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Towards Improving Agricultural Marketing Information Systems for Smallholder Farmers: A Tharaka Nithi Case

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ABSTRACT

Agricultural marketing information systems play a crucial role in farmers' decision making process on production and marketing of farm produce. Farmers require easy access to relevant, up to date and adequate agricultural marketing information. The extent of access and use of agricultural marketing information systems in Tharaka Nithi and Kenya in general is not clear. Often information platforms exist but they are not accessible to the farmers, extension workers and policy makers for decision making process. This study sought to map the existing agricultural marketing information systems, assess the challenges farmers face in their access and use and propose improvements to guide development of robust easy to use and accessible agricultural marketing information systems. Data was collected through semi-structured interviews and analyzed by use of qualitative and quantitative methods. Findings show that, a number of agricultural marketing information system platforms exist in Tharaka Nithi. Farmers who had access to relevant information on appropriate farming methods and output marketing sold their farm produce at higher prices. We have estimated the financial benefit of access to information as Ksh 460 per 90 kg bag of maize and Ksh 870 per 90 kg bag of beans. Using 10% of total land area of Tharaka Nithi to represent the high potential land allocated to maize and beans, we estimate that at the entire county level the financial benefits associated with access to information could conservatively be estimated at more than Ksh 200 million (US$ 2 million) per year. These benefits can potentially be scaled up with improved information dissemination because currently, over 50% of the farmers in the region lack access to various types of existing information packages. To address challenges, there is a need for building capacity of the farmers on

importance of market information, various sources of such information and appropriate interpretation of such information as a driver for agricultural profitability. Marketing group membership is crucial for farm produce aggregation, negotiation for better prices and acquisition of farm inputs at lower costs due to economies of scale. Further, the extension workers ought to be proactive in information dissemination via platforms like Msoko, Soko-pepe and Mfarm which can reach many farmers simultaneously. The study further highlights a need for government support in development of technological and ICT infrastructure as a foundation for modern ICT based marketing information systems. The conventional dissemination method that requires direct contact between the extension workers and farmers is currently impractical due to low extension worker farmer ratio.

Key words: Agriculture, marketing, information systems, Tharaka Nithi

1.0 INTRODUCTION

Increased profitability for farmers may lead them to change their production, investment, and marketing decisions: they may farm land more intensively, sell in larger quantities, invest in productive assets, adopt new agricultural technologies, move land out of non-agricultural use, switch crops, or engage in spatial arbitrage (Jensen, 2010). Having up-to-date market information on commodity and input prices, as well as demand trends, boosts farmers' negotiating positions and informs decisions about when and where to buy and sell, what to produce, and the quantity and quality of future production (Stienen, et al., 2007). Farmers usually lack information about current market prices because of villages' remoteness and poor communications with marketplaces. Access to agricultural marketing information by farmers and other agricultural stakeholders can be enhanced through availability of easy to use, accessible agricultural marketing information systems. FAO, (1997) defines agricultural market information system here after referred to as MIS

or AMIS as "a service, usually operated by the public sector, which involves the collection on a regular basis of information on prices and, in some cases, quantities of widely traded agricultural products, from rural assembly markets, wholesale and retail markets as appropriate and dissemination of this information on a timely and regular basis through various media to farmers, traders, government officials, policymakers and others, including consumers". Agricultural Market Information Systems are designed to collect, analyze and disseminate data on the status and the dynamics of agricultural market prices. CTA, (2015) further describes marketing information systems as systems that collect, analyze, package, store and disseminate prices and other information relevant to farmers, traders, processors and others interested in agricultural commodities. Marketing information is a wide concept which includes details on potential market channels, payment requirements, packaging, quality and a whole lot of information required by a producer to make a successful sale, including market information. Good performance of the agricultural marketing information systems is dependent on the innovations applied in the information capture, analysis, storage and dissemination. According to Galtier *et al.* (2013), MIS have primarily been conceived as tools for fulfilling two related objectives: 1. Improvement of public policies through an increased awareness of market realities; 2. Enhancement of market transparency, to bring about a fairer and more efficient allocation of resources.

