Measuring the Impact of an Agricultural Market Information System (MIS) on Household Income for Tomato Smallholder Farmers

Thesis

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ABSTRACT

This study measured the economic impact of market information on household income for tomato producers who use the MVIWATA Market Information System (MAMIS). More broadly, this study: (a) determined the relationship between farmers’ demographic characteristics and their participation/non-participation in MAMIS; (b) compared and contrasted quantities sold for both participants and non-participants; and (c) estimated gross margin earned by both groups. A cross-sectional descriptive design was used for data collection, and 215 respondents were interviewed through structured questionnaires. Data were analyzed using both EXCEL and the STATA statistical package. Results showed a statistically significant association between the age of farmers and their participation/non-participation in the market information system. A statistically significant relationship was found to exist between education farmers’ participation/non-participation in the market information system. Gender and marital status were not statistically significant, meaning that males and females and married and unmarried individuals were equally as likely to benefit from market information. Farmers who were beneficiaries of the market information system sold larger quantities of tomatoes than non-beneficiaries, and they also earned higher gross margins.
Dedication

To my mother, Gabriella G. Chagula, for her support, encouragement, and prayers throughout my studies. Thank you for always being there for me despite your many family responsibilities.

Further, I dedicate this thesis to my fiancé, Ernest Likoko, for his moral and material support.
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CHAPTER 1

INTRODUCTION

Background

Tanzania is largely an agro-based developing country, with economic characteristics that are similar to those of many other developing countries. The agriculture sector employs 75% of total population, contributes about 24% of the country’s gross domestic product (GDP), 30% of its export earning, and 70% of household income for rural residents (URT, 2013). On average, annual growth of agriculture is higher than annual population growth, but not high enough to significantly reduce poverty because of low technological advances within agriculture. For the past few years, maize has accounted for more than 20% of GDP in the agricultural sector (NAP, 2013).

Agricultural production in Tanzania is mainly subsistence, with farm sizes ranging from 0.2 to 2.0 hectares. This small acreage creates challenges for farmers, as they attempt to generate enough income to alleviate poverty and advance their overall wellbeing. Agricultural production has been dominated by crops that are intended for exports. Chief among these crops have been cashew nuts, sisal, tobacco, coffee, cotton, tea, pyrethrum and sugarcane (URT, 2013). According to the most recent
Tanzania National Agriculture Policy (2013), other commodities have been identified as equally important for production because of their potential for contributing to farmers’ income and national income through local and international transactions. Horticultural crops, which constitute many of the high-valued crops, are among nine selected crops for crop diversification in the country. The Tanzania Horticultural Association (TAHA) has introduced interventions to support production of horticultural crops in the country, but farmers face a lot of challenges in marketing their produce. Often times, farmers receive a disproportionate share of profit during selling because of factors such as inadequate market information and information asymmetry. To rectify this situation, it is imperative that farmers receive reliable, accurate and affordable market information. Such information flows would provide farmers some protection from middlemen who take advantage of farmers’ knowledge to exploit them (TAHA, 2013).

The Market Information System (MIS) is a structure designed to gather, process and disseminate information on conditions and dynamics of agricultural markets to different stakeholders through one or more information channels for decision making (Muganga 2011). In Tanzania, the Market Information System was initiated in 1970, when the Marketing Development Bureau (MDB) operated under the Ministry of Agriculture. Funds for operating MIS were first provided by the United Nations Development Programme (UNDP) in 1972, and the Food and Agriculture Organization (FAO) served as the executing agency. In its early stages, MDB was responsible for advising the government on marketing policy and for
providing training and regular market reports. After a period of time, MDB was given additional tasks, such as price controls for consumers and price recommendations for producers, especially for main cash commodities and staples. Further, MDB was expected to carry out research on crop cultivation costs on behalf of cooperative unions (Temu et al., 2001).

In its early stages, MDB provided official information on just quantities and commodity prices; by the early 1980s, MBD’s role had expanded to cover unofficial parallel markets. The acknowledgement of this information came in 1986, after the economy had shifted to a market-led economy. Since then, MDB has been going through role adjustments, structural changes, and expanded coverage of products. Because of these many changes, the title of the department has alternated from MDB to Agriculture Information Service (AIS), and to its current name of Market Information System (Temu et al., 2001).

**Problem Statement**

Market information has always been a critical component in the functioning of efficient markets. Any imbalance in the knowledge of buyers and sellers can lead to adverse effects on efficiency. Readily available and widely distributed information can guide the planting decisions of farmers, facilitate pricing decisions at all points along the marketing chain, lower risk for all market transactions, and improve the flow of commodities from rural to urban areas (Bernard et al., 2014). A study by Camble (1994) reveals that inadequate and irrelevant information slows down any
development activity, including agriculture activities. Realizing the necessity for market information access, considerable effort has been expended to provide market information to different participants in the marketing chain. The importance of market information is demonstrated by the fact that most countries have NGO/Donors, government, and private organizations striving to provide market information (Mwakalinga et al., 2011). Yet, few studies have assessed the contributions market information systems have made to household income, particularly households in Tanzania consisting of tomato producers. This study addresses this void by examining the relationship between information and economic benefits.

Tomato growers in the Mgeta division are quite prominent, with 80 to 100 percent of households producing the crop. Yields per hectare have averaged 7 bags on a plot size of 0.2 hectare (Mtandao wa Vikundi vya Wakulima Tanzania, MVIWATA, 2014). Tomato (Solanum lycopersicum L) is perhaps the most important and significant vegetable that is produced in both the southern and northern regions of Tanzania. Its importance and significance are reflected in the large area under cultivation and total production, amounting to more than 235,000 tons annually. Some leading tomato producing areas in Tanzania include Iringa, with an acreage of 4,248 hectares; Tanga, with an acreage of 1,289 hectares; Kilimanjaro, with an acreage of 900 hectares; Mbeya, with an acreage of 380 hectares; and Dar es Salaam, with an acreage of 353 hectares (Temeke district) (MAFSC 2002). Other areas with significant tomato production include Morogoro, Arusha, Mwanza and Dodoma. Across all of these production regions, there are three identifiable seasons that are
Objectives

The overall objective of this study is to assess the economic impact that the Market Information System has made to producers of tomatoes. More specifically, this study seeks to estimate the relationship between farmers’ demographic characteristics and their participation or non-participation in the market information system. Additionally, this study examines farmers’ use of MIS and compares and contrasts quantities sold among farmers who access MAMIS and those who do not access MAMIS. Lastly, this study estimates gross margins across groups.

