness to Pay for Agricultural Extension Program Components

3.1 Introduction and Research Problem Statement

In most of the developing countries including Kenya, agricultural extension program (AEP) are often characterized by poorly developed institutions including failure to incorporate a mechanism to give farmers a voice, which leads to lack of accountability and responsiveness to farmersô needs (Davis, 2008). In recent times, there has been a growing clamor for demand driven extension. Towards this end, most countries in the world continue to reform their extension systems in order to better address the needs of the agrarian communities (Davidson, 2007).

Following this notion, the government of Kenya implemented the National Agricultural and Livestock Extension Program (NALEP) in the year 2001, which was based on a focal area approach. The approach entailed strategically positioning specialized extension officers in an area for a specific period of time (usually one year) to work with frontline extension workers and farmer groups (Muyanga and Jayne, 2006). NALEP has demonstrated a pluralistic approach, however some of the criticism includes inadequate linkage and coordination between stakeholders (Kibett, 2005). In addition, the policy was not widely owned by stakeholders outside (and in some cases within) the sector ministries, and resources needed to give effect to key policy provisions were slow to materialize (Rivera, 2004).

The above mentioned issues necessitated review of NALEP, which resulted in the development of the current agricultural extension policy; The National Agricultural Sector Extension Policy (NASEP). The NASEP whose implementation is in its preliminary stage has adopted a sector-

wide approach that will enable the Kenyan agricultural extension clientele demand and access appropriate and quality extension services. Among the main challenges NASEP seeks to address include: commercializing public extension without compromising public interest, harmonizing extension approaches especially those promoting demand-driven extension and capacity building for grassroots institution, and addressing the weak linkage between research, extension and clients. The policy aims to achieve synergy and sustainability by empowering lower level stakeholders to participate in priority setting, designing projects and program as well as resource allocation (GOK, 2012).

Moreover, the current development focus on governance structure in Kenya stresses the need to decentralize and devolve decision-making to a local level, increase individual accountability and ensure that policies made better reflect local needs (Kukamba, 2010; GOK, 2011). The essence of devolution is that at the local level the people allow a certain flexibility within which they can make decisions that are unique to themselves and their locality. With regard to agricultural extension, devolution does offer the possibility that research agenda and extension service structure would be designed to reflect the local community needs (Kukamba, 2010). Studies have found most extension officers particularly in rural areas to be ineffective due lack of a wide range of extension knowledge (Irungu et al., 2006), which sometimes may not address the actual needs on the ground. The lack of multi-skilled extension agents have led to provision of uniform extension service to clients with varying problems (GOK, 2012). Identifying local skill needs makes it cost efficient to propagate extension massages and reduces resource wastage (Muyanga and Jayne, 2006).

This study focused on investigating what farmers want included in an AEP in order to offer insight to policy makers on the development and implementation of demand-driven extension

program. This was done through analyzing farmers' willingness to pay for AEP attributes. In many developing countries including Kenya, charging a fee for extension services offered has been advocated in order to sustain provision of appropriate agricultural services to farmers (Ulimwengu and Sanyal, 2011).

A study done in Uganda on farmersô willingness to pay for crop and livestock extension services reported that the preferred price per visit for extension services was too low about US$ 1.8 and US$ 2, respectively (Mwaura, 2010). Another study in Nigeria showed a that relatively small percentage (30 percent) of farmers were willing to pay for extension services which included identifying rural problems and giving advice, organizing group meetings and discussions and monitoring farmers' activities (Oladele, 2008). Brinkerhoff and Azfar (2006) argued that seeking citizensô feedback on service delivery is one of the mechanisms of allowing citizens to participation in improving performance the service providers.

The current approach to farmer participation in extension program involves attendance to extension program meetings for briefing (GOK, 2012). This study focuses on farmer participation where the farmers are engaged fully in the process of designing extension program and deciding the terms of delivery. This form of farmer participation has not been introduced to the extension system in Kenya. Therefore, this study aimed to inform policy on farmersô priorities with regard to AEP design and thereby contribute to the literature on participatory extension system.

3.2 Methodology

The commonly used approaches for valuing non-market goods and services include stated preference and revealed preference approaches (Hanemann, 1994). In Revealed Preference (RP)

methods, statistical inferences are made on the values people place on goods and services based on actual purchase decisions (prices paid and quantities purchased). On the other hand, Stated Preference (SP) methods are used when the goods have not been introduced in the market and so cannot observe choice being made. They are based on responses to questions about hypothetical situations (Freeman, 2003). The SP methods have advantages in that one is able to design several varieties of a product before they are introduced in the market (Swait et al. 1994).

The most commonly used SP methods are contingent valuation (CV) method and choice experiment (CE) methods. The CV method is a survey based valuation that offers the respondents an opportunity to make an economic decision on a good / service, for which no market exists. Individualsô Willingness to pay (WTP) for the benefits or willingness to accept (WTA) compensation for loss can be used to estimate the economic value of such goods and services (Hanemann, 1994; Portney 1994). The theoretical basis of CV method is well rooted in welfare economics in the neo-classical concept of economic value based on individual utility maximization. This suggests that the stated WTP amounts relate to respondentsô underlying preference in a consistent manner. However, the CV method has been criticized in the literature for being so subjective, leading to extreme value of independent variable (Smith, 1993; NOAA, 1993; Freeman, 2003). This is one of the reasons why CE is preferred as it is designed to obtain preferences over similar goods but differ in the levels of their common attribute.

The microeconomic framework of CE is based on Lancasterôs theory of consumer choice, which suggests that consumption decisions are determined by the utility or value that is derived from the attributes of the particular good being consumed rather than the good itself (Lancaster, 1966). Therefore, utility is assumed to be separable and individual preference for components of the product can be measured. The framework of random utility theory forms the econometric basis

of CE method (McFadden, 1974; Ben-Akiva and Lerman, 1985). This theory considers utility to be unobservable (random) variable to the analyst due to the effect of latent attributes, taste variation and unobserved individual characteristics that influence the choices they make. The hypothesis is that every individual is a rational decision maker and maximizes utility divined from his/her choices.

CE has important advantage in that it enables estimation of trade-offs between attributes and their levels as well as values of individual components of a good rather than the value of the whole good as in the case of CVM. Such information helps inform policy on the attributes that are significant in determining the value people place on goods as well as the value of different features of the good. In addition, the repeated responses from the same respondent on a panel of choice tasks provide an opportunity to obtain more information from a relatively small sample size (Hanley et al., 2001)

The CE approach has been used in different disciplines. For instance, in environmental economics to estimate benefits of specific environmental attributes, which have served to inform policy makers aiming to reverse decline in environmental quality (Ruto and Garrod, 2009; Maria et al., 2010). CEs have also been used to analyze preferences for various recreational sites (Haynes et al., 2008), to value animal genetic resources (Ruto et al., 2008) and to analyze preferences for disease-free zones (Otieno et al., 2011). However, no study has focused on what farmers want included in an AEP. This study employs a CE to estimate farmersô preference for individual attributes in an AEP as well as the value they place on different extension program policy scenarios or package. This information will help to inform policy on potential acceptability of Agricultural Extension policy designs.

The rest of this chapter is organized as follows. The next two sections discuss the CE design and data collection methods used in the study. Thereafter, the choice model used in the analysis is specified. This is followed by the final section that reports the findings from the study.

3.3 Choice Experiment Design

The first step involved is defining a hypothetical agricultural extension program in terms of its voluntary or optional and compulsory attributes. Both sets of attributes were identified from the literature and were validated through a focus group discussion (FGD). Compulsory features are those which must be followed by all extension service providers and/or farmers in order to effectively implement the AEPs. They are equally important for purposes of enforcing public policies (Otieno et al., 2012). The compulsory features in the study included: legal registration of service providers; full disclosure of information relating to a new technology; reporting of misleading extension information; formation of common interest groups and recommended minimum education qualification of extension agents.

The requirement for agricultural extension providers to legally register their company or organization would facilitate government or concerned authority to enforce the rules and standards in service provision. Moreover, the registration would enable the revenue authorities to follow up on company returns hence increasing the tax collection to the government (GOK, 2012). Disclosure of information relating to a new technology would enhance access to the information by farmers. Providing the right information to farmers is crucial in improving farm production, which is in line with the Kenya vision 2030.

Minimum education qualification of extension agents is important to ensure they have the knowledge base necessary to handle unique and new challenges faced by farmers in their diverse

production environment. Education qualification goes hand in hand with the right interpretation of farmer farm problems and consequently, the recommendation of the appropriate measures (Muyanga and Jayne, 2006). Farmer groups have been used as most convenient and cost efficient way of reaching out to farmers. In addition, grass root organizations such as the common interest groups are effective in lobbying as well as building synergy with the service providers (GOK, 2012).

The voluntary features enable individuals with varying interests to make choices. These are the attributes, which are normally included in the CE design. Table 5 below summarizes the attributes used in the study. These included: extension content; content developer; research-extension-farmer linkage; monitoring and evaluation and price per extension agent visit.

Table 5: Attributes used in AEP choice experiment design

AEP attributes	Description of attribute levels
Extension content	Extension program focus: livestock and fishery farming; cereal farming; horticultural farming
Content developer	Who designs the content of the program: Provider only; Provider and farmers; Farmers only
Research-extension-farmer linkage	Venue for linkage activities: Experimental/ extension station; on farm
Monitoring and evaluation	Frequency of review of the program: After 2 years (short term); 4 years (medium term); 6 years (long term)
Price per extension agent visit (in Kenya shillings; Kshs)	950; 1200; 1700

Source: farmer focus group discussion (2013)

Given the diverse climatic conditions in Kenya, farmers engage in various agricultural enterprises that may include: livestock; field crop and horticultural enterprises. Extension content attribute was selected to focus extension skill on what farmers are doing in different agro-ecological zones of Meru County (Hellin and Dixon, 2010). In the fertile and wet regions of Meru County, farmers grow crops such as tea and vegetables as well as dairy keeping. In the drier areas, drought tolerant crops including green grams, millet and sorghum are grown (Monda, 2003). Failure of AEPs to focus on agricultural activities in an area will render it irrelevant and result to rejection or low participation by farmers (Belay, 2003).

The usefulness of an AEP has been attributed to the extent to which the extension content reflects the needs of the target farming community (Kameswari et al., 2011). The main actors in extension program include the extension service provider (ESP) and the client (farmers) and they

may jointly or separately develop the content of the AEP. Managing extension from the central government in Nairobi rather than County offices in Meru often lack, accountability to clients; poorly maintained linkages to knowledge generation; limited resources for operations and a supply- driven technology transfer (Feder et al., 1999). It is easier for County government to fully engage farmers in decision making since it is closer to them. Participatory extension approaches are more responsive to clientôs needs (Kameswari et al., 2011) but it is important that they are made financially sustainable. Financial sustainability is crucial as it would ensure continuity of the program especially in the devolved system where government support is limited (Quizon et al., 2001).

Among the emphasized linkages in extension is the linkage of extension agents with research and farmers (Rivera and Elkalla, 1997). Development of outreach program would enable direct contribution to resolving farmersô production problems and decision making capabilities, advancement and effective dissemination of demandï driven technologies and extension (GOK, 2012). The linkage activities may be done in agricultural demonstration fields or on-farm (on plots of land belonging to the farmers and within the environment of the farmer). Research linkage is aimed at solving farmersôproblems and on-station (experiment station) research may not reflect the local farmerôs condition. In the design of on-farm research linkage, farmerôs environment (socio-cultural, anthropological and economic environment) within which they operate has to be taken into account. Farmerôs fields may have many problems associated with soil fertility, drainage and complex cropping systems than used in on-station (SSC, 1998).

