



**KNOWLEDGE, PERCEPTION AND CHALLENGES OF ICT TOOLS ADOPTION TO IMPROVE
MARKETING OF VEGETABLE PRODUCE: CASE STUDY OF VEGETABLE FARMERS
IN MANZINI REGION, SWAZILAND**

Ajay S. Singh*., Sebuliba SimonThomas and Kibirige Douglas

Department of Agricultural Economics and Management,
University of Swaziland, Luyengo. M205, Swaziland.

ARTICLE INFO	ABSTRACT
<p>Received 22nd, December, 2016, Received in revised form 8th, January, 2017, Accepted 15th, February, 2017, Published online 28th, March, 2017</p> <p>Keywords: Adoption, Information Communication Technology, marketing, farmers, vegetable produce</p>	<p>Vegetable production in Swaziland is seasonal and mainly carried out during winter. There is increasing demand for vegetables as a result of rising income and changing consumption patterns in Swaziland. However, access to these vegetable markets remains one of the major challenges faced by these vegetable farmers. In this error ICT has been used as a tool to ease networking and connections to potential relevant service providers and customers. However little is known about farmers' knowledge, perceptions and challenges they face when using ICT tools for improved marketing of vegetable produce. Primary data was collected using questionnaires administered to 83 respondents including 41 farmers contracted by the National Agricultural Marketing Board (NAMBoard) and 42 farmers who sold vegetables independently to communal markets in Manzini, Mhlanganyane and Mbabane areas, respectively. The study mostly employed descriptive and inferential statistics. Results of the study indicate that the majority (54%) of NAMBoard farmers were female and 57% of the Non-NAMBoard farmers were female. About 55% of NAMBoard female farmers and 68% of the non-NAMBoard female farmers had ICT Knowledge. Most farmers (46% NAMBoard and 36% non-NAMBoard members) were aged between 30 and 40 years, mostly the younger farmers aged between 20 and 30 were more knowledgeable about ICT in both categories 67% of NAMBoard contracted and 83% of non-NAMBoard contracted farmers). Most farmers attained secondary education and at least 50% of NAMBoard and 60% of non-NAMBoard farmers at this education level had knowledge about ICT. Whereas NAMBoard members perceived ICT as an important tool for doing farming businesses, improve vegetable production, and help in farmer to farmer exchange of farming knowledge, additionally the non-NAMBoard farmers indicated that ICT further improves on the communication with extension workers and enhances communication amongst farmers and their market places. Major challenges faced by vegetable farmers included high transportation costs, less access to farm inputs, poor communications between sellers and consumers, poor market information and limited access to extension service, and market price fluctuations for both inputs and outputs. The study recommends that government and donors should encourage creation of ICT facilities for agricultural market information centres and set programs that encourage farmers to adopt the use ICTs more efficiently and effectively for improved agricultural production and marketing.</p>

Copyright © 2017 Ajay S. Singh et al., This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Agriculture plays a crucial role in the development of the economy in Swaziland and it provides resources for agro-processing industries that form the backbone of the manufacturing sector. In 2008, agro-processing industries contributed 11.9 per cent of the gross domestic product (GDP) and agricultural activities conducted on the Swazi Nation Land contributed about 5 per cent of the GDP (Sifundza, 2013). The agricultural sector is characterised by a dualistic nature

consisting of modern and traditional sectors. About 80 % of the Swazi population lives on Swazi Nation Land (SNL). They derive their livelihood from subsistence agricultural production (Thompson, 2007). The promotion of vegetable production has been the basic foundation in the overall promotion of horticultural products in Swaziland. However, farmers are facing challenges concerning reduced government support, increasing foreign competition, a changing demographic make-up of the domestic population and concentration of industry

*✉ **Corresponding author: Ajay S. Singh**

Department of Agricultural Economics and Management, University of Swaziland, Luyengo. M205, Swaziland

marketing power (Taylor, 2003). The National Agricultural Marketing Board (NAMBoard) (2011) states that the number of small commercial and semi-commercial vegetable farmers is between 1 900 and 2 200. These farmers are cultivating between one to five hectares of vegetables either contracted to the larger wholesalers or processors, or selling to supermarkets, markets or directly to consumers. Of these only 2 to 6% cultivate baby vegetables and the rest cultivate conventional vegetables (NAMBoard, 2011).