Description of the Selected Market Information System

MVIWATA is a national network of farmers’ groups that was established in 1993. The goal of this network was to strengthen smallholder farmers and place them in a position to defend their interests. It was founded by 22 innovative farmers from Morogoro, Iringa, Kilimanjaro, Dodoma, Mbeya and Rukwa, as they sought to organize a farmer-to-farmer exchange forum. To address the problems of market information access for smallholder farmers, MVIWATA decided to establish a market information system in 2010, abbreviated as MAMIS. Initially MVIWATA Market Information System was established so as only neighboring markets could exchange information, but it was later realized that most traders came from far markets. Hence,
MVIWATA increased its market coverage to include Buguruni, Temeke Stereo and Kariakoo. This particular system assisted smallholder farmers in making informed decisions, based on relevant and current price information. Subscribers were provided a menu from which to select options, such as market outlets and crop varieties. The system has enjoyed widespread usage, having linked users across 27 urban and rural consumer markets.

Approximately 73,200 users took advantage of the system in 2012/2013, and roughly 20% of these users received tangible benefits (MVIWATA, 2014). The kind of information provided by MAMIS include; price (average price from at least 5 operators), location (title of the market from which prices are collected from), Type/grade of some of the products such as beans (soya, red, rose coco, etc.) and date of collection.

MAMIS indicate prices of the following commodities: avocado, black pepper, beans (rosecoco), beans (soya), beans (red), cabbage, cauliflower, coconut, cowpeas, cassava, cinnamon, cucumber, groundnuts, garlic, gram, green banana, green gram, groundnuts, irish potatoes, local chicken, maize, onions, orange, peas, parsley, pineapple, pawpaw, rice, pipe banana, simsim, sorghum, soya, sugar cane, sunflower, sweet potatoes, tomatoes, yams, and watermelon.

Markets covered by MAMIS include Morogoro, Tawa, Tandai, Nyandira, Kibaigwa, Dodoma, Igunga, Tabora, Shinyanga, Maswa, Bariadi, Bukombe, Kahama, Arusha, Kariakoo, Buguruni, Temeke, Mbeya, Mkuranga, Makambako na Mkata.
For most of the markets, MVIWATA gather data through phone calls and keep records in paper forms. Then these forms are submitted to MAMIS manager for analysis before entry into the computer system (MMA, 2011).

Figure 1. How to Request Market Price Information from MAMIS
A MAMIS’ leaflet showing procedures on an SMS reply after how to request price information, a list texting “NAUZA of crops, markets covered and the MAHINDI,” meaning “I number to send the message. am selling maize.”
Source: Agricultural Production and Poverty Reduction - MVIWATA (2014)
CHAPTER 2

REVIEW OF LITERATURE

Marketing Information System in East Africa

According to a 2011 report by March Maker Associates (MMA), all East African countries initially had First Generation MIS, meaning government ministries and marketing boards provided market information. The main goal of First Generation MIS was to assist government institutions in forecasting and analyzing demand and supply conditions. Ultimately, First Generation MIS sought to provide a set of guidelines and procedures that different food marketing institutions could follow and implement. A perfect example of a food marketing institution that benefitted from clear instructions was the National Milling Cooperation (NMC) in Tanzania. After a period of privatization and structural changes, many state-owned parastatals and marketing boards lost the power to provide market information. Essentially these organizations stopped buying and selling commodities and this withdrawal from the market limited their ability to track prices.

Government ministries continued to provide market information despite the loss of parastatals and marketing boards. Additionally, donor-funded programs assisted with the development of structures that provided market information. These
interventions, however, suffered some setbacks, as some programs lacked adequate funding to sustain themselves beyond short time horizons. A specific program that failed because of inadequate funding and ownership challenges is the Tanzania Chamber of Commerce, Industry and Agriculture, abbreviated as TCCIA initiative. Some selected private companies have also developed initiatives to provide market information, but many of these operate with funds from donor programs and they cease operation once donor funds are cut off. Indeed the MMA report concludes that none of the private MIS providers were completely sustainable. Cost and benefit analyses for many of these initiatives show that they can become sustainable.

Currently, developing countries all across the globe have NGO/Donors, government, and private organizations involved in the provision of market information. Yet, a successful and sustainable initiative has not been realized (MMA, 2011).

To improve information collection and its dissemination, several organizations came together in 2000 to form a partnership for sharing market information at the regional level. This partnership included: Food Net; the Tanzanian Marketing Development Bureau (MDB); The Kenya Agricultural Commodity Exchange (KACE); and the Project d’ Appui a la Securite Alimentaire, or Rwanda (PASAR) project. All of these partners compiled data and then shared information with potential traders through emails on a weekly basis. This procedure, largely known as RECOTIS (Regional Commodity Trade and Information System), was the first initiative to use regional marketing information to facilitate higher regional trade. After this success, an idea was floated to develop a national MIS system. This system
failed to gain traction, as it was vulnerable to the inability of weak partners to develop regular quality data (Ferris and Robbins, 2004).