Monitoring and evaluation of AEPs ensures quality service and enhances consistency in the adoption of both livestock and crop related agricultural technologies and program (Anderson and Feder, 2004). Literature provides various key indicators for evaluating impact of a program that

require being measured and estimated at distinct time intervals. Among these indicators is change in productivity or yield, which is a medium-to long-run measure (Winters et al., 2010).

Based on the information gathered from the FGDs, this study considered three time interval options for evaluation of extension program with respect to yield indicator; that is after two years, four years and six years of adoption. Two years was selected because of the seasonal crops such as maize which mature in three months. Four and six years catered for growth and gestation period of livestock and perennial crops such as tea. The gestation period of cows is about nine months therefore in six years the cow will have at least two generations which will provide sufficient information on yield. On the other hand, the full cover of tea plantation is attained by the second to third year of planting after which the harvest of tea leaves is begins.

Finally, payment for extension service by the farmer would ensure continuity of the AEP in the event of limited government or donor financial support. The current extension policy in Kenya (NASEP) aims to ensure sustainability in financing extension service through commercialization of public extension. This is meant to start with cost sharing moving gradually to full-cost recovery in all areas based on clientõs ability to pay for the services (GOK, 2012). This study estimated the price per on-farm extension agent visit based on transport cost and professional fee.

The Kenyan public service lunch rates for field extension officers at three different job groups (group G and H, group K to N and group P and above) were used as professional fee (GOK, 2005), while the transport cost was based on the market rates. The professional fee considered were Ksh 750, Ksh 1000 and Ksh 1500 for job group G and H, K to N and group P, respectively. Given that the most commonly used mode of transport by extension officers in Kenya is motor

cycles, a transport cost of Ksh 200 was used considering the distance of the study area from the division agricultural office. A sum of transport cost and professional fee was done to give the price for each of the three categories of extension agents. Therefore, the levels of price to be paid by the farmers per extension agent visit were either Ksh 950 or Ksh 1200 or Ksh 1700. Following the validations through the FGD, three levels were used for each attribute except for linkage attribute where only two levels were used as shown in Table 5 earlier.

In CE design, different experimental approaches such as complete factorial design and fractional factorial design can be used. While complete factorial designs often produce impractically large number of profiles to be evaluated, fractional factorial designs are able to reduce the number of profiles. The two criteria used in fractional factorial experimental design include: orthogonality and statistical efficiency. Experimental designs are said to be orthogonal if the attribute correlations are zero between alternatives. This is practically important because it ensures no attribute or attribute level dominates the choice tasks and that the combinations of attribute levels do not follow a predetermined pattern (Louviere et al., 2000). Efficient designs on the other hand maximize efficiency criteria such as D-efficiency and B-efficiency. D-efficiency refers to the determinant of the variance-covariance matrix of the design. The efficiency increases with decrease in the variance. Thus, D-efficient designs minimize standard errors, yielding more reliable parameter estimates (Scarpa and Rose, 2008). B-efficiency on the other hand is a statistic which ranges from zero to 100 percent and measures utility balance in the design, meaning it measures equal probability of appearance of all alternatives within choice sets (Kassel et al., 2004).

The study focused on maximizing the D-efficiency hence a two stage design procedure was used (Bliemer and Rose, 2010). In the first stage a fractional factorial orthogonal design was used in a

pretest survey of 42 farmers to obtain prior coefficients, which were then used to generate an efficient design in the second stage. The D-efficiency measure of the efficient design was 87.7 percent, while the utility balance was 76.4 percent, which indicate that the probability of dominance by any alternative in the choice tasks was insignificant (Huber and Zwerina, 1996). This design would therefore maximize information on respondentsô preference over all observations. The efficient design included 24 choice profiles, which were then randomly blocked into six sets of four choice tasks during the CE design process. One of the six choice sets were randomly presented to the respondents and each choice task consisted of alternative A and B, and an exit option C. Inclusion of the exit option is instrumental to allow flexibility since not all respondents may prefer the choice alternatives presented in the survey (Louviere et al., 2000; Bateman et al., 2003). According to Hanely et al. (2001), an exit option makes the choice set exhaustive, which is consistent with demand theory considering that it is impossible to present a full scope of alternatives. An example of a choice set presented to respondents is shown in Figure 4 below.

Figure4. Example of AEP choice set used in choice experiment

	AEP A	AEP B	Neither A nor B
Extension content	livestock and fisheries	horticulture	
Content designer	Farmers	provider	
farmer-agent-research linkage	On-farm	experimental station	
Evaluation period	4 years (medium term)	4 years (medium term)	
Price	Ksh 950	Ksh 1700	
Choice question: Which extension program would you prefer?			

In order to ensure choices made are reliable and based on farmers preference, when making choices, farmers were asked to consider only the attributes explained in the choice task and treat each choice task independently. It was made clear that if they choose the exit option they will not have any of the described extension program meaning that no change will be made on the existing extension system.

3.4 Data Collection

Meru County is clustered into cool-wet regions, warm-wet regions, and warm-dry regions (KNBS, 2004; Orodho, 2006). The Imenti North Constituency where this study was conducted lies in the cool-wet and warm-wet regions. The warm-wet region is relatively a low agro-ecological potential zone in comparison with the cool-wet region. Thus, the study conceptualizes the cool-wet region as high potential area and the warm-wet region to be low potential area. In the high potential areas, the major agricultural enterprises are tea and dairy farming while in the low potential areas crops such as fruits and vegetables are grown. Two divisions were randomly selected from each cluster, and subsequent stages involved random selection of smaller administrative units where the ultimate primary sampling unit was a household. A semi-structured CE questionnaire was administered through personal interviews with the help of trained research. Face-to-face interview method was appropriate in the study area given the limited and poor communication networks which could not allow use of other methods such as computer-based surveys or telephone interviews. This method is also preferred in CE surveys since it enables the correct respondent to be selected within the household and helps to clearly explain the choice sets to respondents (Binnett and Birol, 2010).

The questionnaire comprised sections on agricultural extension and technology questions, information on farm enterprises and CE questions (see appendix 1). During the survey,

systematic random sampling was used to selected every fourth household in low ecological zone (population is relatively sparse) and every sixth in high ecological area. Appropriate replacements were randomly made (next fourth and next sixth household) in cases where consent for interview was not granted, or correct respondent was not available. Only households who engaged in farming qualified for the survey and the respondent was defined as an adult (above age of 18 years) who makes farm decisions especially related to extension services.

The research assistants gave brief introductions to every respondent on the purpose of the survey before seeking the permission to start the interview. The respondents were assured that their responses would be kept confidential and only used for research and policy making purposes. Majority of the households approached cooperated and participated in filling the questionnaire which took about an hour per respondent on average. A total of 288 farmers were interviewed; an equal number from both regions of Meru for the purpose of comparing their preferences for AEP.

3.5 Model Specification

Multinomial logit (MNL) model (McFadden, 1974) is one of the most commonly used discrete choice models in the analysis of CE data. The advantage of the MNL model is its relative computational simplicity, but has important limitations. For instance, the MNL assumes homogenous preference across the respondents and independence of irrelevant alternatives (IIA),i.e., that the relative probability of two alternatives in the choice set do not change with possible introduction or removal of other alternatives (Hausman and McFadden 1984). However, in reality the preferences across individuals may be heterogeneous (Scarpa et al., 2003). Due to the limitations of the MNL, the study uses random parameter logit (RPL) model, which corrects

for preference heterogeneity by allowing parameters to vary randomly and continuously over individuals. Following Revelt and Train (1998), the RPL model is specified as follows:

Let T = 4, denote the series of choices each respondent is presented with. In each choice occasion the respondent faces three alternatives that comprise two AEP options described in terms of the key extension program attributes and a choice of neither option. Therefore, the respondent faces a choice between J=2 alternatives plus a baseline option. Let X_{int} denote a vector of attributes of alternative i in choice occasion t faced by respondent n. The utility obtained by individual n from alternative i in choice occasion t is given by:

$$U_{int} = \beta_n X_{int} + \varepsilon_{int} \quad \text{é é} \quad (10)$$

where β_n is a vector of unobservable individual-specific parameters representing individual taste with a density function $f(\beta_n \mid \theta)$, and θ are parameters of this distribution .ε_{njt} is an unobservable random term assumed to be independent of β_n and X_{njt} - independent and identically distributed extreme value on.Thus, conditional on β_n, the probability that individual n chooses alternative in choice situation t is given by the standard MNL model as:

$$P_{int}(i) = \frac{e^{\beta_n X_{int}}}{\sum_{j} e^{\beta_n X_{jnt}}} \quad \text{é ..(11)}$$

Let i(n,t) be the alternative chosen in choice occasion t by respondent n. Assuming that the respondentôs n taste does not vary over the sequence of choices in the T choice occasions, the joint probability of the respondentôs observed sequence of choices conditional on β_n is the product of standard logits:

$$\text{[illegible]} \quad \text{[illegible]} \qquad \text{é é} \quad (12)$$

Note that the β_n is not observed by the researcher, but its density $f(\beta_n \mid \theta$. Therefore, the unconditional probability of the respondentôs sequence of choices is given by:

$$\text{[illegible]} \qquad \text{é é} \quad (13)$$

The log-likelihood function is given by:

$$\text{[illegible]} \quad \text{[illegible]} \qquad \text{é é é é é é é é é é é é ..é é é é é é é é é é é é é é é é ...} \quad (14)$$

Due to lack of closed mathematical form of *Equation 14*, this expression cannot be computed analytically but using simulated methods (Train, 2003). A number of draws of β is picked from its density $f(\beta_n \mid \theta)$, and for each draw, product of the standard MNL conditional to β_n is calculated and results averaged over the draws giving the approximate choice probability. The simulated log-likelihood function used in estimation is constructed as:

$$\text{[illegible]} \qquad \text{é .....} \quad (15)$$

where R is the number of draws of β and β^r is the *rth* draw. The simulation was based on Halton intelligent draws which have been found to provide to a greater extent accurate results than independent random draws (Train, 2003). The resulting estimated parameters maximize SLL(θ). The respondentôs marginal willingness to pay (WTP) for specific AEP attribute gives a measure of relative importance that respondents place on an attribute in the AEP design. It is computed following the suggestion of Hanemann (1984) as follows:

$$\text{WTP} = -1 * \frac{\beta_k}{\beta_p} \quad \text{é (16)}$$

where β_k is the estimated coefficient for an attribute/attribute level and β_p is the marginal utility of income given by the coefficient of price attribute. The study also computes the compensating surplus (CS) welfare measure for different AEP policy scenarios. Implementation of project or programme involves cost and the CS measure gives the amount of income that an individual would give up after the programme has been implemented that would return her utility to the status quo utility level. The CS measure enables assessment of the value of multiple attributes combined and it is computed as shown:

$$\text{CS} = \frac{-1}{\beta_p} V_1 - V_0 \quad \text{é ..(17)}$$

where V_1 denotes the value of the indirect utility associated with attributes of the AEP policy scenario under consideration and V_0 is the indirect utility of the baseline scenario which is given a value of zero indicating no improvement of the status quo scenario

3.6 Results and Discussions

3.6.1 Farmer Preferences for Extension Program Design

The variables employed in AEP design analysis and their coding is shown in Table 6 below. The utility parameters for the first seven AEP attributes were entered as random parameters assuming a normal distribution. Literature shows normal distribution to be the most used distribution. In addition, the focus is on improving the design of extension program and it is logical to expect that at least some of the farmers would have a positive preference for the AEP attributes. Therefore, other distributions such as lognormal distribution that can be used when a coefficient is deemed to have same sign for all respondents in the sample (Campbell et al., 2009) were not

preferred. Generally, all distributions have limitations in the sign of the coefficient and/or size of the tail (Hensher and Green, 2003). However, according to Train (2003, pg. 142), the researcher should specify the distribution that aligns with the expectations about behavior in that particular situation. The distribution of price attribute was specified as constant. This was in order to avoid the likelihood of getting extreme negative or positive trade-off values, which might affect the estimation of the distribution of willingness to pay (Revelt and Train, 1998).