The agricultural marketing information systems are classified into two major categories: the first and the second generations (Kizito, 2011). The first-generation information systems are mainly managed by government and are intended to help attain efficiency and fairness in markets and to provide information for better policy formulation and monitoring of market performance. On the other hand, second generation marketing information systems are characterized by technical and organizational innovations to collate and disseminate information through internet and mobile phone networks

(Galtier, Subervie, Staatz, & Thirion, 2012; Kizito, 2011). Though records show availability of information in Tharaka Nithi County, many farmers are often not able to access timely marketing information to inform their farm production and marketing decisions (MPA, 2012). Gakuru et al., (2009) observed that, market related information like the weather forecast, transport facilities and information storage facilities are vital, but they have a tendency to quickly either get out-dated or change frequently. The poor access to agricultural marketing information identified in the county is a proof that the existing information systems do not fully meet farmer's information needs. Against this background, this study sought to map the existing agricultural marketing information systems, assess the challenges farmers face in their access and use, and propose improvements to guide development of robust easy to use and accessible agricultural marketing information systems.

2.0 MATERIALS AND METHODS

2.1 Study area description

The target area was Tharaka Nithi County which has a total population of about 400,000 (Tharaka Nithi County, 2014). Tharaka Nithi County has three sub-counties which include Maara, Tharaka and Meru South. In terms of agricultural production Tharaka Nithi can be divided into the high potential, adequate rainfall region covering Maara and Meru south and low potential arid region covering Tharaka (Jaetzold, Schmidt, Hornetz & Shisanya, 2006). The range of crops and crop yields in the arid part of Tharaka Nithi is low due to precipitation related climatic challenges, while the types of crops and the associated yields are high in the upper region of Tharaka Nithi (Jaetzold, Schmidt, Hornetz & Shisanya, 2006). Surplus crop yields are mainly common in the upper high

potential region. This study therefore, concentrates on the higher potential region of the County, i.e. Meru south which is also referred to as Chuka and Maara sub counties.

2.2 Study design & data collection

Representative sampling locations were purposively identified in Maara and Meru south on the basis of food crop productivity. Four most productive wards in Meru south and two most productive wards in Maara were identified and sampled. Quota sampling and purposeful sampling were employed to draw a sample from Maara and Meru south sub-counties. Application of quota sampling ensures that the sample represents certain targeted characteristics of the population (Mugenda & Mugenda, 2003). For this study, the target population was food crop farmers and extension workers in Meru South and Maara sub-counties of Tharaka Nithi County. For purposes of capturing market dynamics farmers were further clustered into independent marketing farmers and group marketing farmers. In the context of this study independent marketing farmers are those who marketed most of their produce within their farms, while group farmers were those that marketed their produce within a group structure that allowed for aggregation of outputs, group bargaining and group input acquisition. The farmer group structure was made up of the chairperson, secretary, treasurer and ordinary group members. Both categories of farmers were growing either or all of the following food crops (bananas, maize and beans). The sample size consisted of 154 farmers and 9 extension workers.

2.3 Data management & analysis

Prior to analysis, data was organized by coding, classifying and checked for errors of omission and commission. Data coding was done by assigning symbols to answers so as to put responses into limited related categories and to relate them with the study objectives. The processes of arranging data, reflecting on it, learning from the data and

making sense of the data was carried out concurrently with the data collection process to optimize recall of flow of events and ideas. The coded data was then analyzed qualitatively and quantitatively.