**Historical Background of MIS in Tanzania**

Until 1984, Tanzania was a state-controlled economy but later transformed into a market-oriented economy. As a state-controlled economy, the government had direct control over the market through price setting, imposition of trade restrictions, product market monopolization, and state control of firms, food crops and agricultural inputs. In the absence of competitive marketing, the state used the National Milling Corporation (NMC) to collect commodities from places of surplus, and then process and distribute them to areas with deficits. Moreover, agricultural cooperatives in the rural areas functioned as agencies for NMC but apart from NMC; within these rural areas, the private sector also operated, largely as a parallel market (Temu et al., 2001).

During calendar year 1986, Tanzania went through a structural adjustment in which new policies were devised that imposed clear limits on procedures the government could implement to meet specified goals. An exception was made for emergency type situations, such as restocking cereal reserves and addressing acute shortages. Otherwise, the government promoted private sector participation and refrained from interfering in food markets (Temu et al., 2001).

Market information System (MIS) originated as early as 1970, when the Marketing Development Bureau (MDB) was created under the Ministry of Agriculture. Funds for this marketing division were provided by UNDP, with FAO
participating and serving as the executing agency. By 1972, MDB was fully operational. Initially MDB had several objectives. Key among these were: advise the government on marketing policy; provide required staffs with marketing training; and develop market news service on a regular basis. As the work of MDB progressed, more tasks were added to its agenda. Included among these tasks were responsibilities for regulating consumer prices, conducting cost analyses on behalf of cooperative unions, and providing recommended producer prices for main cash crops as well as staples (Temu et al, 2001).

When MDB was initiated, it was recognized as an organization that provided official information on prices and volumes of commodities. Before liberalization of the market in the early 1980s, MDB had increased its coverage, including branching into unofficial parallel markets. MDB’s involvement in parallel markets was acknowledged by the government after it made the shift to a market-oriented economy in 1986. Since this time, MDB has undergone changes in its actions, its operation structure, and its product coverage. As a result of these adjustments, the name of the department was changed from MDB to Agriculture Information Service (AIS), and finally to Market Information System (Temu et al., 2001).

**Current Market Information System**

Under current adjustments, MIS has been shifted from the Ministry of Agriculture into the Ministry of Cooperatives and Markets. Figure 2 illustrates the current structure of MIS under the Ministry of Cooperatives and Markets.
Figure 2. Agricultural Market Information System in Tanzania

Need for Market Information Provision

It is well known that resources are easily misallocated when consumers and producers are faced with imperfect information. Two outcomes are generally possible: (1) consumers end up paying too much or too little; and (2) producers end up producing too much or too little. One way to minimize or remedy such outcomes is to provide all market participants with information at the lowest possible cost. In essence, the supply of information should be increased because this will lead to a corresponding increase in demand, as demand generally responds to lower prices. As a result of such efforts, the information market becomes more efficient and increased efficiency is the motivating factor for establishing MIS for farmers and producers.
(Yanagizawa et al., 2009; Molla et al., 1995). Information is most valuable when it is provided in forms that are most desirable for users. For example, business reports are useful forms for helping beneficiaries identify potential trade partners. Other useful reports include analytical market reports that provide analyses of current market conditions and the likely impact of these conditions on stakeholders. Finally, a most valuable source of information is market news reports that provide traders price information and business contacts (Magesa et al., 2014).

According to Molla et al., (1995), market information is a public good because it can be used simultaneously by many individuals without any reduction in its quantity. For example, information about the availability of Product A at Location B can be used simultaneously by thousands of individuals and traders. Further, if the information is accurate, reliable, and accessible to the public, there is increased efficiency for all market transactions (Shepherd, 1997).

Market information services include frequent collection of product prices from larger markets, sorting, storing, and finally disseminating the information to other beneficiaries through chosen channels (Kizito et al., 2011). Different ways of disseminating commodity prices across stakeholders are used. Proven methods of dissemination include televisions, radio, email, newspapers, internet, mobile phones, and other devices. The information that is commonly used by marketing systems can be grouped into up-to-date, or current information, and historical information that is compiled over time (Shepherd, 1997). Up-to-date information is used most effectively in bargaining between stakeholders. By contrast, historical information is largely used
for planning (e.g. government planning and production planning), alert systems for food security, and decisions on storage.

Availability of timely market information services has tremendous advantages to participants in the market (Kaganzi et al., 2008; Yanagizawa et al., 2009). Current information assists producers in making planting decisions that are in line with market forces; it helps producers decide where to sell; it helps them negotiate with greater strength; and it allows them to operate in a more profitable environment compared to those who lack the same information. In addition, with improved information, traders possess the ability to profitably move commodities from a market with surplus toward markets with smaller quantities, or deficits. Further, high-quality and readily available information allows producers to make decisions as to whether it is viable to store produce, given its technical feasibility. Aldridge (1992) discusses a case study in which the market information system of Mali (Système d'Information sur le Marché) monitored 13 markets in Bamako and the information shared enabled consumers to find the lowest priced markets within the city.

Another important function of MIS is that of promoting transparency among participants and this can be achieved through the provision of current market prices and other appropriate market reports (Shepherd, 1997). Farmers and traders are encouraged to produce more for the market as a result of increased market transparency, lower participation risk, and efficient sharing of market signals (Aldridge et al, 1992). Hence, participants in the market are able to make decisions on
where to sell, when to sell, or whether to store and sell later, as market conditions improve.

Failure to access relevant and timely information acts as a barrier to entry in both production and trade activities. In most cases, traders find it hard to trade without sufficient information. As such, insufficient market information services lower the level of competition in the markets. Furthermore, poor access to market information increases costs because actors are forced to invest personal funds to collect information (Magesa et al., 2014).

**Impact of Market Information System**

A study by Goyal (2010) that quantified the effect of improved market information to farmers through IT technology, specifically computer terminals, concluded that farmers in areas with reliable and improved market price information receive (through e-chopals) wholesale price benefits of 1-5% compared to farmers in areas with poor to no access. This finding shows the potential benefits that improved market information holds for farmers.