Table 6: Description of variables used in choice experiment analysis

Variable	Description
LVSTCKF	Extension program to focus on provision of skills for livestock and fisheries farming: 1=yes; 0 otherwise
HOTCUL	Extension program to focus on provision of skills for horticulture farming: 1=yes; 0 otherwise
PRVDERF	Extension provider and farmer to jointly develop program content: 1=yes; 0 otherwise
FMRS	Extension program content to be developed by farmers only: 1=yes; 0 otherwise
ONFAM	Extension linkage/outreach activities to be done on farmersĉ fields: 1=yes; 0 otherwise
SHORT	Short term evaluation of program (after 2 years): 1=yes; 0 otherwise
LONG	Long term evaluation of program (after 6 years): 1=yes; 0 otherwise
PRICE	Price in Kshs to be paid per farm visit by extension agent (950, 1200 or 1700)

Source: Authors; compilation

The results of the RPL models for the two zones as well as for the pooled sample are reported in Table 7. The models show a good level of explanatory power with McFadden R^2 values ranging between 0.42 and 0.44 indicating that the models account for a good variation in the data.

The models results show that the mean coefficient of the majority of variables used to describe the AEP are statistically significant at 10 per cent significance level or less. Farmers in the high potential zone prefer an extension program, which focuses on livestock and fisheries while those in low potential zone prefer a program on horticultural farming. This result is due to the fact that 90 percent (see appendix 6) of farmers in high potential area engage in dairy farming while those in low potential zone do crop farming for home consumption and/or for sale. The result conforms to the suggestion by Hellin and Dixon (2008) that the varied ecology within a country as well as the differences in farmersô resource endowments, constraints, opportunities and managerial abilities, call for development and promotion of diverse agricultural extension packages.

Table 7: Random parameter logit estimates for AEP attributes

	Mean coefficients (*t*-ratio)		
Variable	High potential zone	low potential zone	Pooled sample
LVSTCKF	6.84 (2.64)***	6.16 (3.23)***	3.18 (5.05)***
HOTCUL	3.24 (3.25)***	6.94 (3.59)***	2.29 (4.83)***
PRVDERF	29.98 (0.0)	30.99 (0.0)	31.10 (0.0)
FMRS	-1.61 (-2.02)**	0.33 (0.43)	-0.48 (-1.91)*
ONFAM	1.92 (2.89)***	6.51 (4.93)***	1.8 (7.16)***
SHORT	3.61 (3.48)***	9.83 (4.38)***	2.84 (7.56)***
LONG	2.57 (3.45)***	9.81 (4.69)***	2.54 (7.17)***
PRICE	-0.0008 (-2.3)**	-0.0041 (-3.25)***	-0.0008 (-3.81)***
Standard deviations of parameter distribution (*t*- ratio)			
sdLVSTCKF	6.76 (2.72)***	12.48 (4.35)***	4.35 (6.33)***
sdHOTCUL	4.3 (2.69)***	9.58 (5.07)***	3.17 (6.62)***
sdPRVDERF	0.00(0.0)	0.00(0.0)	0.00 (0.0)
sdFMRS	0.73 (0.97)	5.19(3.92)***	1.09 (3.15)***
sdONFAM	1.65 (2.73)***	1.3 (1.53)	1.14 (4.41)***
sdSHORT	0.05 (0.09)	7.04 (3.78)***	0.01 (0.01)
sdLONG	0.60 (1.38)	3.14 (1.94)*	0.99 (2.69)***
Log-likelihood	-362.31	-355.35	-735.65
Adjusted pseudo R^2	0.43	0.44	0.41
n (respondents)	144	144	288
n (choices)	576	576	1152

Note: ***, ** and * indicate statistical significance at 1%, 5% and 10% levels respectively. Corresponding standard errors are shown in parentheses

In both regions, the models show that the preferred venue for research linkage activities between farmers, extension agents and researchers is at on-farm. This may indicate the dissatisfaction with the commonly practiced experimental/on-station meetings that may not reflect farmerôs actual agro-climate condition (SSC, 1998).

There is a higher preference for evaluation of extension programs in shorter periods than in long term. This result suggests that farmers want frequent monitoring and supervision to ensure that they are applying extension messages and skills in the right way for maximum benefits. The result also reflects the findings from the FGD that, the market offers variety of technology to farmers hence, farmers wish to know the reliability/profitability of a technology after the minimum required period of practice. The estimated coefficient for price attribute exhibits a negative and significant sign as expected.

An interesting though unexpected result is the negative sign on the attribute of farmersô involvement in content development. This shows that, if farmers are to participate in extension content development activity, they will demand to be paid for their time. The likely explanation for this may be due to the fact that majority of the respondents are farmers by occupation and earned part of their income if not all from farming (69 percent and 58 percent had sold crop produce and milk respectively), which indicate that farmers attach value to the time they spend on their farms. The result is also consistent with the literature which shows that farmers expect some transport and lunch allowances from extended meetings or activities outside their daily engagement e.g. participation in extension content design(Obaa, 2005).

Most attribute coefficients have highly significant standard deviations in the pooled sample model as well as in the low potential model. This depicts the farmersôheterogeneous preferences

for the AEP attributes. In the high potential region, the preference heterogeneity is high on livestock and fishery extension, horticulture extension and on-farm linkage attributes.

Three quarter of farmers had a positive preference for the extension program attributes (except for only farmers developing extension content) that were included in the CE, as shown in Table 8. This shows that collectively these attributes to a greater extent captured the farmersô preference range for an AEP.

Table 8: Percentage Distribution of Preferences for Attributes

ATTRIBUTE	MEAN	SD	NEGATIVE	POSITIVE
LVSTCKF	3.18	4.35	23.24	76.76
HOTCUL	2.29	3.17	23.50	76.50
PRVDERF	31.1	0.82	0.00	100.00
FMRS	-0.48	1.09	67.02	32.98
ONFAM	1.8	1.14	5.72	94.28
SHORT	2.84	0.01	0.00	100.00
LONG	2.54	1	0.55	99.45

Source: Survey data (2013)

Preference for extension program to provide skills either on livestock and fishery farming (LVSTCKF) or horticultural (HOTCUL) farming was about 77 percent. There was 100 percent preference for farmers and extension service (PRVDERF) providers to jointly develop the content of extension programs. Only a small percentage (33 percent) preferred farmers only (FMRS) to develop extension program content. Nearly 94 percent preferred extension linkage activities to be done at farmersô fields (ONFAM) rather than at the experimental stations. Both short (SHORT) and long (LONG) term evaluation or review of extension program was highly preferred by all respondents.

Table 9: Marginal WTP estimates for AEP attributes at 90 percent confidence interval (Kshs)

Variable	High potential zone	low potential zone	Pooled sample
LVSTCKF	7871	1488.3	3807.3
	(3304 to 12438	(894.5 to 2082.1)	(2044 to 5570.6)
HOTCUL	3728.1	1677.1	2739.5
	(1673 to 5783.2)	(1107.8 to 2246.4)	(1648 to 3831)
PRVDERF	___	___	___
FMRS	-1848.2	___	-580.9
	(-425 to -3271.3)		(-10.4 to -1151.4)
ONFAM	2206.2	1581.1	2155.9
	(1035.1 to 3377.3)	(1154.4 to 2007.5)	(1382.4 to 2929.4)
SHORT	4152.1	2373.9	3403.5
	(2131.2 to 6173)	(1638.1 to 3109.7)	(2197.9to 4609.1)
LONG	2955.5	2370.4	3040.9
	(1602.5 to 4308.5)	(1667.8 to 3073.0)	(1997 to 4084.8)

Notes: ___ indicate that the variable is not significant at 10 percent level of significance.

The WTP values have been calculated using the RPL coefficients from Table 7 in NLOGIT version 4.0

The WTP results in Table 9 confirm the heterogeneous preferences for the extension program attributes in the sample of Kenyan farmers. The pooled sample results show that farmers are willing to pay between Kshs 2,101 and Kshs 5,908 and between Kshs1,301 and Ksh 4,040 per month for extension programs on livestock and fishery farming and horticultural farming respectively; Kshs 1,234 and Kshs 3,078 for on farm linkage activities; Kshs 1,967 and Kshs 4,840 and between Kshs 1,797 and Kshs 4,285 for extension programs to be evaluated in short and long periods respectively. However, farmers are willing to be paid between Kshs 99 and Kshs 1,261 for their participation in the extension content development. Given the WTP values, farmersô preferences for the AEP attribute can be ranked as follows: livestock and fishery

extension; short term evaluation of the programs; long term evaluation; horticultural extension; on-farm linkage and farmers only to participate in content development.

The estimated WTP values for the extension program attributes ranges between Kshs 2,156 and Kshs 3,807 in the pooled sample. In relation to the amount Kenyan tea farmers are found to spend on medical bill per year, that is Kshs 4,300 on average (Stefan et al., 2012), these figures seem realistic for an extension program running for at least two years. The study focused on a hypothetical extension program which is targeted to exist in future. Assuming relevant and quality extension services, farm productivity would increase improving farmers returns hence enable them to pay for the services. Literature shows that farmers pay for private extension service, which is said to be more efficient and effective compared to the public service (Rivera, 2004). Nonetheless, Gonzales et al., (2009), explains WTP values as simply a clear indication of positive acceptance levels and the expected potential benefits.

Generally, farmers in the high potential zone have higher WTP estimates for all the attributes. This might be explained by the high value farming enterprises in the area; about 90 percent of farmers keep dairy cows with mean monthly milk sale of 252 liters and 56.3 per cent grow high value crops such as tea. It is also expected that prior access to extension services would increase farmers WTP. Generally, use of extension services and farmer field day attendance is higher among farmers in the region (79.2 and 64.3 per cent respectively), hence the high WTP values may indicate farmersô appreciation of the extension services offered.

The most preferred attribute by farmers in the low potential zone is monitoring and evaluation of extension programs indicating the importance and need for appropriate extension program evaluation frameworks. The mean WTP value for on-farm linkage is higher (margin of Kshs

626.1) in high ecological zone, which is consistent with the literature that research linkages should be done within the farmersô environment and conditions (SSC, 1998). On average, livestock and fishery farming is highly valued in high potential zone, which might suggest high returns from dairy farming. Horticulture farming is most valued in the low ecological zone. This may be due to the fact that majority of farmers (87 percent) sold crop produce for income in past year. Farmers in both potential zones have higher WTP estimates for short term evaluation of AEP which might suggest that farming is important for their livelihoods and farmers would like to engage in an appropriate and up-to-date farming practices for high returns.

Farmersô CS measures are estimated for four possible alternative AEP policy scenarios. These were derived from the WTP amounts and involved listing the most preferred AEP attributes by farmers in both regions. The attributes were then combined to form different policy scenarios of AEP. This provides a broader picture of how farmers in different agro-climate zones would respond to specific extension program policies. The likely policy scenarios include:

Scenario one: Extension program that focuses on livestock and fishery farming; linkage activities are done on farm; and the program is evaluated/revised after 6 years (long term).

Scenario two: Extension program that focuses on horticultural farming; farmers develop the content; and the program is evaluated /revised after 2 years (short term).

Scenario three: Extension program that focuses on livestock and fishery farming; farmers develop the content; linkage activities done on farm and the program is evaluated/revised after 6 years (long term).