3.0 RESULTS & DISCUSSIONS

From an economic perspective, market performance depends on the quality of information accessed by various actors along the agricultural production value chains. However, in practice, economic agents (traders, producers, and government authorities) often have incomplete and sometimes inaccurate information. This difference in the access to information leads to inequitable price formation, often to the disadvantage of producers (Inter-réseaux, 2008). Hence, the driving idea behind MIS was to enable the market system's core stakeholders to make better decisions on when (temporal arbitrage) and where (spatial arbitrage) to buy and sell. This, in turn, was assumed to lead to a more integrated market and more stable prices (Galtier *et al.*, 2013).

3.1 Types of agricultural marketing information systems (AMIS) in the County

Our results show existence of wide range of marketing information systems in the county (Table 1). More use of such information system was found among the farmers associated with the group relative to independent farmers. Community based information systems accounted for over 50% of information used by farmers across the two classification category. The second most important, especially among the group members was government managed market information system which was used by more than 40% of group members. Use of privately owned information sources was lower than 5%.

Table 1: Types of agricultural marketing information systems/services (AMIS)

Type of AMIS	Independent farmers (n=80)	Farmer group (n = 74)	Independent + Farmer group (n =154)
	……%.....		
Do not use any	25	8	17
AMIS managed by government	3	46	23
Community based AMIS	53	89	70
Privately owned AMIS	3	5	4

3.2 Community based agricultural marketing information system

Averaged across the two categories, about 70% of the farmers' access information through community-based marketing information system. Community-based system uses the following methods to disseminate agricultural marketing information:

i) Farmer to farmer interaction and other value chain actors

Access to information through interactions with family members, other farmers and friends is one of the most common information access pathways among farmers. Findings in this study show that 82% of the farmers accessed agricultural marketing information through such interactions (Table 2). Farmers were also found to capture information from middlemen who provided market for their farm produce. The vested interests by the middlemen risked the accuracy of the captured information. Often middlemen distorted information provided to win farmers' trust and buy produce at a lower price than the market value. An extension worker in Maara sub-county noted that, *middlemen blocked vital information provided by extension workers from reaching farmers citing an example of Meru Green Company which bought bananas at Ksh 16 per kilogramme while middlemen lied to farmers*

that Meru green was notorious for not paying farmers. This way the middlemen were able to convince farmers to sell bananas to them at an average of Ksh 12 per kilogramme

ii) Farmer groups information sharing

The ultimate goal of farmers is to improve their livelihoods through farm activities. This has motivated farmers to form marketing groups through which they develop innovative production and marketing strategies to realize better profits. The county government has acted as a catalyst to the development of such farmer marketing groups which brings farmers together to learn agricultural best practices for boosting return on investment. Through farmer groups, extension workers provide access to relevant production and market information which guide farmers in decision making. Findings from this study show that about 22% farmers contact farmer group leaders for agricultural marketing information while 19% got information during farmer group meetings (Table 2). Extension workers were found to provide information through groups during group meetings and through group leaders who share the same with other farmers in their groups. To confirm this, an extension worker noted that, *group leaders received information from the extension offices and communicated it to farmers during farmer group meetings and also conducted individual consultations with other farmers.* Farmer group members were found to earn better income from sale of their farm produce than independent farmers (Table 3). The high returns in investments are associated with ability to gain access to information from both the groups and the extension workers.

iii) **Administrative meetings and places of worship**

Extension workers looked for every opportunity to share agricultural marketing information with the community members. They mainly targeted administrative

meetings and places of worship to make available the information. This is evident from the findings which show that, dissemination of agricultural marketing information by extension workers was through administrative meetings and places of worship (Table 2). Such forums enable extension workers to reach out to many farmers who hardly visit their offices in search for information.

3.3 Public/Government Agricultural Marketing Information Systems

These are government managed agricultural information services which are established to facilitate information sharing with farmers. Government, through the ministry of agriculture manages the agricultural information services and extension workers are charged with the responsibility of capturing, processing, storing and disseminating the information. It is popular among farmer group members (46%) in comparison with the independent farmers (3%) (Table 1). This popularity is rooted in the relationship cultivated between extension workers and farmer group leaders. An extension worker from Maara noted that, *they developed rapport with farmer group leaders who visited their offices regularly to gather the information which they shared with group members*. Overall, extension workers disseminate information using both manual and modern information technology (internet and mobile phones).