Aker and Fafchamps (2011) used producer price data to examine the impact that mobile phones have on prices of storable and perishable goods. The authors found that this use of mobile phones significantly reduced price dispersion across markets that traded in perishable goods. Indeed a commodity that showed considerable shrinkage of dispersion was cowpea. A slightly different result was revealed for millet, with price dispersion reduced within a limited geographic radius (2011).
Despite a reduction in dispersion, the authors did not find evidence to support higher farm-gate prices for farmers.

Aker (2008) concluded that mobile phone usage reduced search costs for a group of grain farmers in Niger. This phone usage provided grain traders wider geographic coverage and more options for market outlets. As outcomes of these attributes, farmers in Niger realized a 6.5% decrease in price dispersion and a 10% reduction in price variation during intra-annual seasons. In short, it is reasonable to conclude that grain farmers in Niger received improved welfare from their mobile phones during the severe food crisis of 2005.
CHAPTER 3

METHODODOLOGY

Introduction

The availability of information together with its dissemination is a critical link in the success of commodity and product marketing in Tanzania. To this end, this study seeks to identify the role of information in the marketing of tomatoes in an area known as the Mgeta division. A statistical survey of a random sample of farmers is conducted to ascertain the value and uses of information among farmers. It is known that many of these farmers access information on prices and available crops but others have no access to this information. As such, this study specifies a number of hypotheses to try and capture the economic effects of market price information on farmers’ income and overall wellbeing. These hypotheses are tested with general statistical and econometric procedures that are part of a statistical package known as STATA.
Description of the Study Area

Location

Tanzania is divided into roughly 30 regions and approximately 165 districts, municipalities, and towns. Morogoro is one of the largest regions in terms of population and agricultural production and it is this area that provides focus for this research. More specifically, the Mvomero district within Morogoro is known for its tomato production and, from this area, a random sample of farmers is surveyed and selected for this research.

Mvomero is one of six districts in the Morogoro region and it is bordered by five other districts: Tanga to the north; Pwani to the northeast; Morogoro Rural District to the east; Morogoro Urban District to the southeast; and by Kilosa District to the west. Total area within Mvomero is roughly 140,042 km², having latitudes boundaries of 05°80' and 07°40'S, and longitudes boundaries of 37°20' and 38°05'E. This area lies between 300m to 400m above sea level (Mkonda, 2014).

As of 2012, this district had a total population of 312,000 and it is administratively divided into 18 wards: Bunduki, Diongoya, Doma, Hembeti, Kanga, Kibati, Kikeo, Langali, Maskati, Melela, Mhonda, Mlali, Mtibwa, Mkindo, Mvomero, Mzumbe, Sungaji, and Tchenzema (TNC, 2002). Specific villages within Mvomero that comprise this study area are Nyandira and Tchenzema in Mgeta.
Climate

The annual rainfall in Mvomero is highly correlated with altitude. Areas near the coast experience rainfall of roughly 100 to 800 millimeters per year; by contrast, inland areas of Dodoma and areas north of the Sub-basin experience rainfall of 500 to 600 millimeter per year (Mkonda, 2012). The area is divided in two agro-ecological zones: (1) flood plain at the lowland; and (2) dryland at the highland. As such, the flood plain is identified as a high potential area, while the dryland is considered a low potential area.
Economic Activities

The major activities in Mvomero include crop production and animal keeping, making the district’s economy highly dependent on agriculture. The main crops grown in the area include maize, rice, sorghum and vegetables. On the other hand, animal keeping is practiced largely by the Maasai (pastoralists) (Mkonda, 2014). Other important activities performed are making charcoal, hunting, bee keeping and fishing (Madulu, 2005).

Research Design

The study employed a cross-sectional descriptive design to determine various issues pertaining to the usefulness of the market price information system to tomato producers. The design was selected because of its cost effectiveness. An article by Agresti and Finlay (2009) explained that a cross-sectional design provides combination of various survey methods for gathering a body of both qualitative and quantitative data and it offers immediate results at low costs.

Sampling Technique

Sampling is a procedure that assists in understanding the behavior/features of a large population by examining a small part of the population (Chandan, 1998). Sample size determination is influenced by several factors depending on the subject under investigation. Some relevant factors include level of accuracy, cost, and available
It is important that the selected sample size, as well as all procedures used to analyze data, be representative and appropriate for the entire population.

To determine sample size, scientific procedures will be followed. Yet, because of the unique nature of this research, other factors such as time, research cost, availability and accessibility of transport facilities must be taken into account.

To construct the sampling frame for this study and avoid any biases, simple random sampling will be utilized for all tomato producers in the Mvomero division to determine the necessary sample size. From roughly 250 tomato farmers situated alongside the Uluguru Mountains, it is estimated that a sample size of 215 farmers is needed to provide a desired confidence level of 95% and a margin of error of 2.5%. As such, a total of 215 producers were interviewed and 112 of these producers were classified as non-beneficiaries. All others (103) were identified as beneficiaries of the market information system. The two groups of respondents were chosen carefully and systematically, taking into consideration possible diffusion of information between the two groups that could bias the results.

**Data Collection**

A key determinant of the type of data to be collected for a research study is the set of questions the research is intended to answer. Quantitative data is most desirable for this research but the low level of educational attainment for some farmers makes it imperative that qualitative data is also collected. That is, some farmers are likely to lack the necessary record-keeping to answer specific questions about costs and
revenue in quantifiable terms. Yet, many of these same farmers are likely to have some rote memory of general costs and revenue to allow a research to infer reasonable values. As such, both quantitative and qualitative data are collected for this study. These data will be used to answer specified objectives and research questions. As a minimum, these data are expected to include demographic, socio-economic, and behavioral characteristics of tomato farmers in the Mvomero division. Further, these data are expected to answer questions pertaining to the overall value of agricultural market information to beneficiaries and non-beneficiaries.