Scenario four: Extension program that focuses on horticultural farming; there is on farm linkage activities; and the program is evaluated/revised after 6 years (long term).

Table 10: Compensating surplus for AEP policy scenarios (Kshs)

Attribute							Compensating surplus in ecological zones		
Scenario	Livestock and fishery	Horticulture	farmers	on-farm	short term	long term	High potential zone	low potential zone	pooled sample
1	*			*		*	13,032.79(4046.67)	5,439.80(872.65)	9,004.09(1957.00)
2		*	*		*		6,032.04(1744.61)	4,131.86(714.47)	5,562.03(1070.53)
3	*		*	*		*	11,184.61(3330.61)	5,520.69(905.80)	8,423.20(1748.04)
4		*		*		*	8,889.86(2539.92)	5,628.55(876.14)	7,936.24(1562.17)

Source: Survey data, 2013

Note: *Indicate the attribute is present in the scenario. The CS estimates are all significant at 1% level. In parentheses are the standard errors.

The CS estimates for the four scenarios are positive indicating that farmers prefer a change from the current agricultural extension system. Generally, the high potential zone has higher CS estimates. The climate in the high potential zone enables farmers to grow high value crops such as tea and coffee as well as keep dairy cows; 56 percent of the farmers grow cash crops and 86.4 percent produce milk. It might therefore be expected that farmers get higher returns and hence their higher WTP. Moreover, literature shows dairy farming to be among the fastest growing source of income for small holder farmers in central and eastern Kenya (Ngigi, 2004). Scenario 1 is the most preferred by the farmers in the high potential zone, while scenario 4 is most preferred in the low potential zone. In both zones, CS estimates are higher where the scenario includes on-farm linkage. This is consistent with the inadequate and in some areas absence of outreach activities between the farmers, extension and research. Within the high ecological zone, the CS

estimates are higher where the program focuses on livestock and fisheries farming, indicating that the dairy farming in the area may be more profitable to farmers than other agricultural enterprises. Scenario 2 is the least preferred by farmers in both agro-climate zones probably because it does not offer outreach activities, which is present in all other scenarios. Scenario 3 is the second best for farmers in both zones hence would appear a fair choice in the event stakeholders settle for an undifferentiated program for all.

Development and implementation of more selective AEPs call for an organization structure which allows participation of relevant stakeholders. Establishment of stakeholdersôcollaborative forums at various levels within the County might ensure contribution of various stakeholders towards development of demand led AEPs. The organization structure may include the County Agricultural Extension Committee at a higher level to streamline working standards of extension service providers and ensure quality and monitoring. The development of extension content, monitoring and evaluation of extension programs should involve farmers in order to ensure their priorities and conditions are taken into account. This could be achieved through use of farmer-based institutions and forums such as Common Interest Groups (CIG) at village level to set extension priorities and then these could be harmonized at a divisional level. Formulation of guidelines on the formation and operationalization of such forums is crucial to ensure efficient participation. The system should allow penetration of farmersô views and complaints to higher levels responsible for control and disciplinary actions. Finally, establishment of such a participatory extension system requires mobilization of resources from relevant sources such as government, donors and other interested parties.

3.6.2 Factors influencing farmers' WTP for AEP attributes

To determine the source of heterogeneity on the farmersô preferences, interaction variables were created between the AEP attribute and farmer and farm characteristics. This was tried for several characteristics but only three were statistically significant as presented in Table 11. These include: the interaction between level of education of the farmer and extension program that provide skills on livestock and fishery farming (LVSTCKFEDU); the interaction between farmersô source of market information and extension program that provide skills on livestock and fishery farming (LVSTCKFMKT); and the interaction between land ownership and extension program that provide skills on livestock and fishery farming (LIVSTCKFDOC). However, the highly significant standard deviations of the parameters indicate that there is unaccounted preference heterogeneity, which probably could be explained by other variables not included in the model. The top part of Table 10 is the RPL estimates, which was discussed earlier under Table 7.

The results in the middle part of Table 10 show that having higher education level (at least secondary level) shifts preferences for livestock and fisheries extension up by 0.19. The possible explanation may be that it is possible that the more educated farmers have other sources of income, which increases their purchasing power. These findings concur with Foti et al (2007) who found that farmer income positively affect the demand for private fee-for-extension service.

Similarly, farmers who rely on their fellow farmers for market information also value livestock and fishery extension more. Market information offers insight to farmersô decisions including the market outlet to use. This result shows that farmers-to -farmer extension plays an important role in identifying more lucrative marketing channels, which fetch them higher prices for their produce. To enhance demand-driven agricultural advisory services, improving farmerôs access to

market information is highly important (Chipeta, 2006). This result conforms to the findings by Halloway and Ethui (2001) who found that farmers in Ethiopia are more willing to pay for extension in the context of milk market development.

Table 11: Random parameter logit estimates for interaction variables

variable	coefficients	standard error	p value
Random parameter in utility functions			
LVSTCKF	2.58	0.88	0.00**
HOTCUL	1.89	0.61	0.00**
PRVDERF	31.19	840278.8	1.00
FMRS	-0.45	0.25	0.08*
ONFAM	1.84	0.25	0.00**
SHORT	2.95	0.41	0.00**
LONG	2.76	0.41	0.00**
PRICE	-0.00	0.00	0.00**
Non random parameter in utility functions			
LVSTCKFEDU	1.19	0.68	0.08*
LIVSTCKFFMRS	-0.37	0.24	0.12
PRICEDU	0.00	0.00	0.15
LIVSTCKFMKT	1.86	0.73	0.01**
HOTCULMKT	0.58	0.69	0.40
LIVSTCKFDOC	-1.30	0.70	0.06*
Derived standard deviations of the parameter distributions			
NsLVSTCK	3.81	0.63	0.00
NsHOTCUL	3.39	0.6	0.00
NsPRVDER	0.00	951045.5	1.00
NsFMRS	1.17	0.4	0.00
NsONFAM	1.17	0.31	0.00
NsSHORT	0.89	0.52	0.08
NsLONG	0.77	0.49	0.11

Source: Survey data (2013)

The interaction variable between livestock and fishery extension and having title deed for the farm (LVSTCKFDOC) is negative and significant, which shows that land ownership reduces the value farmers place on the extension services. This result contradicts the three economic relationships that govern the link between land tenure right and access to agricultural services, which include (Feder, 1988): (a) the land title deed can be used as collateral to improve access to credit for agricultural investment; (b) the title could increase tenure security and enhance farmers willingness to make more permanent investments on their land; (c) the title may stimulate land markets that will facilitate transfer of land resources to more productive farmers. However, this outcome may be explained by the householdsô small land size (average of 1.9 acres) and it is possible that the larger part of the owned land is used for settlement purposes (home) rather than farming. This is confirmed by the fact that close to half (47 percent) of respondentôs farms are rented or owned by relatives.

3.7 Conclusions

The study concludes that farmers want design of extension programs to be participatory and they are WTP for extension program that incorporate their priorities. Among the highly preferred components of extension program include extension skills on livestock and fisheries farming and horticultural farming; extension linkage activities on farmersô fields; and scheduled evaluation and review of the extension program. Mechanisms should be put in place to enable and ease participation of farmers in the process of designing extension programs.

References

Anderson, J.R., and Feder, G. (2004), óAgricultural extension: Good intentions and hard realitiesô, *The World Bank Research Observer,* 19:41ï 60.

Bateman, I. J., Carson, R. T., Day, B., Hanemann, W. M., Hanley, N., Hett, T., Jones-Lee, M., Loomes, G., Ozdemiroglu, E., Pearce, D. W., Sugden, R. and Swanson, S. (2002), *Economic valuation with stated preference technique. A manual, Department for transport*, ISBN 1-84376-852-6, Edward Elgar, Cheltenham.

Belay, K. (2003), óAgricultural extension in Ethiopia: The case of participatory demonstration and training extension systemô, *Journal of Social Development in Africa,* 18(1):49-84.

Ben-Akiva, M., and Lerman, S.R. (1985), D*iscrete Choice Analysis: Theory and Application to Travel Demand,* MIT Press, Massachusetts.

Bliemer, C. J. and Rose, J. M. (2010), óConstruction of experimental designs for mixed logit models allowing for correlation across choice observations. *Transportation Research* 46(3):720-734.

Brinkerhoff, D.W. and Azfar, O. (2006), óDecentralization and community empowerment: Does community empowerment deepen democracy and improve service delivery?ô, *Paper prepared for U.S. Agency for International Development Office of Democracy and Governance*, Washington, DC.

Campbell, D., Hutchinson, G. W. and Scarpa, R. (2009), óUsing choice experiments to explore the spatial distribution of willingness to pay for rural landscape improvementsô, *Environment and Planning A*, 41(1):97-111.

Chipeta, S. (2006), "Demand Driven Agricultural Advisory Services", Neuchâtel group, Switzerland.

Davidson, P. (2007), "Participation, education and pluralism towards a new extension ethics", *Development in Practice,* 17(1):39-50

Davis, K.E. (2008), "Extension in Sub-Saharan Africa: Overview and assessment of past and current models, and future prospects", *Journal of International Agricultural and Extension Education,* 15(3):34-46.

Feder, G. (1988), *Land Policies and Farm Productivity in Thailand*, Baltimore: Johns Hopkins University Press.

Feder G., Willett A., Zijp W. (1999), "Agricultural Extension – Generic Challenges and Some Ingredients for Solutions", *World Bank Policy Research Working Papers 2129,* Washington, DC.

Foti, R., Nyakudya, I., Moyo, M., Chikuvire, J. and Mlambo, N. (2007), "Determinants of Farmer Demand for Fee-for-Service Extension in Zimbabwe: The Case of Mashona land Central Province", *Journal of International Agricultural and Extension Education,* 14(1):95– 104.

Freeman, A.M. (2003), *The Measurement of Environmental and Resource Values*, Resources for the Future, second Edition, Washington, DC.

GOK (Government of Kenya) (2005), "Public service allowances", *Government printers.*

GOK (Government of Kenya) (2012), óNational agricultural sector extension policy (NASEP): Ministry of Agriculture; Ministry of Livestock and Fisheries Development and Ministry of Cooperative Development and Marketing, *Government printers.*

González, C., Nancy, J., and Matin, Q. (2009), óConsumer acceptance of second-generation gm foods: the case of biofortified cassava in the North-East of Brazilô, *Journal of Agricultural Economics,* 60(3):604-606.

Hanemann, W. M. (1984), óWelfare evaluations in contingent valuation experiments with discrete responsesô, *American Journal of Agricultural Economics*, 66(3):332-341.

Hanemann, M.W. (1994), óValuing the environment through contingent valuationô, *Journal of Economic Perspectives,* 8:19-43.

Hanley, N., Mourato, S., Wright, R.E. (2001), óChoice modeling approaches: a superior alternative for environmental valuation?ô*Journal of Economic Survey,* 15(3):436-462.

Hausman, J. and McFadden, D. (1984), óSpecification tests for the multinomial logit modelô, *Econometrica,* 52:1219ï 1240.

Haynes, S., Hanley, N., and Scarpa, R. (2008), óEffects on welfare measures of alternative means of accounting for preference heterogeneityô, *American Journal of Agricultural Economics*, 20:1-17.

Hellin, J. and Dixon, J. (2008), óOperationalising participatory research and farmer-to-farmer extension: the Kamayoq in Peruô, *Development in Practice,* 18:4-5.

Hensher, D. A. and Greene, W. H. (2003), óThe mixed logit model: the state of practiceô, *Transportation*, 30(2):133-176.

Holloway, G. J., and Ehui, S. K. (2001), ôDemand, Supply, and Willingness-to-Pay for Extension Services in an Emerging-Market Settingö, *American Journal of Agricultural Economics,* 83: 764ï 768.