It is recognized that agricultural marketing is the critical link between agricultural production and farm sector revenue percolating to the farmers. One of the most important problems of agricultural marketing can be traced to lack of information. Such information is instrumental in making decisions about future crops and commodities and about the best time and place to sell and buy goods (Stienen, Bruinsma, & Neuman, 2007). Casaburi et al. (2014) also reported that ICT tools could potentially offer the opportunity to deliver personalized agricultural information to farmers at low-cost and in a way that is tailored to their context and timed to coincide with the relevant part of the agricultural season. It could also help them coordinate with buyers and secure inputs from suppliers more efficiently. In Swaziland, the telephone system is somewhat modern but not an advanced system, a domestic single source for mobile-cellular service with a geographic coverage of about 90% and a rising subscribership base; combined fixed-line and mobile cellular tele-density roughly 60 telephones per 100 persons in 2011; telephone system consists of carrier-equipped, open-wire lines and low-capacity, microwave radio relay (Central Intelligence Agency, 2014).

In Swaziland, there is a high demand for vegetables but most of the farmers lack the necessary skills of going about growing them due to the fact a high percentage is being imported from South Africa (Xaba & Masuku, 2013). In an interview with the Information and Communications Technology (ICT) manager of NAMBoard, most farmers would receive information from the market extension officers about what type of vegetables to plant for the market, the prices available to purchase inputs as well as their produce in the market. Most farmers reside in rural areas and market extension officers visit them at least once a month. Some farmers have reported that they have not been visited by extension officers, and these could be attributed to a number of issues including lack of enough extension officers, the farmers being too remote that the extension officers find it difficult to reach these farmers and therefore causes inefficiencies in terms of the flow of market information as well as accruing more costs to the farmer (personal communication, 2015). Furthermore, most conventional vegetable farmers do not receive visits from extension officers, and when they do, it is after long periods of time when these officers come to their farms and monitor operations (Griffon, 2007).

According to the Food and Agricultural Organization (FAO) (2013), most farmers have access to a variety of information sources that they consult for regular agricultural information, even though these may not be the most up-to-date, accurate or beneficial sources. Many farmers do not have a single channel

that serves as a comprehensive source for all their information needs. The most common sources are still TV, radio, newspapers, other farmers, government agricultural extension services, traders, input dealers, seed companies and relatives. However, the quality and relevance of the information provided by these sources can be highly variable (FAO, 2013). The main limitations to the adoption of ICTs in agriculture appear to lie in the education levels and cultural backgrounds of rural communities, as well as a lack of motivation stemming from the farmers' perception of the scant usefulness of ICTs and their limited digital skills (Rodrigues, 2012). This leads to misinformation in markets whereby farmers and traders who do not fully rely on their vegetable business for a steady income often sell their produce without the proper information of selling the produce. This subsequently allows retail agents to encourage this practice since it provides an opportunity for them to make more profits (Sithole & Grenoble, 1999).

Small and Micro Enterprises (SMEs) in particular vegetable farmers find limited access to market information which therefore lessens opportunities in the market. Overall aggregate demand for the sector's products is low and markets are saturated due to overproduction and dumping of cheap imports. Markets do not function well due to insufficient information, high transaction costs and stiff competition for similar products (Kiveu & Ofafa, 2013). Therefore, intermediary organisations have to connect rural communities to available knowledge make relevant information accessible to end user. One of the main challenges is the trust factor that must be overcome for buyers to turn to new ICT-enabled forums as an alternative to their relationship-based trade (USAID, 2013). From these observations, the researcher will be inquiring whether farmers have sufficient knowledge about ICT and can they adopt the usage of ICT tools for marketing purposes in their businesses.

The objective of the present study is to see how farmers' knowledge towards Information Communication Technology (ICT) and how they can use ICT tools (cell phone, television, computers, and newspapers) in improving their marketing of vegetable produce and to identify farmers' perceptions towards use of ICT tools for marketing purposes. Another important objective of present study is to describe the knowledge of ICT and also identify the challenges which commercial farmers face in marketing their produce.

LITERATURE REVIEW

Vegetable production in Swaziland

Vegetable production in Swaziland is seasonal and farmers, especially on SNL produce maize in summer and vegetables in winter with the most commonly produced vegetables in the country being tomato, cabbage, carrot and onion. These could be labelled as the 'big four' and others include beetroot, lettuce, potato, green pepper, cauliflower, brussels sprouts and broccoli. Vegetables such as tomatoes, cabbages, carrots and onions can be grown in any part of the country and as a result, all vegetable growers usually produce these crops. From mid-winter to early summer these vegetables are usually plenty at the market place. The bulk of locally produced vegetables are sold within the country, but they can be sold outside the country if produced

throughout the year and in significant quantities (NAMBoard, 2009).