The actual process for collecting data used in this study consisted of developing structured questionnaires, pre-testing these questionnaires, and then administering them to respondents to try and understand their marketing practice for tomatoes. Face-to-face interviews were conducted at participants’ homes, workplace, or marketing outlets. For some of these participants, it was necessary to use translators to convert local languages to Swahili. Further, trained enumerators assisted with developing and administering the questionnaires. Both open- and close-ended questions were used because of the low levels of education for many farmers. Indeed some of the open-ended questions provided valuable qualitative data for making comparisons across farmers.

It should be emphasized that a pilot study was first conducted and this study provided important information for modifying the questionnaire. This process revealed that certain questions should be re-phrased to gain some efficiency and quality of results. These changes were made and the revised questionnaire proved to
be more than adequate to collect both qualitative and quantitative data effectively and efficiently. Of course, limited education attainment for Tanzanian farmers made it necessary to collect all data through face-to-face interviews.

**Data Analysis**

Before attempting to analyze collected data, it was first checked for accuracy, coded, and then entered into an EXCEL spreadsheet. Each entry in the EXCEL spreadsheet was furthered checked against the survey instruments to insure proper transfer of data to the spreadsheet. Descriptive statistics for demographic characteristics were derived, summarized and reported in tabular form. These data were subsequently used to test relevant hypotheses and draw meaningful conclusions about relationships between selected variables and marketing information. In addition to EXCEL, a statistical package known as STATA was used for many analyses.

One convenient use of STATA involved chi-square tests of statistical relationships among demographic variables and farmers’ use of information. Several hypotheses were specified about information use, especially with respect to beneficiaries of information and non-beneficiaries of information. Both males and females are heavily invested in tomato production and it was of interest to test whether information use is gender specific. Further, hypotheses were specified to test whether information use was independent of the spectrum of marital status (single, divorced, married, etc.). A final test involved information use and gross margins. Specifically,
it was of interest to determine if differences in quantities sold and gross margin varied according to information use between beneficiaries and non-beneficiaries.
CHAPTER 4

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Sampled Farmers

This study provides results from a random sample of 215 farmers from two villages in Mvomero district: specifically, Nyandira and Tchenzema. Table 1 presents the socio-economic characteristics of these farmers in order to provide a basis for discussion of the results. The characteristics described include age, sex, marital status and education level of the farmers. As shown in Table 1, the socio-economic characteristics of the randomly selected farmers are quite diverse. A total of 103 farmers (48%) were beneficiaries of market information, while the remaining 112 (52%) were non-beneficiaries. With respect to age, 22% of respondents were 30 years of age or younger. A far larger percentage of the respondents (52%) were between the ages of 31-40 and 18% were between the ages of 41-50. Finally, 5% were between the ages of 51-60, and 3% were over 60. From information gathered during interviews, this researcher learned that respondents in the 31-40 age group are the most active and engaged farmers. These farmers are also the ones who demonstrate the highest probability of utilizing farming as their primary source of income. To a lesser extent, farmers in the 18-30 age group also rely heavily upon farming as their main source of
income. The probability by which the 18-30 age group utilizes farming as its primary source of income is an increasing function of age. That is, younger farmers in this age group are less likely to depend on farming for their main source of income.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>Beneficiaries</th>
<th>Non-beneficiaries</th>
<th>All Respondents</th>
</tr>
</thead>
<tbody>
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<td>Age</td>
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<td>12.50</td>
<td>21.86</td>
</tr>
<tr>
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<td>31-40</td>
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<td>41-50</td>
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<td>22.32</td>
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<td>51-60</td>
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<td>8.04</td>
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<td></td>
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<td>47.57</td>
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<td>Primary</td>
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<td>Secondary</td>
<td>23.30</td>
<td>8.93</td>
<td>15.81</td>
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<td>Single</td>
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<td></td>
<td>Divorced</td>
<td>2.91</td>
<td>6.25</td>
<td>4.65</td>
</tr>
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<td></td>
<td>Not married but living with partner</td>
<td>0</td>
<td>3.57</td>
<td>1.86</td>
</tr>
<tr>
<td></td>
<td>Widow/widower</td>
<td>0.97</td>
<td>3.57</td>
<td>2.33</td>
</tr>
</tbody>
</table>

Table 1. Demographic Characteristics of the Farmers

With respect to gender, 49% of all respondents were males, while 51% were females. These percentages are consistent with data for many developing countries that show a larger percentage of women than men in farming. From conversations with women during the survey, this researcher learned that most women are actively involved in decision-making at all levels. This engagement exists even within households for which males are clearly household heads. Much of the decision-
making observed for women undoubtedly results from their prominence in the labor force. A recent study by the Food and Agricultural Organization showed that 50% of agricultural labor force is comprised of women, especially women from rural areas (FAO, 2010).

Low levels of education among farmers in Tanzania clearly serve as impediments to agricultural growth and development. As shown in Table 1, 21% of respondents have no formal education and another 63% have just a primary education. The remaining 16% have some secondary education but few, if any, have completed a high school education. Beneficiaries of information dissemination are somewhat better educated than the overall farming population. Just 9% of the beneficiaries have no education and much larger percentages have primary and secondary education. By contrast, non-beneficiaries of information are shown to have extremely low levels of educational achievements, with just 9% attaining some secondary education. These educational attainments for Tanzanian farmers are consistent with those observed by other researchers who have found low levels of education among farmers (Churi et al., 2012).

A very positive observation from the survey is that an overwhelming majority of the respondents are married and engaged in farming as couples and families. Indeed Mwilomo (2012) argues that the majority of rural households consist of large families (up to 10 individuals) and these households depend on family labor for their source of income. Respondents to this survey revealed that 85% of them are married, while just 11% are single or divorced. Further, just as shown for educational
attainments, marriage percentages are even better for beneficiaries. That is, a higher percentage is married (89) and a lower percentage is single or divorced (10). Relative to other distinct groups in Tanzania, the marriage rate for farmers is much higher and the divorce rate is much lower.