Huber, J. and Zwerina, K. (1996), ôThe importance of utility balance in efficiency choice designsö, *Journal of Market Research,* 33, 307-317.

Irungu, P., Omiti, J. M., and Mugunieri, L. G. (2006), ôDeterminants of farmersô preference for alternative animal health service providers in Kenya: A proportional hazard applicationö, *Agricultural Economics,* 35(1): 11-17.

James, P. (2010), ôUsing farmersô preferences to assess development policy: A case study of Ugandaö, *Development Policy Review,* 28(3):359-378.

Kameswari, L.V., Kishore, D., and Gupta, V. (2011), ôInformation and communication technology for agricultural extensionö, *The Electronic Journal on Information Systems in Developing Countries,* 48(3):1-12.

Kessels, R. Goos, P. and Vandebroek, M. (2004), ôComparing algorithms and criteria for designing Bayesian conjoint choice experimentsö, *Working paper No. 0427*, Department of Applied Economics, *Katholieke Universiteit*, Leuven.

Kibett M. (2005), ôElements of agricultural extension policy in Kenya: Challenges and opportunitiesö, *African Crop Science Conference Proceedings,* 7:1491-1494.

KNBS (Kenya National Bureau of Statistics) (2004), ôKenya Demographic and Health Surveyö, KNBS, Nairobi.

Kukamba, U. (2010), ôLocal government citizen participation and rural development: reflection on Ugandaôs decentralization systemö, *International Review of Administrative Sciences*, 76(1): 171-186.

Lancaster, K. (1966), ôA new approach to consumer theoryö, *Journal of Political Economy,* (74):132-157.

Louviere, J. J., Hensher, D. A., and Swait, J. D. (2000), *Stated Choice Methods: Analysis and Applications*, Cambridge University Press, Cambridge.

Maria, E.G., Jesus, B.H., and Ruto, E. (2010), ôWhat do farmers want from an Agri-Environment Scheme design? A choice experiment approachö, *Journal of Agricultural Economics,* doi: 10.1111/j.1477-9552.

McFadden, D. (1973), ôConditional logit analysis of qualitative choice behaviourö, in P. Zarembka (ed.), *Frontiers in Econometrics,* Academic Press, New York.

Muyanga, M. and Jayne, T. S. (2006), ôAgricultural extension in Kenya: Practice and policy lessonsö, *Working paper No. 26*, Tegemeo Institute of Agricultural Policy and Development, Nairobi.

Mwaura, F., Muwanika. F. R., Okoboi, G. (2010), ôWillingness to pay for extension services in Uganda among farmers involved in crop and animal husbandryö, *Paper presented at the joint 3rd African Association of South Africa (AEASA) Conference,* September 19-23, Cape Town, South Africa.

Ngigi, M. (2004), ôBuilding on successes in African agriculture: Smallholder dairy in Kenyaö, *International Food Policy Research Institute policy brief No. 6.*

NOAA (National Oceanic and Atmospheric Administration) (1993), Report of the NOAA Panel on contingent valuation, *Federa*l *Register,* 584602ï 14.

Obaa, B., Mutimba, J., Semana, A.R. (2005), ôPrioritising farmers extension needs in a publicly-funded contract system of extension: A case study from Mukono District, Ugandaö, Agricultural *Research and Extension Network paper No. 147.*

Oladele, O.I. (2008), ôFactors determining farmersô willingness to pay for extension services in Oyo State, Nigeriaö, *Agricultura Tropica et Subtropica,* 41 (4): 165-170.

Orodho, A.B. (2006), Country pasture/forage resource profiles, Kenya.

Otieno, D.J., Ruto, E., Hubbard, L. (2011), ôCattle farmers preference for disease-free zones in Kenya: An application of the choice experiment methodö, *Journal of Agricultural Economics,* 62(1):207-224.

Portney, P. R. (1994), ôThe contingent valuation debate: why economists should careö, *Journal of Economic Perspectives,* 8:3-17.

Quizon J., Feder G., Murgai R. (2001), ôNote on the Fiscal Sustainability of Agricultural Extension: The Case of the Farmer Field School Approachö, *Journal of International Agricultural Extension and Education,* 8 (1):312-328.

Revelt, D. and Train, K. (1998), ôMixed logit with repeated choices: Householdôs choices of appliance efficiency levelö, The R*eview of Economics and Statistics,* 80:647-657.

Rivera W.M., and Elkalla M.A. (1997), ôRestructuring agricultural extension in the Arab republic of Egyptö, *European Journal of Agricultural Education and Extension,* 3(4):251-260.

Rivera, W. (2004), 'Demand-Driven Approaches to Agriculture Extension, Case Studies of International Initiatives', *Agriculture and Rural Development Discussion Paper 10.*

Ruto, E., Garrod, G. and Scarpa, R. (2008), 'Valuing animal genetic resources: A choice modeling application to indigenous cattle in Kenya', *Agricultural Economics* 38:89–98.

Ruto, E. and Garrod, G. (2009), 'Investigating farmers preference for the design of agri-environment scheme: A choice experiment approach', *Journal of Environmental Planning and Management,* 52(5):631–647.

Scarpa, R., Ruto, E. S. K., Kristjanson, P., Radeny, M., Drucker, A., Rege, J. E. O. (2003), 'Valuing indigenous cattle breeds in Kenya: an empirical comparison of stated and revealed preference value estimates', *Ecological Economics,* 45,409-426.

Scarpa, R. and Rose, J.M. (2008), 'Design efficiency for non-market valuation with choice modeling: How to measure it, what to report and why', *Australian Journal of Agricultural and Resource Economics,* 52:253-282.

Smith, K.V. (1993), 'Nonmarket valuation of environmental resources: an interpretative appraisal', *Land Economics,* 69:1-26.

SSC (Statistical Service Centre) (1998), *On-farm trials-Some biometric guidelines,* The University of Reading, United Kingdom.

Stefan, D., Gunning, A.Z., Claudia, C., Simone L. (2012), 'Health insurance participation: experimental evidence from Kenya', *Micro insurance innovation facility research paper No. 10.*

Swait, J., Louviere, J., and Williams, M. (1994), óA sequential approach to exploiting the combined strengths of SP and RP Data: Application to Freight Shipper Choiceô, *Transportation* 21,135-152.

Train, K. E. (2003), *Discrete Choice Methods With Simulation*, Cambridge University Press, New York.

Ulimwengu J. and Sanyal P. (2011), óJoint estimation of farmers, stated willingness to pay for agricultural servicesô, *discussion paper 01070,* International Food and Policy Research Institute, Nairobi.

Winters, P., Salazar, L., and Maffioli, A. (2010), óDesigning impact evaluation for agricultural projects, *Impact-evaluation guidelines,* Inter-American Development Bank (IDB) technical notes No. IDB-TN-198.

Chapter Four

4 Conclusions and Policy Recommendations

4.1 Summary

The purpose of this study was to investigate farmersô preferences for participatory design of agricultural extension programs within the devolved governance system in Kenya. The specific objectives included: to assess farmersô awareness of agricultural extension devolution and to analyze their willingness to pay for various attributes considered to be important for an agricultural extension program design. Data were collected in Meru County using semi-structured questionnaires through face-to-face interviews on a representative multi-stage sample of 288 farmers. A binary logit model was employed to investigate the characteristics of the farmer and the farm that might influence farmersô awareness of the extension devolution. Further, random parameter logit model was used to analyze the farmersô willingness to pay for different AEP attributes. The interaction variables between the AEP attributes and farmer characteristics were also created to determine their effect on the willingness to pay for the AEP attributes.

The level of agricultural extension devolution awareness was found to be about 44 percent which indicated the need to raise awareness on extension devolution. The mean awareness was significant at 5 percent level hence the hypothesis that farmers were not significantly aware of extension devolution was rejected. The factors that were found to have a positive effect on awareness include: attendance for farmer field day, land tenure security, income and education. Age, gender and farm size were found not to influence extension devolution awareness. These findings may have policy implications on policies aimed at increasing public awareness on agricultural extension devolution system.

In high potential areas where a large number of farmers practiced dairy farming, the WTP for livestock and fisheries extension was higher than in low potential areas. It was noted that in both zones, farmers were WTP for on-farm research-extension-farmer linkage and frequent review and evaluation of extension programs. However, farmers would like to be compensated or paid to participate in the process of developing the content of extension programs. From the FGDs, this was envisaged to be the transport and lunch cost incurred on farmerôs part. The AEP policy scenario which comprised on-farm linkage was found to be highly preferred by farmers. In overall, farmers in high potential zone had higher WTP estimates compared to those in low potential zone. Education, source of market information and land tenure security were found to significantly influence farmersô WTP for AEP attributes.

4.2 Conclusions and Policy Recommendations

Among the goals of this study was to assess devolution awareness level with regard to agricultural extension. Results showed that less than half of the respondents were aware of extension devolution. The objects of devolution include enhancing the participation of the people in making decisions affecting them (GOK, 2012). To achieve this objective, awareness and understanding of the devolved system among citizens is crucial and this result indicates the need to invest in public awareness programs on devolved agricultural extension system. Farmers need be informed and educated on their roles and rights in order to enhance agricultural sector in the Counties.

In addition, farmers who attend farmer field days were found to be more aware of extension devolution, implying that the exposure to and contact with farmer field day organizers/ facilitators and fellow farmers were essential in dissemination of information about extension devolution. Simtowe et al. (2012) also found access and exposure to extension agents to

positively influence awareness of new agricultural technologies. This result shows agricultural extension forums to be an important avenue of diffusing information hence it is envisioned that incorporating devolution education in such forums and narrowing down to how farmers could be integrated in designing extension could enhance awareness and farmer participation.

Results show awareness level to be directly related to education, meaning that farmers who had attained a higher level of education were more aware of extension devolution. This suggests that it requires relatively high level of literacy to access and process available information on extension devolution. Most of the information such as that on devolution is published in materials such as newspapers or aired on radios and television in Kiswahili or English languages (GOK, 2012). Moreover, such information may not be specific on extension devolution. Considering that farmers and particularly small scale farmers generally have low levels of education (about half of the respondents had attained primary education at most), they may not be able to synthesize extension devolution from the broad information on devolution presented in unfamiliar languages. Hence it may appear reasonable for the County governments to promote policies on publishing and airing extension devolution information in languages easily understandable by less literate farmers particularly in vernacular. Public and private investors could consider provision of incentives to Radios and television channels which air information in vernaculars to slot in more programs on agricultural extension devolution.

Land tenure security was as well found to significantly influence extension devolution awareness, that is, farmers who had title deeds of their farm lands were more knowledgeable of extension devolution. Considering that the tenure system in Kenya and specifically in this area is privatized (Akinyi, 2006), and that agriculture is a land-based enterprise, policies to ease acquisition of farm title deeds are necessary for agriculture development. Exclusive rights to

access and use of farm lands may encourage investment in agriculture enterprises hence making farmers interested in agriculture related information such as extension devolution. Improving awareness and understanding of extension devolution would enable farmers to exercise their roles and rights in shaping extension service system, which could possibly contribute to development of agriculture sector.

This study has also focused on analysis of farmersô WTP for various key components of AEPs and provides insights into policy on development of appropriate extension programs for Kenyan clientele in different ecological zones. Results show that farmers are WTP for most of the attributes included in the study. Compared to the current process of designing extension programs which engages more the local extension officials and few farmers specifically the group leaders and those who manage to attend such meetings, this result indicates that farmers prefer a more participatory design of extension programs. The study suggests that farmers should be incorporated in the boards which are involved in the process of designing extension programs; either as individuals or farmer representatives depending on the cost.