Xaba & Masuku (2013) also reported that the increasing demand for fruits and vegetables as a result of rising incomes and changing consumption patterns coupled with declining farm incomes due to increase in costs and stagnating food grain productivity has necessitated diversification towards high-value crops in recent times. Apart from income enhancement, high-value crops have a potential to generate additional employment opportunities in farming due to their labour-intensive character. Vegetable production has been impressive, more especially production by farmers on the Swazi Nation Land. Vilakati (2009) stated that 56% of the country's total area is Swazi Nation Land and the remaining 44% is title deed land. About 130,000 hectares out of 965,000 hectares of land are cropped in the Swazi Nation Land with different crops including conventional vegetables. The type of farmers that are found in this type of land are small scale farmers and low income earners. They lack technology, credit facilities and are poor educated, yet they are significant participants in the production and marketing of vegetables (Vilakati, 2009).

Marketing of vegetables in Swaziland

Barnard et al. (2012) defined marketing as the process of anticipating the needs of targeted customers and finding ways to meet those needs profitably. Kohl & Uhl (2002) further explains marketing as the performance of all business activities involved in the flow of products and services from a point of initial production unit (farm/firm) into the hands of consumers. The National Agricultural Marketing Board (NAMBoard) was established in 1985 to be responsible for encouraging Swazi farmers to grow vegetables and therefore provide a market where farmers can sell their vegetables (NAMBoard, 2011). Although NAMBoard was established as a national marketing channel in Swaziland, vegetables are also marketed through a number of marketing channels in Swaziland. These channels include supermarkets, communal farm gates, hotels, restaurants and vendors (Shongwe, 2010).

It should be noted that these alternative channels gained significantly popularity, to the extent where the operations of NAMBoard was considered to have become either stagnant or declining during its restructuring process (Mathunjwa, 2007). Improving vegetable marketing in developing countries such as Swaziland is vital because of the fast growing demand due to urbanization, opportunities it offers in generating income for smallholder farmers by exporting high value crops and providing employment opportunities as a result of its labour intensive production (Xaba & Masuku, 2013).

ICT tools defined

According to Nmadu et al. (2013), Information and Communication Technology (ICT) is an umbrella term that includes any communication device or application encompassing; radio, television, cellular phones, computer, network of hardware and software, and satellite system. It covers all forms of computer and communication equipment and software used to create, design, store, transmit, interpret,

manipulate, produce and present information in its various formats. Sibozwa (2015) defined ICTs (Information and Communication Technologies) as any electronic means of capturing, processing, storing and disseminating information. Saghir et al. (2013) differentiated ICT into three categories such as, new ICTs (computer, internet, and mobile phone), old ICTs (radio, television, land line telephone and telegraph) and really old ICTs (Newspaper, books and libraries).

Role of ICT tools in agricultural marketing

The rise of ICT tools is only one of the ICT solutions with significant potential to serve developing markets, especially rural ones. For example, recently, many Internet-provided services have begun to shift away from written language towards the use of audio and video services, lessening the need for consumers to be able to read and write. From making a simple call to a contact for information, to gaining access to new markets and buyers, or obtaining expert advice from distant experts, ICT in particular the mobile phone has made obtaining the right information on demand achievable for many people, despite their remoteness (FAO, 2013). According to Palmer (2011), strengthening smallholders' access to quality market information especially market information is an area where ICT has great potential and already some success in developing countries' agriculture.

Despite multiple public and private investments in agriculture, there are very few countries that have good basic price information services. Yet this is changing with increases in connectivity and affordability of ICT tools. Market information can be provided through a diverse set of mediums including ICT tools, Internet, and radio. Using ICT tools, like mobile phones farmers can:

- Make more informed decisions on where and when to sell the farm output,
- Bypass or bargain with middlemen (empowering their negotiation prospects),
- Make better risk mitigation decisions based on localized weather, and
- Be more aware of more demanded products, scarce agro-inputs, and availing subsidies. (Palmer, 2011).

Several documented examples exist of the impact of traders and farmers simply using mobile phone technologies on their own to exchange price information. In Kerala, India, a study found that mobile phone coverage alone led to significant market efficiencies: the difference in prices across markets declined, as did waste; fishermen's profits increased by 9 per cent and consumer prices declined by 4 per cent (Jensen, 2007). The Japan International Cooperation Agency (JICA) conducted a similar study of the banana market in 2009 and found that as mobile phone markets expanded their coverage in Uganda, information flows rose and banana farmers, especially those furthest from markets began participating more in markets and their profits increased by 10 per cent (Megumi & Yamano, 2009).