Table 2: How agricultural marketing information is accessed in the county

Access method	Independent farmers (n =80)	Farmer group members (n =74)	Independent + Farmer group (n =154)
	……..……%.....		
Through other farmers and friends	78	87	82
Contacting group leaders	2	22	11
Group meetings	0	19	9
Meetings with agricultural officers	11	24	17
Through buyers/middlemen	49	63	56
Administrative barazas	38	41	39
Announcements in churches/mosques	22	38	30
Media	20	34	27

3.4 Private agricultural marketing information system

This type of information system is used by internal clients of an organization to support marketing and decision-making of a company trading in agricultural products. Meru Green enterprise is an example of such an information system provider providing information services in Meru and Tharaka Nithi County. Our findings have shown that 4% of the farmers used the system to access marketing information (Table 1). An extension worker further supported this by noting that *"they partnered with NGOs and private companies such as Meru Green and agro dealer companies to disseminate information"*.

Though farmers were found to use the above agricultural marketing information systems, they lacked information on the existence of other marketing information systems. These include AMIS managed by service providers such as Kenya Agricultural Commodity

Exchange and National Farmers Information Service among others. Use of these MIS depends on the farmers' knowledge of their existence.

These agricultural marketing information systems can further be classified into either the first or second generation information systems, based on the level of adoption of modern information technology. The first-generation information systems disseminate information manually while the second-generation information systems use modern information communication technology e.g. through mobile phones and internet. In this study, the public agricultural marketing information systems provided information through various traditional methods including: information desk, exhibitions, schools, administrative meetings/places of worship, farmer groups and billboards. Information disseminated manually only reached a limited group of farmers.

3.5 Implications of availability or unavailability of agricultural information for farmers

Farmers' economic returns are determined by the nature of information at their disposal during farm production and marketing. The decisions they make at every stage of farming affects the farm productivity and the expected profits. Findings in this paper show impact of relevant information on farmers' income (Table 3). Overall farmers who had access to relevant information on appropriate farming methods and output marketing sold their farm produce at higher prices. We have estimated the financial benefit of access to information as Ksh 460 per 90 kg bag of maize and Ksh 870 per 90 kg bag of beans. On average farmers in this region produce about 2.5 tons of maize and 1.0 tons of beans per hectare (Mucheru-Muna et al., 2007, Mugwe 2007). As a ton is equivalent to 11 bags this translates to about 27.5 bags of maize and 11 bags of beans per hectare. On a perspective of returns per unit of land, the financial advantage of information can therefore be estimated to be approximately Ksh 9,570 for beans and Ksh

12,650 for maize per hectare. The total land area of Tharaka Nithi is estimated at 261,000 of which between 10 and 20% is high potential. Using a conservative estimate of 10%, it implies that farmers grow maize and beans under good climatic and soil conditions on at least 20,000 hectares. This implies that on average, at a regional scale (entire county level) the benefit of access to agricultural market information could exceed Ksh 200 million (US$ 2 million) per year. In these typically poor regions, this is crucial for building the household and regional wealth and food security. Similar potential benefits were observed by Ogutu *et al.* (2013) who compared farmers in Kenya with access to ICT-based market information to those without any such access. They found a positive and significant effect on the usage of purchased seed, fertilizer, labour and land productivity, but a significant decline in the use of hired, family and total labour, which could be attributed to the greater efficiency resulting from information use. From an econometric analysis of a two-year panel household data set for four provinces in Mozambique, Kizito (2011) found that the mean price difference per kg of maize sold between households with and without information was 12 per cent. The estimated aggregate marginal gain in income for over 250 000 households that received information and sold maize was about US$723 121 annually in the main marketing season. The authors noted that these gains were approximately six times greater than the operational costs of the Government's MIS in 2002, equivalent to US$130 000.