The study finds heterogeneity in farmer preference for AEP attributes. Farmers in high potential zone, where dairy farming is commonly practiced had higher WTP for extension program focusing on livestock and fisheries while those in low-potential zone were WTP more for horticulture extension programs. This result indicates that extension programs on local agricultural enterprises could be of high potential benefit to farmers. Therefore, the study suggests that deployment of extension skills should consider the skills required by the clients in different agro-climatic zones. This would help avoid wastage of resources in cases where the skill does not meet farmersô needs. Generally, farmers in the high-potential zone have higher

WTP for all AEP attributes than those in low-potential zone due to high value agricultural enterprises practiced in the area.

According to the results, it appears that on-farm research-extension-farmer linkage is important as compared to on-station linkage especially in ensuring that farmers environment and conditions are accounted for in development of agricultural technologies. In order to encourage farmer participation in extension content development, it appears reasonable to emphasize on some compensation (transport or lunch allowances) to farmers for their time. Monitoring and short term evaluation of the programs is preferred by farmers in both zones. Generally, the WTP values were found to be high, which could suggest strong preference for participatory extension program designing.

Farmersô preferences for various AEP options were also derived and the results show that farmers in both zones had a high preference for AEPs scenarios that included on-farm research-extension-farmer linkage. Development of appropriate institutions and resource mobilization is necessary to ensure fair harmonization of priorities of different stakeholders in planning, designing and implementation of extension programs. Agricultural extension Policy should promote formation of farmer groups at village level and encourage priority setting and extension program designing process to start at such grass root organizations. Rules and guidelines should be set and enforced (probably by the County extension office) to ensure that the farmer groups participate in such activities. NGOs are known to have an advantage in bringing together local communities (Anderson and Crowder, 2000) hence, it is envisaged that involving them in mobilizing farmer groups might enhance farmer participation.

4.3 Contribution to Knowledge and Suggestions for Future Research

This study contributes to knowledge in that it offers insight on agricultural extension devolution awareness among Kenyan farmers and contributes to the literature on awareness of public programs and policies. This is useful information for development of policy and strategies to improve local community awareness and understanding of devolved system of agricultural extension in order to enhance their participation in improving service delivery. The use of CE in analyzing farmersô WTP for AEP attributes contributes to the limited empirical applications especially in Kenya and represents a useful application in incorporating stakeholdersô opinions in policy design. Moreover, the use of prior coefficient from orthogonal design to create an efficient design in this study contributes to the thin empirical literature on complementarities of both criteria particularly in developing countries.

Future research could focus on issues relevant to this study but were left out due to time and budget constraints. Considering that a large number (about 75 percent) of Kenyan population are farmers, the scope of the study was limited since it focused on a small area relative to Meru County and even whole country. In addition, the farmer and farm characteristics used account for only about 24 percent in influencing farmersô awareness hence; future research could focus on a larger area and wider range of variables to give more representative results.

The current study focused on farmers WTP for extension services at the production level. Future research could focus on other areas such as credit and input supply related extension services, which are crucial in enabling farmers apply agricultural skills and knowledge (Obaa et al., 2005). The AEP policy scenarios were based on ecological conditions and other studies could categorize the AEP based on other variables such as farming system or even farmer socio-economic stratification.

References

Akinyi, N. (2006) ó*Land policies in sub-Saharan Africa'*, Nairobi: The Centre for Land, Economy and Rights of Women.

Anderson, J. and Van Crowder, L. (2000), ó The present and future of public sector extension in Africa: contracting out or contracting in?ô *Public Administration and Development,* 20:373-384.

GOK (Government of Kenya) (2012), ónational agricultural sector extension policy (NASEP): Ministry of Agriculture; Ministry of Livestock and Fisheries Development and Ministry of Cooperative Development and Marketing, *Government printers.*

Obaa, B., Mutimba, J., and Semana, A.R. (2005), óPrioritizing farmers extension needs in a publicly-funded contract system of extension: A case study from Mukono District , Ugandaô, *Agricultural Research and Extension Network, Paper no. 147.*

Simtowe, F., Muange, E., Munyua, B. and Diagne, A. (2012), óTechnology awareness and adoption: the case of improved pigeon pea varieties in Kenyaô, *Paper presented at the international association of agriculture economists (IAAE) triennial conference*, Brazil.

Appendices

Appendix 1: Household survey questionnaire Date: 10/4/2013

Farmers' Preferences for Agricultural Extension Program Design Survey in Kenya 2013

Objective of the Survey (Enumerator should explain to the respondent)

The aim of this survey is to obtain farmers opinions and experiences on how to improve the design of extension programs in order to better address their daily farm needs. Extension program refers to systems that facilitate access of farmers and their organization to knowledge, information and technologies; facilitate their interaction with partners in research, education and agri-business and assist them to develop their own technical, organizational and management skills and practices. The survey is being undertaken on random sample of farmers and the respondent shall be the main decision maker regarding the access and use of extension services. About 300 respondents will be randomly selected from Meru County and the information they give will be treated confidentially. This information will be used to facilitate development of policies that enhance demand driven extension in Kenya. The interview will not take more than one hour and with your permission, I would like to start the interview.

Identification

Interviewerôs code: _____ Household No_____

Date of interview (dd /mm /yy): _____ Start Time: _____End Time: _____

Respondents Name (optional): _____

County: _____ Division: _____

Location: _____ Sub-location: _____

Village: _____ Agro-Ecological Zone (High/low potential)_____

Section A: Technology Use and Agricultural Extension

1. Do the household use extension services on either crop or livestock production? 1= yes 2= No._____ If NO go to question 5 .
2. If yes, please answer the table below:

Extension content	Did you seek extension service in the last 12 months? 1=Yes 2=No	If yes, did you get? 1=yes 2= no	Where did you get extension Information? 1=Public agent 2=NGO agent 3=Company agent 4=Farmer organizations /cooperatives 5=Traders/input dealers 6=Researcher 7= fellow farmer 8= media	How did u receive it? 1= agent came on your schedule 2= agent came on their extension Program 3=went to extension station 4= media	Channel used to deliver the information 1=Field day/demonstration 2= ASK shows 3=radio/television 4=newspaper/magazine 5= mobile phone	Which two MAIN REASONS made you choose/use this particular service provider 1= located near me 2=get it when you need it 3=cheaper 4=give information i need 5=other(specify)_____	
						Source 1	Source 2
Crop production extension			Source 1:__				
			Source 2:__				
Livestock extension			Source 1:__				
			Source 2: __				

3. What is the level of your satisfaction with the performance of agricultural extension service? Tick the appropriate answer.

	Very satisfied	satisfied	neutral	dissatisfied	Very dissatisfied
Timeliness of information					
Information is adequate/enough					
Agent knowledgeable (professionalism)					
Relevancy of information					

4. Have you applied any of the recommendations made by the extension worker/s?_____ 1=Yes 2=No 3=Some

   If no, why not?

   1 =Canôt afford 2= Not appropriate 3=Not interested 4=Same as what Iôve been using 5=Too demanding of my time 6=Other (specify) _____

5. Answer if the household do not use extension services. What are the reasons for not using extension services on the householdôs agricultural enterprises? _____ 1=not interested 2=not accessible, 3=not affordable,4=not useful, 5=Other (specify)_____

6. How would you like extension and other technical information packaged so that it is more useful to your household?

   Codes for information packaging: 1=Print (Brochures, Pamphlets, and leaflets) 2= Radio 3= Television 4= Internet 5= Others, Specify_____

   And in which language?_____

   Codes for languages: 1= English 2=Kiswahili 3= Vernacular

7. Over the last 12 months, what is the approximate money you spend on livestock extension? Ksh_____,On crop extension? Ksh_____

8. Please answer the following table on Farmer field days (FFD) ?

Are you aware of FFD in this area? 1=yes 2=no	Where are the FFDôs meetings held? 1=experimental station 2=members farm	Which two service providers commonly organizes for a FFDôs meetings 1=public extension agents 2=NGO agents 3=Agro-chemical company agents 4=Researchers 5=cooperatives 6=other(specify_____)		Do you attend the FFD? 1=yes 2=no	If yes, to what extent do you think the information from FFD is useful? 1=very useful 2=useful 3=not useful	If do not attend, why? 1= no time to attend 2=not useful 3=not invited 4=not affordable 5= donôt like venue 6= other (specify_____)
		CHOICE 1	CHOICE 2			

9. Are you aware that in the devolved government agricultural extension will be dealt with at county level?_____1= Yes 2=No

10. Where did you get information that agricultural extension issues will be devolved to county level? ___ 1= Political rallies 2= Radio and/or television 3=farmer groups/meetings 4= Neighbors 5= Others (specify)_____

11. Suppose extension programs were to be designed at county level, to what extend do you think these features are important to address?

Extension program Attributes	[1=very important; 2=important; 3=not important]
Extension content	
Content developer	
Technology developer, extension agent &farmer linkage	
Monitoring &evaluation of extension programs	
Price to be paid per visit	

Section B: Choice Experiment on Extension Program Design*(The enumerator should explain this section before asking following questions 1, 2, 3, 4).*

Suppose the Agricultural Extension systems in Kenya are to be reformed/ redesigned. The new systems would comprise compulsory and voluntary features. The compulsory features would ensure public confidence in extension program and that they operate within the regulatory framework of the country. These include:

(i) The extension service providers shall be required to obtain approval from the county Agricultural office.

(ii) Extension service providers shall be legally registered by the government; proof of legal registration of company

(iii) The minimum education qualification of the extension agents shall be diploma level

(iv) The public extension service providers will be required to submit periodic reports on performance.

(v) If payment is required, the farmer must pay for the extension service provided

(vi) The farmer must report to the agricultural office any ill advice given by the agents which causes destruction of crops of livestock

(vii) There shall be full disclosure of information relating to the developer of any new technology. Propagation of misleading information on a new technology by extension agent or farmers will attract penalties.

(viii) Farmers will be required to form common interest groups and elect management committee which will be assisted by government officials.

(ix) Farmers must pay a group membership fee if required

In addition to the compulsory features, the following are voluntary features which you are required to choose the best combination that you prefer included in an extension program.

Extension design attribute	Description of attribute	Attribute levels
Extension content	The area of specialization or focus/what should the extension program focus on?	Livestock & fisheries, cereals, horticulture
Content developer	Who should design the content of the program after the type of extension has been identified?	Extension provider only, extension provider and client/farmers, client/farmer only.
Research-extension-farmer linkage / outreach activities	In which venue/where should farmer field days be conducted to promote outreach/linkages between technology developers/researchers, extension agents and farmers?	Meeting at experimental research station, on farm meeting but rotating to all farms.
Monitoring and evaluation of the program	Frequency of review of the extension program	After 2 years, 4years ,6years
Price of extension program/service	The amount of money that farmers should pay per visit	Ksh.950, Ksh.1200, Ksh 1700

1. Which one of the following descriptions of an agricultural extension program would you prefer?

Choice set 1

AEP Attribute	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	horticulture	livestock &fisheries	
Content designer	provider & farmers	provider & farmers	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	4 years (medium)	4 years (medium)	
Price	Ksh 1200	Ksh 1200	
Choice question: Which extension program do you prefer?			

Choice set 2

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	livestock & fisheries	horticulture	
Content designer	farmers	provider	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	4 years (medium)	4 years (medium)	
Price	Ksh 950	Ksh 1700	
Choice question: Which extension program do you prefer?			

Choice set 3

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	cereals	cereals	
Content designer	farmers	provider	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	2 years (short)	6 years (long)	
Price	Ksh 1700	Ksh 950	
Choice question: Which extension program do you prefer?			