Farmer's perception towards ICT

Ogbonna and Agwu (2013), stated that there are lots of difficulties facing rural farmers which can be solved by

providing them with adequate access to quality information which many researchers have generated. ICTs can enhance the integration and efficiency of agricultural systems by operating new communication pathways and reducing transaction cost by enhancing accessibility of information on price, transportation and production technologies (CTA, 2003). The ICTs play important roles in addressing these challenges and enhancing the standard of living of rural farmers. The ICTs when available to rural farmers will improve the availability and quality of information either indirectly through producers, associations, extension workers and the like or directly through broadcast radio information and mobile phone messaging. The ICTs also facilitate the ease of communication, which has many profound effects. In marketing of agricultural products deals can be made through emails and mobile phone technology.

Cheap and high-quality internet access can unlock more of the potentials of rural areas and make them more viable places for people to live. The ICTs can help existing rural business to perform tasks more effectively and efficiently and respond to their demand for rapid access to diverse kinds of information. The traditional media has been very successful in developing countries and rural radio in particular has played a major role in delivering agricultural messages. Rural farmers can tune in to radio stations even when they are working at their farms. Telephones, video, television, films, newspapers and pictures have also been used to speed up the flow of information to rural people (Ogbonna & Agwu, 2013).

Market Information Systems

Shepard (2011) reported that FAO defines a market information service (MIS) 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, policy-makers and others. Before focusing on ICT applications that can make market price information easier to obtain, it is important to understand the potential of cell phone communication by itself as an effective means for producers and traders to learn market prices. Although some subscription-based market information services can be more efficient, it is important to understand the impact of an "organic" approach for producers, traders, and other market actors to receive market information, especially given how elusive sustainable and scalable business models for subscription services have been in sub-Saharan Africa to date (Payne, 2010).

The purpose of market information is to assist growers and traders in balancing supply and demand on particular markets and so to limit excessive price rises and surpluses (Palmer, 2011). He also further notes that as the price is generally fixed after buyer and seller have judged supply and demand to the best of their ability, market information should be available prior to price information whenever possible. In many developing countries and countries in transition, government-

run market information services (MIS) may not be the main source of market information for farmers. Some countries still do not have such services and, where MIS are operated, they often provide inadequate information. Small farmers often rely more on word-of-mouth information from other farmers and from traders. As telecommunications improve rapidly, many farmers are beginning to seek information by telephone directly from the major markets.

Dozens of ICT solutions are being launched in developing countries worldwide to deliver market information to small farmers (Payne, 2010). Magesa et al. (2014) reported that market information services usually involve the regular collection of commodity prices from major markets and supply conditions, processing and storing them, and disseminating the information to different stakeholders using one or more channels. The low returns of agriculture produce to smallholder farmers are associated to lack of market access and the marketing information. Due to lack of market information, farmers are failing to negotiate better on the prices of their produces and thus are paid a little. Small size of produce and poor road conditions may discourage farmers to travel to distant markets to search for better price. Lack of market information has also resulted in introduction of middlemen or intermediaries who are better equipped with marketing information.

Marketing challenges faced by vegetable farmers

Poor access to these assets affects the way in which conventional vegetable farmers can benefit from opportunities in agricultural markets, and especially in terms of volume and quality of the produce traded (Sifundza, 2013). Kohl & Uls (2002) stated that some of these challenges could include land size, physical access to markets, poor market information systems, access to production finance and access to affordable farm inputs.

Land size of farmers

The land size of most farmers is very small, and farmers are located all over the country. This makes marketing of particular commodities extremely difficult, both from the farmer's and the market perspective (Kohls & Uhl, 2002). The size of the plot, especially in communal projects is identified as a major constraint. The situation is exacerbated by the high number of households on a single plot in the country. Some vegetable farmers in most parts of the country identified water and irrigation infrastructure as being the major constraints causing under-utilization of land (FAO, 2010).

Low production is a major limitation for some of the commodities considered. In many cases this results from the small acreage of land owned or leased by farmers. Also, the quality of planting stock used by farmers is generally poor, resulting in poor-quality products that cannot compete on the market. This acts as a disincentive to increasing production (Pswarayi-Riddihough & Jones, 1995).

Physical access to markets

Most farmers are off the main roads and during certain times of the year access to and from can be extremely difficult. Since

agricultural products are highly perishable, farmers make huge losses. Additionally, the cost of marketing for small holder farmers can be very high owing to the negative economies of scale, transportation can significantly dent farmers' profitability and thus farmers will resort to trading in the village, and prices are very low owing to the low number of people who can afford to pay (Kohls & Uhl, 2002).

In urban areas, infrastructure and transportation are usually well developed, but not in remote areas where poor infrastructure and high costs of transportation are barriers for potential market entrants, leading to a less competitive market environment. In some countries like Nepal, produce intended for the market never makes it there because both infrastructure and transportation are poor.