Table 3: Economic returns for various crop outputs with and without market information

Crop/unit	Unit price with information	Unit price without information	Financial advantage of information access
	……..……..Ksh…..……..		
Maize /90 kg bag	3,700	3,240	460
Beans/90 kg bag	4,910	4,040	870
Bananas/kg	15	11	4

3.6 Challenges in the access and use of Agricultural Marketing Information

Farmers faced a myriad of challenges to access agricultural market information (Table 4). The poor physical and technological infrastructural challenge was the most common challenge as it faced over 50% of the farmers while the other challenges were experienced by between 5 and 45% of the farmers across the farmer categories. The physical and technological infrastructure as a challenge to access of agricultural market information was corroborated by an extension worker who noted that, "*transport in the county is poor and roads are impassable during rainy seasons. This complicates our capacity to reach farmers and farmer group with both market and production information*". More than 30% of the farmers lacked sufficient information to make informed timely decisions on production and marketing (Table 4). The existing information gaps included tabulation of prices without information on quantities required by various markets. In such scenarios farmers could deliver farm produce but find that the specific markets they were targeting did not have the capacity to absorb the quantities of produce they supplied.

The trend of reporting challenges was similar among the group and independent farmers with exception of recognition of cost of information as a challenge which was reported

by more than 4 fold more group farmers than independent farmers. Recognition of cost of information as a major challenge among group members could be related to the higher level of literacy and accounting skills that characterized this group as compared to the independently marketing farmers (Ameru et al., 2018). This is further corroborated by the challenge of low information literacy which was observed amongst 43% of independent farmers as compared to 35% of group farmers. An extension worker observed that "*low literacy levels hindered dissemination of information to farmers who are not able to read because they could not access and use written information*". The low literacy resulted in language barrier which inhibit efficient information sharing. Another extension worker noted that, "*communication breakdown occurred when all people involved in communication sharing did not originate from the same locality and did not use native language to share information*".

Table 4: Challenges experienced by farmers in access and use of agricultural marketing information (AMI)

	Independent farmers (n =80)	Farm group members (n =74)	Independent + Farmer group (n =154)
Challenges	……%.....		
Poor infrastructural linkages hindering access and use of AMI	50	62	56
Low information literacy	43	35	39
Lack of adequate information	33	45	39
Inadequate support by the government agencies	30	43	36
Costly to get information	5	27	15

The aforementioned literacy driven challenges, coupled with low extension service staffing levels reduce the level of extension officers'-farmer interaction for information dissemination. Furthermore, with more than 150,000 farmers against less than 100 county agricultural marketing extension workers it is difficult for the county employees to meet the information demand for each farmer. This translates to extension worker farmer ratio of more than 1:1500 while the international best practice recommends for a ratio of 1:400 (Mutegi and Zingore 2014).

3.7 Opportunities for creating efficiency of agricultural marketing information systems (AMIS)

The improvement of AMIS in Tharaka Nithi should begin with addressing information access challenges identified in this study. These include improvement of physical and technological infrastructure, enhancement of government support to extension service and recruitment of more extension workers to improve information management (Table 4). The agricultural marketing information systems in the county are largely manual and have minimal ICT application for information processing, storage and real time dissemination. Currently the extension workers store information in the office computers and manual files. The County government ought to support development of robust agricultural marketing information system through the ministry of agriculture, the core ministry under which the agricultural information management responsibilities fall. This study proposes a system with the following components:

(i) Information generation, synthesis, packaging and dissemination

It is proposed that the county adopts a system which is able to generate, capture, package and disseminate agricultural marketing information in real time. Findings show that,

extension workers play a major role in information capture and dissemination to farmers and other agricultural stakeholders. However, the dissemination of the information presents a challenge in reaching the intended information users on time because most of the agricultural marketing information systems are manual and slow (Ameru, 2018). The co-ordination between the major information sources i.e. the national agricultural research institutions and extension workers is poor thus the disseminated information is often un-harmonized and conflicting. While traditionally, knowledge was intended to flow from research institutions through the extension workers to the farmers, this structure crushed when the ministry of agriculture under which extension is done was put under the county government while the national agricultural research institutes like the Kenya Agricultural and Livestock Research Organization (KALRO) remained under the central government. The limited coordination and harmonization of these two state organs resulted in two lines of farmer training, one led by KALRO and the second one led by the ministry of agriculture. Often the information from the two sources is un-harmonized and conflicting. This confuses farmers and the policy makers who rely on such information for decision making leading to poor production and marketing decisions (KSHC, 2015). Harmonization of the activities of these two state departments is critical to promote efficient capture, analysis, organization, packaging, storage and dissemination of adequate, relevant and up to date information to support farming and marketing activities in the county.

(ii) Farmer information need

The way in which MIS distribute information on prices and other related factors depends on the specific operation of the marketing system. Thus, when designing a MIS, it is necessary to perform a careful analysis of the supply chain, to collect information on the flow of products between farms and markets and between markets, as well as on the functions of the various intermediaries. Farmers and extension workers identified

information they considered key for improved farm productivity and economic returns. It includes quality and quantity of farm produce required in the market, market prices, availability and accessibility of markets, reliable and affordable transport, weather forecast, value addition, post-harvest handling of the farm produce, farm input availability and their prices. Any information system generated for Tharaka Nithi should be cognizant of these felt needs. The information requirement for Tharaka Nithi concurs with the CTA (2015) which observed farmer information needs for other regions in Africa. Based on the level of the transaction of the commodity, various types of price data may be distinguished. For price observation, the most commonly considered transaction levels are (FAO, 2017).

- **Farm-gate level**: at or near the farm or place of production. Usually, it is the location where a commodity is first exchanged. Gathering information at this level tends to be expensive and impractical except for small, localized MIS.
- **Assembly**: where smaller quantities of a commodity – usually from different farmers and small-scale traders – are accumulated or aggregated. Assembly markets facilitate marketing and movement of commodities, and reduce marketing costs. Prices from these markets are probably the most useful for small farmers. However, they may also involve considerable collection costs.
- **Wholesale level**: usually, this is where traders sell to other traders or agents in the market, who then sell to retailers. Volumes per transaction tend to be larger. It is easiest to collect data at these markets, although farmers may require assistance in interpreting the meaning of wholesale market prices for their own situations.
- **Retail level**: where commodities are sold mainly to end users, especially consumers. Volumes per transaction tend to be smaller. While useful for early warning purposes, retail prices are only useful to farmers when they can access retail markets to make direct sales to consumers.

In addition to price information, several other services could be offered to farmers, depending on their location and the products produced. The CTA (2015) identifies these as:

- Weather, current and forecast: temperature, rainfall, wind strength, humidity
- News: news relating to the commodity in question
- Trade: quantities and volumes traded at selected markets, and across borders.
- Warehouses: location, quality and grades
- Inputs: type and prices of inputs sold (retailer, wholesaler and importer)
- Demand: consumption levels and patterns
- Production: crop types, area planted, stocks, yield levels, crop calendars
- Financial: foreign exchange, tariffs, insurance
- Regulations: taxes, standards, export requirements

3.8 Information products and information platforms

These are synthesized information products which facilitate efficient information dissemination. The flyers, magazines, bulletins, research journals are the main information products used to disseminate information to farmers in Tharaka Nithi (Table 5). Between 80 and 90% of interviewed farmers in Maara and Meru south had used them. These farmers reported accessing such materials from groups, from the ministry of agriculture office, during field training and from friends. The accuracy, quality and relevance of the information contained in such products ought to be reviewed by agricultural experts. As these are written products, they tend to benefit literate farmers more.