Choice set 4

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	cereals	cereals	
Content designer	provider	farmers	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	6 years (long)	2 years (short)	
Price	Ksh 1700	Ksh 950	
Choice question: Which extension program do you prefer?			

2. How sure are you about the choices you have made in the extension program options?

   1= very sure 2=sure 4= probably sure 5= not sure

3. Did you consider the following attributes when making your choice?

Attribute	1=Always considered	2=Sometime considered	3=Never considered
Extension content			
Content developer			
Research-extension-client linkage			
Monitoring &evaluation of program			
price			

4. Did you consider any other factor when responding to choice experiment questions apart from the information given in the survey? 1=yes 2=no If yes, please specify_____

Section C: Household Enterprises

1. How many pieces of land holding do this household use? _____

2. How many of these pieces of land holding do the household own? _____, Approximation in acres? _____

3. Do you have any document to proof ownership of these land holding?_____1= Yes 2=No

4. Please answer the table below on the commercial crops this house hold grew during the last main crop season.

Three main commercial crops grown in past 12 months *See crop code below*	Size of the land covered by the cash crop in acres	Is this farm 1 =owned with deed 2 =owned without deed 3 =rented 4 =owned by parents/relative 5=government/ communal/ co-operative	Planted seed type 1=purchased new hybrid 2=retained hybrid 3=local variety 4=seedlings/splits /cuttings 5=hybrid &local variety 6=hybrid purchased &retained 7= not applicable	Fertilizer used? 1= Yes 2=No	Quantity harvested *99= if not yet harvested*		Quantity sold		Main buyer 1=small trader 2=larger trader 3=KTDA 4=coffee coop 5=NCPB 6=miller 7=other coop 8=NGO 9= consumer
					qty	unt	qty	unt	

Unit codes: 1=tonnes 2=5-10(90 kg bags) 3=1-4(90 kg bags) 4=kgs 5=litre 6=crates 7=numbers	8=bunches 9=wheelbarrow 10=cart 11=canter 12=pickup 13=2kg packet(seed)	Crop codes: 1=maize 2=beans 3=tea 4=coffee 5=pyrethrum	6=Irish potatoes 7=Peas 8=yams 9=sorghum 10=green grams	11=groundnuts 12=millet 13=Cassava 14=Banana 15 cotton 16= khut

5. How do you prepare the land on which you plant the above mentioned commercial crops?

1= Manual __which commercial crops_____

2= Oxen__ which commercial crops_____

3= Tractor __which commercial crops_____

4= Not applicable_ Which commercial crops

6. What type of watering system do you use on your commercial crop?

1= Rain fed__ which commercial crops _____

2= irrigated__ which commercial crops_____

3= Rain fed & irrigation__ which commercial crops_____

7. Please answer the table below on the food crops this house hold grew during the last main crop season.

Three main food crops grown in past 12 months *Use previous crop code*	Size of the land covered by the food crop in acres	Is this farm 1 =owned with deed 2 =owned without deed 3 =rented 4 =owned by parents/ relative 5=government /communal /co-operative	Planted seed type 1=purchased new hybrid 2=retained hybrid 3=local variety 4=seedlings/ splits/cuttings 5=hybrid &local variety 7=hybrid purchased &retained	Fertilizer used? 1= Yes 2=No	Quantity harvested *99= if not yet harvested*		Quantity sold		Main buyer 1=small trader 2=larger trader 3=KTDA 4=coffee coop 5=NCPB 6=miller 7=NGO 8=Consumer 9=other (specify_____ 9=c
					qty	unt	qty	unt	

Unit codes: 1=tonnes 2=5-10(90 kg bags) 3=1-4(90 kg bags) 4=kgs 5=litre 6=crates 7=numbers	8=bunches 9=wheelbarrow 10=cart 11=canter 12=pickup 13=2kg packet(seed)	Crop codes: 1=maize 2=beans 3=tea 4=coffee 5=pyrethrum	6=Irish potatoes 7=Peas 8=yams 9=sorghum 10=green grams	11=groundnuts 12=millet 13=Cassava 14=Banana 15 cotton 16= khut

8. How do you prepare the land on which you plant the above mentioned food crops?

   1= Manual __which food crops_____

   2= Oxen__ which food crops_____

   3= Tractor __which food crops_____

9. What type of watering system do you use on your food crop?

   1= Rain fed__ which food crops _____

   2= irrigated__ which food crops_____

   3= Rain fed & irrigation__ which food crops_____

10. In the past 12 months, did this household keep livestock? 1=yes 2=no

11. If yes, complete the following table on the household livestock activities over the past 12 months

Four main Type of livestock kept by this household *Use livestock codes below*	Number Owned by the household currently	Number Died In last 12 months	Number Sold In last 12 months	Main feed used? *Use feed* *codes* *below*

Livestock codes	Livestock codes	Codes for animal feed
	7=goats	AF1=Napier grass
1= Dairy cows	8= indigenous chicken	AF2=Agricultural by-products
2= grade bulls	9= improved chicken	AF3=Open pasture
3=cross bulls	10= Ducks/ghees	AF4= Commercial concentrates
4= local cows	11= Turkey	AF5= Others specify
5= local bulls	12 Rabbit	
6=sheep	13 Other (specify_____	

12. Did this household produce any milk during the past 12 months? (1=yes 2=no)

13.In average, how many animals were producing the milk?

Cows_____ Goats_____

14. What was the average quantity of milk produced per day? Cow milk_____ Goat milk_____

15. Average quantity of milk sold per day?

Cow milk sold_____ Goat milk sold_____

16. Who was the main buyer of the milk?

Cow milk buyer_____ Goat milk buyer_____

1=Cooperative societies 2=K.C.C. 3=Private processors/traders 4=Hawker /informal trader 5=Institutions/Hotels 6=Consumer /Neighbor/Farmer

7=Other , specify_____

17. What was the common price you received per liter?

Cow milk price _____ Ksh Goat milk price _____Ksh

18. Do you have other enterprises apart from farming? 1=yes 2=No

19. If yes, which ones?

enterprise		Location (1= village; 2=town; 3=city)
Retail shop	1	
Grocery shop	2	
Kiosk	3	
Others(specify)	4	

Section D: Institutional Services

1. Are you a member of any community based group? 1=Yes 2=No

   If yes, which ones?___ 1=Youth Group; 2=Women Group; 3=Men Group; 4=Church Group; 5=Water User Group; 6=Forest User Group; 7=Community Welfare Group; 8=Common Interest Group; 9=Business group;
   10=Other(specify)_____

2. Where do you get market information? _____1=radio; =2Television 3=Neighbour 4=extension officer 5=farmer group 6= cooperative 7=Other(specify)_____

3. Credit

Credit providers		Did you apply for credit in the last 12 months? 1=yes 2=no	Did you get? 1=yes 2=no	Have you paid? 1= fully paid 2= paying 3= not started paying	On what enterprise did you use your credit on? 1=farm related enterprise 2=non-farm enterprises
1	Bank				
2	Cooperatives				
3	Self-help group				
4	Individual lenders				

Section E: Socio-demographic Characteristics

1. Personal information of the respondent:

Gender of the respondent? 1=male 2=female	Marital Status of the respondent? *See codes Below*	What is the respondentôs highest level of education? *See codes below*	Does the respondent reside at home? 1= yes 2=no	What is the main occupation of the respondent? *See code below*	Age of the respondent

Marital status codes	**Education level codes**	**Occupation codes**
1=single	1=none	1= civil servant
2= married	2= primary school	2=crop farmer
3=divorced	3=secondary school	3=livestock farmer
4=widowed	4=Certificate level	4=fish farmer
5=separated	5= diploma level	5=businessman
	6= undergraduate degree	6=other(specify_____)
	7=masters degree	
	8= PhD	

2. Household composition and age structure:

Number of adult male members (18 years and above)	
Number of adult female members (18 years and above)	

3. What is the average monthly net income of this household?

Income group	Tick category	Write average amount(ksh)
Below 10,000		
10,001-20,000		
20,001-40,000		
40,001-50,0000		
50,001-90,000		
90,001-140,000		
Above 140,000		

THANK YOU

Appendix 2: Checklist questionnaire used in the focus group discussion

Focus group discussion 2013

Kenya

Respondents

The respondents for this Focus Group Discussion shall be a small group of 8 ï 14 farmers who must be farmers in one of the divisions where the survey is being undertaken.

Objectives

The main purpose of the Focus Group Discussion is to obtain some general information on agricultural extension. The information gathered from the Discussion will be kept confidential and will only be used for purposes of advising policy making on how to make extension services relevant to farmers conditions. The opinions and views of each participant are very important and you are all encouraged to participate fully in this discussion. The discussion will take about one to one-and-half hours. With your permission, I would like to start the discussion.

Division_____

Village_____

Date _____

1. Where do you get agricultural extension services?
2. Which extension programs do you have in this area?
3. What do these extension program focus on?
4. Are you consulted before these programs are developed?
5. On what issues do you think farmers should be consulted before development of an extension program
6. which crops/livestock would you like extension programs to focus on
7. How often would you like extension programs reviewed?
8. How much do you pay extension agents when they visit your farm? How much do you think you should pay?

9. Are you aware that in the devolved government some agricultural sector issues will be dealt with at county level?

10. To what extent do you think the following agricultural extension components/features are important to address at county level

Extension program Attributes	
Extension content	
Content developer	
Technology developer, extension agent &farmer linkage	
Monitoring &evaluation of extension programs	
Price to be paid per visit	

11. What other extension program attributes/features would you like addressed at county level?

Appendix 3: NGENE choice experiment design syntax

(a) Orthogonal design for preliminary survey

Design

; alts = alt1, alt2

; rows = 36

; block = 6

; orth = sim

; model:

U(alt1) = b0+b1*x1[0,1,2]+b2*x2[0,1,2]+b3*x3[0,1]+b4*x4[0,1,2]+b5*x5[0,1,2]/

U(alt2) = b1*x1 +b2*x2 +b3*x3 +b4*x4 +b5*x5$

(b) Efficiency design for final survey

Design
;alts = alt1, alt2
;rows = 24
;block = 6
;eff = (mnl,d)
;model:
U(alt1) = b1[1.156]*x1[0,1,2]+b2[0.687]*x2[0,1,2]+b3[0.338]*x3[0,1]+b4[0.847]*x4[0,1,2]+b5[-0.0003]*x5[0,1,2]/
U(alt2) = b1 *x1 +b2 *x2 +b3 *x3 +b4 *x4 +b5 *x5$

Appendix 4: List of all choice sets used in the choice experiment survey

(a) Profile 1

Choice set 1

AEP Attribute	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	horticulture	livestock &fisheries	
Content designer	provider & farmers	provider & farmers	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	4 years (medium)	4 years (medium)	
Price	Ksh 1200	Ksh 1200	
Choice question: Which extension program do you prefer?			

Choice set 2

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	livestock & fisheries	horticulture	
Content designer	farmers	provider	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	4 years (medium)	4 years (medium)	
Price	Ksh 950	Ksh 1700	
Choice question: Which extension program do you prefer?			

Choice set 3

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	cereals	cereals	
Content designer	farmers	provider	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	2 years (short)	6 years (long)	
Price	Ksh 1700	Ksh 950	
Choice question: Which extension program do you prefer?			

Choice set 4

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	cereals	cereals	
Content designer	provider	farmers	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	6 years (long)	2 years (short)	
Price	Ksh 1700	Ksh 950	
Choice question: Which extension program do you prefer?			

(b) Profile 2

Choice set 1

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	horticulture	cereals	
Content designer	provider & farmers	provider & farmers	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	4 years (medium)	2 years (short)	
Price	Ksh 1200	Ksh 1200	
Choice question: Which extension program do you prefer?			