**Farm Size and Marketing Characteristics**

Tomato farmers across all of Tanzania are generally small, and those surveyed in the Mgeta district for this research followed this pattern, with farms ranging from .5 to 3 acres. As shown in Table 2, 96% of farmers till 1 acre or less. Yet, beneficiaries of market information operate larger farms than non-beneficiaries, and this observation suggests clear benefits for market information. It should be recalled that farmers observed for this study are isolated on the Uluguru Mountains, and therefore market information becomes a critical factor in failure or success.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Percentage Values of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Farm Size</td>
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<tr>
<td>1 acre</td>
<td>79.61</td>
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<td>2 acres</td>
<td>5.83</td>
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<tr>
<td>3 acres</td>
<td>1.94</td>
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<tr>
<td>Market Outlets</td>
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<tr>
<td>Intermediaries</td>
<td>1.94</td>
</tr>
<tr>
<td>Main market</td>
<td>84.47</td>
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<tr>
<td>Other farmers</td>
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<tr>
<td>Retailers</td>
<td>7.77</td>
</tr>
<tr>
<td>Wholesalers</td>
<td>5.83</td>
</tr>
</tbody>
</table>

*Table 2. Farm Size and Market Outlet for Tomato Farmers*
Tomato production in the Mgeta district is highly intensive and considerable expenses are incurred in carrying out this type of production. When this scenario is coupled with sparse and uncertain market outlets, many farmers are reluctant to make the necessary investments that are associated with a risky enterprise. Indeed, non-beneficiaries of market information are shown to focus most of their production on one-half acre or less, while beneficiaries of market information invest in larger farms of 1 acre of more 87% of the time. Particularly striking is the fact that not a single non-beneficiary of market information invests in a farm of 2-acres or larger. This suggests that high perishability for tomatoes forces farmers to limit their production to quantities for which they are reasonably certain they can market.

Regardless of whether farmers are beneficiaries or non-beneficiaries of market information, they are inclined to focus most of their efforts on either ½ or 1 acre of tomatoes. A key difference is that 80% of those who benefit from market information till at least 1 acre, while 70% of those who do not benefit from market information till less than 1 acre (Table 2). Further, with all farms 2 acres or larger being operated by beneficiaries of market information speak to the true value of information. That is, farmers are better able to make investments to engage in extensive and intensive tomato cultivation when the risk of market outlets is diminished. Finally, a more evenly distribution is realized for all respondents by farm size, with 43% tilling ½ acre or less and 53% tilling 1 acre.

An often overlooked factor associated with tomato production is the expenses for labor and other factors of production. To produce large quantities of tomatoes, farmers
must be prepared to apply large application of fertilizers, insecticides and herbicides. Beyond these expenses, they must also incur considerable expenses for planting, weeding and harvesting. When totaled, such expenses can be beyond the reach of non-beneficiaries of market information. Further, even if capital markets were available to provide loans for such expenses, farmers would be reluctant to subject themselves to high levels of risk in the absence of assured markets.

**Market Outlets for Tomatoes**

Tomato farmers in the Mgeta district are observed to have access to five market outlets: intermediaries; main market; other farmers; retailers; and wholesalers. Four of the five markets are commonly known but the main market requires some explanation. For this study, the main market is one that offers farmers the best and highest price. Farmers learn about these prices through the market information system (MAMIS) and they offer their commodities to the highest bidders. Many of these transactions involve buyers seeking the highest-quality of tomatoes in a timely manner. For example, buyers are often independent brokers seeking quality tomatoes such establishments as grocery stores and restaurants. Indeed the real value of MAMIS is that it links sellers with buyers across a wide geographical area, thereby reducing marketing risks and enhancing farmers’ earning, potential and profitability. Farmers in the Mgeta district not only receive price information but they receive reliable transportation information. Specifically, MAMIS provides information as to
when farmers can expect a semi-truck on the mountains to make deliveries to markets as far away as Dar es Salaam, a distance of more than 120 miles.

The value of information is clearly seen in the distribution of tomatoes by beneficiaries and non-beneficiaries of market information (Table 2). Nearly 85% of farmers who benefit from market information sell their tomatoes to the main market. By contrast, just 17% of non-beneficiaries sell their tomatoes to the main market. A key difference between the use of the main market by beneficiaries and non-beneficiaries is that beneficiaries are in constant contact with main market buyers but non-beneficiaries are dependent upon main market buyers to contact them. In essence, main market buyers will occasionally reach out to farmers beyond its information network when farmers within the network are unable to meet total demands. Additionally, it is worth emphasizing that beneficiaries receive advance information on prices and they are able to use this information to make informed decisions on market outlets. Non-beneficiaries, by contrast, typically receive no pricing information prior to market sales. Or, more sadly, they receive inaccurate market information from middlemen.

As shown in Table 2, 70% of non-beneficiaries of market information sell their tomatoes to market intermediaries. These buyers are favored by non-beneficiaries because intermediaries will collect tomatoes directly from their farms and this service is often critical for a highly perishable commodity such as tomatoes. Further, many sales to intermediaries result from pre-harvest contracts that are negotiated for specified prices. Observations on prices show that contract prices are typically lower
than prices realized at harvest. In essence, no-beneficiaries diminish their marketing risks with contracts but this lower risk comes at the expense of higher prices and expected profitability.

Overall, the marketing outlets selected by beneficiaries of market information suggest that farmers have a strong preference for prices offered by the main market but they also realize reasonable returns from retailers and wholesalers. This observation is made because MAMIS provides pricing information on all market outlets and tomato farmers are able to make selections based on posted prices. When quantities offered for sale exceed those buyers in the main market wish to purchase, beneficiaries must select alternative outlets and their marketing history suggests that retailers and wholesalers are better options than intermediaries and other farmers. By contrast, retailers and wholesalers are minor outlets for non-beneficiaries of market information.