Table 5: Level of use of information products for knowledge dissemination

		Maara	Meru South
Information products for information dissemination		……%.....	
Use of fliers		80	90
Use of magazines		85	80
Use of research journals		80	85
Use of bulletins		90	80

Emergence of modern information communication technology provides a bright future for the information management bringing on board efficiency in information capture, storage, analysis and dissemination enabling real time access to information and data. Broad basing agricultural extension activities; developing farming system research and extension; having location-specific modules of research and extension; and promoting market extension, sustainable agricultural development, participatory research, etc. are some of the numerous areas where ICT can play an important role (Meera et al., 2004). Instead of waiting for periodic agro-advisory services from overstretched extension agents, Tharaka Nithi farmers and agripreneurs can access information, like weather forecasts and output market prices, directly on their phones. ICTs are also used to find the best locations and prices of such inputs as seed and fertilizers. In Nigeria, for example, the government's e-wallet program, which leverages farmers' access to mobile phones, enables farmers to obtain subsidized inputs that raise their productivity (Iboma, 2014; Okuseinde, 2014). There is evidence that ICTs increase the impact of young entrepreneurship and facilitate new avenues of addressing systemic barriers, such as skills acquisition, financing, marketing, and business networks. Internet enabled solutions could enable farmers to grow their performance as they become more effective and efficient, increase the scale of their operations, and thereby reap the benefits of global

and regional markets from which they have historically been cut off (Dalberg, 2013). The proliferation of mobile applications and services, web-based information platforms, and social media information increases the choices that farmers have in pursuing agribusiness opportunities. As network services increase in availability and quality, and the cost of technology decreases, devices will allow farmers to access sophisticated tools to develop their agribusiness and increase their access to markets, thus lowering the costs of production (Koira, 2014).

Some of the currently available mobile and web-based technologies:

- ***M-soko-****Msoko* is a mobile commerce application for buying and selling goods using smartphones and tablets. *mSOKO* is derived from the word "Soko" which is a Swahili word meaning "Market" while "m" stands for "Mobile". *mSOKO* is simply a "mobile market" that connects mobile users to merchants in Kenya. The App provides for registration of farmers and traders enabling farmers to sell the farm produce to various traders across the country
- **iCow***:* Extension and P2P learning service for dairy farmers using SMS and IVR in Kenya.
- **Mkulima young; http://www.mkulimayoung.com/:** *Mkulima Young* is a free web based resource that allows farmers to post their produce in search of potential buyers.
- ***Mpesa:*** Mobile money payments and transfers transforming rural economies by providing banking and lending services for millions in Kenyans including farmers.
- **SokoPepe; https://sokopepe.co.ke/** *Sokopepe* is a social enterprise supporting the agricultural sector in Kenya by offering market information and *farm* records management services

- **Mfarm** https://www.mfarm.co.ke/ *MFarm* empowers farmers by providing up-to-date market prices via an app or SMS. MFarm also offers a group selling tool, which gets farmers to team up to bring produce to certain drop off points. They then send an SMS to the system promoting what they have to sell. "All of these farmers who are too small to market to a big buyer become visible because they have more products. This enables them to attract large quantity buyers and also to cut marketing cost.
- **Farmis** http://www.farmis.co.ke/index *FARMIS* is the easy way to manage agricultural business online allowing you to quickly evaluate your income and expenses. It helps the farmers, traders, producers, farmer groups or organizations to create and maintain all your records in one place. It also provides interactive reports at the click of a button.
- **Nafis** http://www.nafis.go.ke/category/market-info/ *Nafis* provides a listing of average market price for produce. *Nafis* provides prices for nearly all the major towns in Kenya on a daily basis .Although it doesn't directly link you to the buyers, the information gathered here will support farmers to determine the prices they could expect from selling their products in different towns.
- **G-Soko-** A trading platform that ensures that farmers growing maize and beans in East Africa can sell their produce across East Africa through regionally certified warehouses.
- **Olx-**Platform through which a variety of products including farm produce are displayed for sale
- **Fertilizer optimization tool-**A mobile and computer based tool that enables farmers to determine appropriate application of fertilizer based on crop profitability
- **Nutrient Expert –** A computer based tool that directs farmers to the rate of fertilizer application that is appropriate for certain level of yield target. Through

this tool a farmer could estimate how much fertilizer he could combine with certain quantities of manure to for example 30 bags of maize in an acre thus reduce the fertilizer wastage that emanates from blanket fertilizer recommendation.