Choice set 2

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	livestock & fisheries	horticulture	
Content designer	farmers	provider	
Farmer- agent- researcher linkage activities	On farm	experimental station	
Evaluation period	4 years (medium)	4 years (medium)	
Price	Ksh 950	Ksh 1700	
Choice question: Which extension program do you prefer?			

Choice set 3

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	livestock & fisheries	horticulture	
Content designer	provider & farmers	provider & farmers	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	6 years (long)	4 years (medium)	
Price	Ksh 1200	Ksh 1200	
Choice question: Which extension program do you prefer?			

Choice set 4

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	cereals	horticulture	
Content designer	provider	farmers	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	6 years (long)	2 years (short)	
Price	Ksh 950	Ksh 1700	
Choice question: Which extension program do you prefer?			

(c) Profile 3

Choice set 1

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	horticulture	livestock & fisheries	
Content designer	provider & farmers	provider & farmers	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	2 years (short)	6 years (long)	
Price	Ksh 1200	Ksh 1200	
Choice question: Which extension program do you prefer?			

Choice set 2

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	livestock & fisheries	cereals	
Content designer	farmers	provider	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	2 years (short)	4 years (medium)	
Price	Ksh 1700	Ksh 950	
Choice question: Which extension program do you prefer?			

Choice set 3

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	horticulture	livestock & fisheries	
Content designer	provider	farmers	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	2 years (short)	6 years (long)	
Price	Ksh 1200	Ksh 1200	
Choice question: Which extension program do you prefer?			

Choice set 4

AEP Attributes	Alternative 1	Alternatives 2	Neither 1nor 2
Extension content	cereals	livestock & fisheries	
Content designer	provider	farmers	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	6 years (long)	2 years (short)	
Price	Ksh 950	Ksh 1700	
Choice question: Which extension program do you prefer?			

(d) Profile 4

Choice Set 1

AEP Attributes	Alternative 1	Alternative 2	Neither 1nor 2
Extension content	livestock & fisheries	horticulture	
Content designer	provider & farmers	provider & farmers	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	4 years (medium)	4 years (medium)	
Price	Ksh 1200	Ksh 1200	
Choice question: Which extension program do you prefer?			

Choice Set 2

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	horticulture	livestock & fisheries	
Content designer	provider	farmers	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	4 years (medium)	6 years (long)	
Price	Ksh 1700	Ksh 950	
Choice question: Which extension program do you prefer?			

Choice set 3

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	livestock & fisheries	horticulture	
Content designer	provider &farmers	provider & farmers	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	6 years (long)	2 years (short)	
Price	Ksh 1700	Ksh 950	
Choice question: Which extension program do you prefer?			

Choice set 4

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	horticulture	livestock & fisheries	
Content designer	provider	farmers	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	2 years (short)	6 years (long)	
Price	Ksh 1700	Ksh 950	
Choice question: Which extension program do you prefer?			

(e) Profile 5

Choice set 1

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	horticulture	livestock & fisheries	
Content designer	provider	farmers	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	2 years (short)	6 years (long)	
Price	Ksh 950	Ksh 1700	
Choice question: Which extension program do you prefer?			

Choice set 2

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	cereals	cereals	
Content designer	farmers	provider	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	4 years (medium)	4 years (medium)	
Price	Ksh 1700	Ksh 950	
Choice question: Which extension program do you prefer?			

Choice set 3

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	cereals	livestock & fisheries	
Content designer	farmers	provider	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	2 years (short)	6 years (long)	
Price	Ksh 950	Ksh 1700	
Choice question: Which extension program do you prefer?			

Choice set 4

AEP Attribute	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	horticulture	cereals	
Content designer	farmers	provider	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	2 years (short)	6 years (long)	
Price	Ksh 950	Ksh 1700	
Choice question: Which extension program do you prefer?			

(f) Profile 6

Choice set 1

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	livestock &fisheries	horticulture	
Content designer	provider & farmers	provider & farmers	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	4 years (medium)	4 years (medium)	
Price	Ksh 1200	Ksh 1200	
Choice question: Which extension program do you prefer?			

Choice set 2

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	cereals	cereals	
Content designer	provider	farmers	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	6 years (long)	2 years (short)	
Price	Ksh 950	Ksh 1700	
Choice question: Which extension program do you prefer?			

Choice set 3

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	cereals	cereals	
Content designer	provider & farmers	provider & farmers	
Farmer- agent- researcher linkage activities	on farm	experimental station	
Evaluation period	6 years (long)	2 years (short)	
Price	Ksh 1200	Ksh 1200	
Choice question: Which extension program do you prefer?			

Choice set 4

AEP Attributes	Alternative 1	Alternative 2	Neither 1 nor 2
Extension content	livestock & fisheries	horticulture	
Content designer	farmers	provider	
Farmer- agent- researcher linkage activities	experimental station	on farm	
Evaluation period	6 years (long)	2 years (short)	
Price	Ksh 1700	Ksh 950	
Choice question: Which extension program do you prefer?			

Appendix 5: Random parameter logit commands

(a) Pooled sample

Parameters

```
Title; rpl for farmers in both high and low potential zones

Sample; all$
    RPLOGIT; Lhs=CHOICE
   ;CHOICES=a,b,c
   ;Rhs = LVSTCKF,HOTCUL,PRVDERF,FMRS,ONFAM,SHORT,LONG,PRICE
   ;FCN= LVSTCKF(N),
   HOTCUL(N),
   PRVDERF(N),
   FMRS(N),
   ONFAM(N),
   SHORT(N),
   LONG(N),
   PRICE(C)
   ;pds=4
   ;halton
   ;pts=100$
```

WTP estimates

```
WALD; Labels=b1,
b2,
b3,
b4,
b5,
b6,
b7,
b8,
sd_b1,
sd_b2,
sd_b3,
sd_b4,
sd_b5,
sd_b6,
sd_b7,
Fix_b8
;start=b
;Var=Varb
;Fn1=-1*(b1/b8)
;Fn2=-1*(b2/b8)
;Fn3=-1*(b3/b8)
;Fn4=-1*(b4/b8)
;Fn5=-1*(b5/b8)
;Fn6=-1*(b6/b8)
;Fn7=-1*(b7/b8)$
```

Compensating surplus

```
WALD; Labels=b1,
b2,
b3,
b4,
b5,
b6,
b7,
b8,
sd_b1,
sd_b2,
sd_b3,
sd_b4,
sd_b5,
sd_b6,
sd_b7,
Fx_b8
;start=b
;Var=Varb
;Fn1=(-1/b8)*(b1*1+b2*0+b3*0+b4*0+b5*1+b6*0+b7*1)
;Fn2=(-1/b8)*(b1*0+b2*1+b3*0+b4*1+b5*0+b6*1+b7*0)
;Fn3=(-1/b8)*(b1*1+b2*0+b3*0+b4*1+b5*1+b6*0+b7*1)
```

;Fn4=(-1/b8)*(b1*0+b2*1+b3*0+b4*0+b5*1+b6*0+b7*1)$

(b) High potential sample
Parameters

Title; rpl for farmers in high potential zone

Sample; all$
RPLOGIT; Lhs=CHOICE
;CHOICES=a,b,c
;Rhs = LVSTCKF,HOTCUL,PRVDERF,FMRS,ONFAM,SHORT,LONG,PRICE
;FCN= LVSTCKF(N),
HOTCUL(N),
PRVDERF(N),
FMRS(N),
ONFAM(N),
SHORT(N),
LONG(N),
PRICE(C)
;pds=4
;halton
;pts=100$

WTP estimates

WALD; Labels=b1,
b2,
b3,
b4,
b5,
b6,
b7,
b8,
sd_b1,
sd_b2,
sd_b3,
sd_b4,
sd_b5,
sd_b6,
sd_b7,
Fix_b8
;start=b
;Var=Varb
;Fn1=-1*(b1/b8)
;Fn2=-1*(b2/b8)
;Fn3=-1*(b3/b8)
;Fn4=-1(b4/b8)*
;Fn5=-1*(b5/b8)
;Fn6=-1*(b6/b8)

;Fn7=-1*(b7/b8)$

Compensating Surplus

```
WALD; Labels=b1,
b2,
b3,
b4,
b5,
b6,
b7,
b8,
sd_b1,
sd_b2,
sd_b3,
sd_b4,
sd_b5,
sd_b6,
sd_b7,
Fx_b8
;start=b
;Var=Varb
;Fn1=(-1/b8)*(b1*1+b2*0+b3*0+b4*0+b5*1+b6*0+b7*1)
;Fn2=(-1/b8)*(b1*0+b2*1+b3*0+b4*1+b5*0+b6*1+b7*0)
;Fn3=(-1/b8)*(b1*1+b2*0+b3*0+b4*1+b5*1+b6*0+b7*1)
;Fn4=(-1/b8)*(b1*0+b2*1+b3*0+b4*0+b5*1+b6*0+b7*1)$
```

(c)Low potential sample
Parameters

```
Title; rpl for farmers in low potential zone

Sample; all$
 RPLOGIT; Lhs=CHOICE
;CHOICES=a,b,c
;Rhs = LVSTCKF,HOTCUL,PRVDERF,FMRS,ONFAM,SHORT,LONG,PRICE
;FCN= LVSTCKF(N),
HOTCUL(N),
PRVDERF(N),
FMRS(N),
ONFAM(N),
SHORT(N),
LONG(N),
PRICE(C)
;pds=4
;halton
;pts=100$
```

WTP estimates

```
WALD; Labels=b1,
b2,
b3,
b4,
b5,
b6,
b7,
b8,
sd_b1,
sd_b2,
sd_b3,
sd_b4,
sd_b5,
sd_b6,
sd_b7,
Fix_b8
;start=b
;Var=Varb
;Fn1=-1*(b1/b8)
;Fn2=-1*(b2/b8)
;Fn3=-1*(b3/b8)
;Fn4=-1*(b4/b8)
;Fn5=-1*(b5/b8)
;Fn6=-1*(b6/b8)
;Fn7=-1*(b7/b8)$
```

Compensating surplus

```
WALD; Labels=b1,
b2,
b3,
b4,
b5,
b6,
b7,
b8,
sd_b1,
sd_b2,
sd_b3,
sd_b4,
sd_b5,
sd_b6,
sd_b7,
Fx_b8
;start=b
;Var=Varb
;Fn1=(-1/b8)*(b1*1+b2*0+b3*0+b4*0+b5*1+b6*0+b7*1)
;Fn2=(-1/b8)*(b1*0+b2*1+b3*0+b4*1+b5*0+b6*1+b7*0)
```

;Fn3=(-1/b8)*(b1*1+b2*0+b3*0+b4*1+b5*1+b6*0+b7*1)
;Fn4=(-1/b8)*(b1*0+b2*1+b3*0+b4*0+b5*1+b6*0+b7*1)$

Appendix 6: Other Farmer Characteristics in both zones

Variable	High potential sample (n=144)	Low potential sample (n=144)
Access to extension services in the past year (% of farmers)	79	67
Aware of farmer field day (% of farmers)	65.3	44.4
Attend farmer field days in the past year (% of farmers)	80.6	82.8
experimental station is the common venue for FFD(% farmer fied days)	28.7	46.9
Percentage of farmers with title deed for their farm	57	55.6
Percentage of farmers who sold crop produce	52	87
Livestock keeping (% of farmers)	88	82
Keep dairy cows	89.7	54.2
Produced milk	86.4	56.9
Mean monthly milk sale (liters)	242.78	119.34
Average monthly income of the respondent (Ksh)	13,916.7	11,437.5
Average age of the respondent (in years)	41.9	40.5
Secondary education and above (% of respondents)	56	55
Average farm size (in acres)	1.54	2.26