Differences in the use of intermediaries by beneficiaries and non-beneficiaries send a clear message about the value of market information. With respect to marketing preference, intermediaries are ranked number 1 by non-beneficiaries but a lowly number 4 by beneficiaries. These differences suggest two sets of tomato growers: (1) one group (beneficiaries) places a premium on price and profitability; and (2) the other group (non-beneficiaries) places a premium on minimum risk and market stability. Interestingly, the main market provides all four of these desirable qualities but a lack of information dissemination among non-beneficiaries is depriving these producers of opportunities to realize all four.
Farmers’ Demographic Characteristics and their Participation/Non-Participation in the Market Information System

Since the primary motivation for this research is to determine the value of market information, it is imperative that we assess its value relative to farmers’ demographic characteristics. To this end, a series of statistical tests is run to determine farmers’ use of information is independent of demographic characteristics such as age, gender, education, and marital status. Specifically, chi-square tests of independence are used and these tests are specified in the form of hypothesis. For example, with respect to age, we test whether the specified age categories (Table 3) are independent of farmers’ access to information. More generally, are farmers in the 18-30 age categories equally as likely to be beneficiaries or non-beneficiaries of market information as those in the 41-50 age category?
<table>
<thead>
<tr>
<th>Variable</th>
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<th>Beneficiaries</th>
<th>Non-beneficiaries</th>
<th>All Respondents</th>
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</thead>
<tbody>
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<td>Age</td>
<td>18-30</td>
<td>32.04</td>
<td>12.50</td>
<td>21.86</td>
</tr>
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<td></td>
<td>31-40</td>
<td>53.40</td>
<td>50.89</td>
<td>52.09</td>
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<td></td>
<td>41-50</td>
<td>12.62</td>
<td>22.32</td>
<td>17.67</td>
</tr>
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<td></td>
<td>51-60</td>
<td>1.94</td>
<td>8.04</td>
<td>5.12</td>
</tr>
<tr>
<td></td>
<td>above 60</td>
<td>0</td>
<td>6.25</td>
<td>3.26</td>
</tr>
<tr>
<td>Chi-square p-value</td>
<td></td>
<td>0**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>47.57</td>
<td>50</td>
<td>48.84</td>
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<tr>
<td></td>
<td>Female</td>
<td>52.43</td>
<td>50</td>
<td>51.16</td>
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<td>Primary</td>
<td>67.96</td>
<td>58.93</td>
<td>63.26</td>
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<tr>
<td></td>
<td>Secondary</td>
<td>23.30</td>
<td>8.93</td>
<td>15.81</td>
</tr>
<tr>
<td>Chi-square p-value</td>
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<td>0**</td>
<td></td>
<td></td>
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<tr>
<td>Marital Status</td>
<td>Married</td>
<td>89.32</td>
<td>80.36</td>
<td>84.65</td>
</tr>
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<td>Single</td>
<td>6.80</td>
<td>6.25</td>
<td>6.51</td>
</tr>
<tr>
<td></td>
<td>Divorced</td>
<td>2.91</td>
<td>6.25</td>
<td>4.65</td>
</tr>
<tr>
<td></td>
<td>Not married/ living with partner</td>
<td>0</td>
<td>3.57</td>
<td>1.86</td>
</tr>
<tr>
<td></td>
<td>Widow/widower</td>
<td>0.97</td>
<td>3.57</td>
<td>2.33</td>
</tr>
<tr>
<td>Chi-square p-value</td>
<td></td>
<td>0.133</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Farmers Demographic Characteristics with Respect to Participation in MAMIS

Such a test is often specified as a hypothesis. For age categories, this test is specified as follows:

H₀: Age categories are independent of benefits farmers receive from information.

H₁: Age categories are not independent of benefits farmers receive from information.
Similar hypotheses can be specified and tested for the other demographic variables and the null hypothesis (H0) is rejected based on a chosen significance level (say $\alpha = .05$) relative to a p-value derived from the chi-square test. Using this specified $\alpha$ value of .05 for testing age categories, we reject the null hypothesis of independence because the p-value of .000 is less than our chosen $\alpha$ value of .05. For information providers, this means that a single approach for all age groups would not be effective.

**Sex of Farmers and Access/Non-Access to Market Information System**

Statistically, the chi-square test of whether gender is independent of farmers’ access to information is insignificant (Table 3). That is, beneficiaries and non-beneficiaries of market information cannot be distinguished by gender. Using $\alpha = .05$, the derived p-value of .722 means that we cannot reject the null hypothesis of no independence. Essentially, both males and females are just as likely to be beneficiaries and non-beneficiaries. This result is consistent with that of another study that found males and females equally involved in production as a requirement to meet family obligations (Scott et al., 2005).

**Education Level and Access/Non-Access to Market Information System**

As one may have hypothesized, whether one is a beneficiary and non-beneficiary of market information is not independent of education (Table 3). A p-value of .000 is derived for this test, and this means that the null hypothesis can be
rejected at all levels of $\alpha$. Education is seen to be especially important to beneficiaries of market information, as 81% of them have attained either primary or secondary education. One factor that has been observed to explain the high correlation between beneficiaries and education is the ability of recently educated youth to quickly understand and utilize new technologies related to information. Indeed studies conducted by Mwanga et al. (1998) and Tesfaye et al. (2001) report a strong and positive relationship between education and information adoption.

**Farmers’ Marital Status and Access/Non-Access to Market Information System**

Unlike for education and age categories, a chi-square test of whether information use among beneficiaries and non-beneficiaries is independent of marital status is not rejected at $\alpha=.05$ level. This is the same result derived for information use and gender and together these findings show that males and females and married and unmarried individuals have roughly the same probabilities of being information users and nonusers. In essence, information providers wishing to improve information usage among beneficiaries and non-beneficiaries should focus their efforts on age and educational differences among farmers.