Whereas these, platforms ease farmers' access to market information, as shown in Table 4, the physical and technological infrastructure is the major challenge to widespread access and use of information in Tharaka Nithi. This finding is corroborated by Odongo, (2014) who showed that in rural Kenya, use of internet as a source of agricultural information could be as low as 4%. Considering the many benefits of ICT, the county government needs to develop physical and ICT infrastructure to enable efficient information capture, analysis and dissemination. This goes hand in hand with development of ICT skills for extension workers & farmers for better information access and dissemination. The agricultural department also needs to seek government's support to establish tele centers and information centers from where farmers and other stakeholders can access information. The county agricultural department needs to link up with the public and private agricultural marketing information generators to gather comprehensive information for use by farmers.

3.9 Information dissemination

Often information exists, but farmers are not aware of its existence. Hartwich et al., (2007) argue that lack of exchange of information between farmers and producers of farm-relevant knowledge is the key issue in pro-poor agricultural development across the world. Effective knowledge and information management in the agricultural sector will be achieved when the right knowledge and information is delivered to the farmers and other stakeholders at the right time in a user-friendly and accessible manner. Once the knowledge flows from research to extension then the extension workers need to create awareness of agricultural marketing information and facilitate its accessibility. This is

possible through farmer group training, farm visits and use of farm demonstrations. Table 6 shows that, among the most effective methods for agricultural information marketing in Tharaka Nithi are: use of local leaders, use of radios & mobile phones, field days, farm visits, field trips and farmer to farmer interactions.

Supply of marketing information alone to farmers is not sufficient for transforming farmers produce marketing. Farmers require assistance with interpreting marketing information (Shepherd, 2011). The areas that require support include helping farmers to understand why prices change. For example, FAO (2017) notes that farmers should understand the qualities and varieties that the MIS prices quoted refer to and, in some cases, their units, when prices are quoted on metric units e.g. kilograms, tons, bags, heap or "bunch. To use market information for longer-term decisions, farmers should be aware of storage costs, to decide whether to store or not; in addition, they should have an understanding of production costs, so that they can use MIS to plan whether to grow new crops or to move to off-season production (FAO, 2017).

Table 6: Suggested ways of delivering agricultural marketing information

	Independent Farmers (n =80)	Farmer Group Members (n=74)	Independent + Farmer group (n =154)
Delivering of AMI	……..%.....		
Farmer to farmer interaction	45	46	46
Conduct personal research to get right information	13	38	26
Communicating during field days, farm visits and field trips	37	43	40
Use of local radios and mobile phones	40	54	47
Use chiefs and village elders to reach out to many farmers	55	51	53
Use of extension services	17	29	23
Use of bill boards in various locations	25	24	24
Use of seminars, open forums and agricultural shows	23	16	19
Through churches	5	14	9
Through groups/Group leaders	5	22	12

4.0 CONCLUSION

This study drives us to a conclusion that the county has existing agricultural marketing information systems serving farmers and other stakeholders. These information systems have not fully addressed farmers' information needs due to a variety of changes ranging from technological, literacy, information packaging and low extension worker-farmer ratio among others. Relevant information ought to be captured, analyzed, stored, packaged, disseminated and feedback sought from users for continuous improvement of

the agricultural marketing information systems. The requirements for efficient agricultural marketing information systems ought to be clearly spelt out to enable the government to provide the required support to ensure efficient agricultural information management.

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