**Market Information and Quantities Sold**

A desired outcome for information providers is to help farmers realize both higher prices and higher sales. To this end, this section is focused on the effect of market information on quantities sold. It is hypothesized that beneficiaries of market
information sell larger quantities of tomatoes than non-beneficiaries because information is intended to reduce uncertainty associated with both prices and profitability. As shown in Figure 4, beneficiaries average sales total 655 kilograms, as opposed to 340 kilograms for non-beneficiaries. A key question is whether or not these differences are statistically significant. Indeed if beneficiaries cultivate more acreage than non-beneficiaries, then their sales are expected to higher. Nevertheless, an assumption of this study is that information enables farms to grow larger and therefore differences in market quantities are directly related to information. In essence, we are unable to compare quantities from beneficiaries and non-beneficiaries by farm size.

![Average Quantities Sold by Information Users](image)

*Figure 4. Impact of Market Information on Quantities Sold*
Relative to a statistical test for the results shown in Figure 4, a means difference approach is used. Test results are shown in Table 4 and the derived p-value of .000 show clearly that beneficiaries produce far large quantities than non-beneficiaries. Further, even though compiled data are not currently organized to compare mean sales for beneficiaries and non-beneficiaries by farm size, it is hypothesized that such test would show higher sales for beneficiaries. That is, given high perishability for tomatoes, farmers with known market outlets are likely to sell a larger percentage of harvested supplies than those with less reliable market outlets. Stated differently, having better access to markets provide beneficiaries a lower probability of realizing spoilage of highly perishable tomatoes. By contrast, non-beneficiaries face a much higher probability of sustaining spoilage because market outlets are not always readily available.

<table>
<thead>
<tr>
<th>Variable</th>
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<th>Std. Err</th>
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<tr>
<td>Beneficiaries</td>
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</tr>
<tr>
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<tr>
<td>Difference</td>
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<td>25.56</td>
</tr>
</tbody>
</table>

P-Value = .000  
t-Value = 12.340

Table 4. Means Tests of Quantities Sold
Gross Margins

Various formulas exist to help farmers and other businesses determine returns to commodities or products sold. Most frequently, these returns are calculated as margins, particularly when businesses have some control over prices. In such instances, some businesses will calculate margins as (price – cost)/ price, whereas others will calculate margins as (price –cost)/cost. Other methods also exist for calculating margins but, over time, all methods help businesses assess changes in earnings. With tomato farmers being more price takers than price setters, a more generic formula of (revenue – cost)/revenue. These values are calculated for both beneficiaries and non-beneficiaries to determine if there is a statistically significant difference in margins for the two groups.

As shown in Table 5, mean gross margins for beneficiaries are more than five times larger than those for non-beneficiaries. As such, a mean difference test is expected to reveal a statistically significant difference for the two groups. Indeed a p-value of .000 is derived from the test and this value is statistically significant at practically any level of $\alpha$. A reasonable conclusion is that beneficiaries realize much larger gross margin relative to non-beneficiaries because they market their tomatoes to outlets that pay higher prices and limited price fluctuations. By contrast, non-beneficiaries face more price fluctuations for their tomatoes because they have access to lower quality of information and make less timely sales. These outcomes present a clear picture of the benefits farmers derive from the information flows through MVIWATA.
<table>
<thead>
<tr>
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<td>Non-beneficiaries</td>
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</tbody>
</table>

P-Value = .000

\( t \)-Value = 13.85

Table 5. Means Tests of Gross Margins
CHAPTER 5

CONCLUSIONS AND POLICY RECOMMENDATIONS

Conclusion

Information availability and its dissemination have always been critical factors in the marketing of farm commodities. For tomato farmers on the Uluguru Mountains in Tanzania, these factors can distinguish successful farmers from unsuccessful ones. Specifically, farmers lacking access to market information are forced to rely on intermediaries who offer lower prices than those available to farmers with market information. Further, farmers lacking market information face uncertainty about market sales and this limit their ability for farm expansion and increased income.

Results from this study revealed that access to market information is not independent of farmers’ age groups. Specifically, farmers in the age group of 31-40 are able to make better use of information than farmers in other age groups. Since one goal of the marketing information system (MAMIS) is to improve the information dissemination to farmers, it seems appropriate for MAMIS to focus more of its efforts on age groups outside of 31-40. Similarly, higher educated farmers were shown to have greater access to information than lesser educated farmers. In the long-run, perhaps the government has a role to play in correcting this distortion by providing
wider access to education for all citizens. In the short-run, MAMIS could make a special effort to focus its dissemination of information to those with low levels of education. Finally, access to information was not found to differ by gender and marital status and therefore MAMIS can use the same approach in disseminating information to these groups.

As an indication of the true value of information, the results revealed that farmers having access to market information have larger sales than those lacking access. More importantly, farmers selling larger quantities received higher prices because they sold their tomatoes to the main market that is endorsed by MAMIS. Additionally, even when beneficiaries of market information used retailers and wholesalers, they often received higher prices than non-beneficiaries who used these same outlets because they could bypass intermediaries who skim a percentage of market price.

**Policy Recommendation**

Findings from this study show that access to market information is still limited in rural areas. Without market information, farmers struggle to plan production and subsequent harvests. These results show a clear need for greater participation of farmers in the market information system. As such, it is recommended that the government make a special effort to strengthen the capacity of extension officers to provide farmers improved knowledge of the market. These efforts must start at an elementary level of making farmers more aware of information availability and it must
spread across all hamlets and villages. Given that farmers with access to market information earn higher margins on their sales, it is recommended that government officials and NGOs make a special effort to offer sustainable market information systems within all villages. Finally, given the positive association between market information access and education, it would be useful to see the government place more emphasis on strengthening the delivery of education to all rural areas and within all age groups, from youths to adults.
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