This problem is acute on larger islands, for example in the Philippines, where farmers are scattered over wide areas and transport costs are high. Some bulky commodities, such as fuel wood, a low-value product, are expensive to transport and therefore less lucrative. Poor transportation decreases quantities available for the market and acts as a disincentive to increased production. Most farmers do not own vehicles so overhead costs of transportation of certain commodities may be even higher than expected returns. Poor economic conditions in these countries hamper the possibilities to upgrade the infrastructure in the immediate future (Pswarayi-Riddihough & Jones, 1995).

Poor market information systems

Farmers generally do not have the required information and means to locate better markets. Many a time reliable markets are located further away and are difficult to access. Only farmers with assets such as vehicles are able to move around in search of a better market. When one visits market centres, it is not uncommon to meet farmers who used their own vehicles to get to the market (Makhura, 2001).

Shongwe (2010) also states that inadequate market linkages and market extension support, fosters multiplicity of technology transfer systems. There are weak research-extension-farmer- market linkages and inadequate operating resources (Kleih, 1999).

Kohls and Uhl (2002) state that farmers to produce effectively and maximize returns, there is a need to receive the right type of information and at the right time for good decision making. Currently, information is derived from different sources, largely distorting the market and causing regular cycles of shortages and gluts in the market.

One of the most common problems faced by small farmers in Asia and other developing regions is the lack of market information on prices and factors influencing market prices. Market information systems must be made available and efficient. Governments should fund and develop ways in which market information can be disseminated. Small-scale farmers are often short of resources, so information must be disseminated at little or no cost to them (Pswarayi-Riddihough & Jones, 1995).

Access to production finance

Agriculture by nature is a slow maturing industry, this does not bode well with commercial lending approaches as crop/livestock cycles are difficult to follow in terms of repayments, and therefore specialized financial products are required unique to each crop/livestock portfolio (Kohls & Uhl, 2002). Conventional vegetable farmers have a challenge of lack access to bank credit since they are unable to provide the traditional forms of collateral security demanded by most commercial banks (Sifundza, 2013).

Most farmers in rural areas are in poor financial position and therefore have no assets. The only security they have for their credit is the anticipated increase in production and income. The greatest issue is the lack of collateral which is demanded by the financiers and most of the projects do not have the muscle to provide the much needed capital (Langwenya, 2011).

Access to affordable farm inputs

Since all farm inputs (seed, fertilisers, and farm chemicals) are produced outside the country, mainly in the Republic of South Africa, the cost of these is beyond reach of many farmers. This therefore causes farmers to use improper combinations of inputs which mean low harvest, poor product quality, resulting on loss of market opportunities and poor prices received (Kohls & Uhl, 2002).

Very few conventional vegetable farmers have access to modern production inputs because they do not have access to credit. However, some farmers are reluctant to seek funds on credit or procure fertilizer on fear of crop failure or not knowing where to sell their produce after harvesting. It has also been found that vegetable farmers operating in groups, particularly group projects are more unwilling to apply for loans and prefer government financial assistance to purchase production inputs such as fertilizer, seeds and chemicals (FAO, 2010).

Marketing support rendered by the National Agricultural Marketing Board (NAMBoard)

National Agricultural Marketing Board (NAMBoard) is an agricultural related parastatal in the kingdom of Swaziland. Its purpose is to stimulate local production by providing technical service and the marketing of agricultural produce in the country, and particularly to support the small farmer. The board facilitates in the agricultural production, processing, storage, transportation, distribution and sale of both baby and conventional vegetables (NAMBoard, 2011). The NAMBoard (2011) states that conventional vegetable farmers contracted to them receive a wide range of benefits in producing and marketing their vegetables. These include cheaper farming inputs like fertilizer, seeds, seedlings, and farming chemicals, which they obtain at the Farmers Shop under the Farmers Support and Development Unit. The farmers are also able to purchase these farming inputs on credit. The money is then deducted from the amounts the farmer will obtain are selling his produce at the market. If the farmer purchases the farming inputs in bulk, NAMBoard does provide transport through extension officers who work under the farmer's region or area. Also, farmers contracted to NAMBoard have a reliable market

for their produce. The farmers apply to supply a particular crop and are assigned planting dates, and told what area to plant. In return they get a guaranteed market and price for the produce. The project benefits both the market which has better control over its supplies of fresh produce, and the farmer who does not need to worry about marketing his crop (NAMBoard, 2011).

Support from Government and non-governmental bodies to small holder farmers

The Ministry of Agriculture plays a significant role in running the competition which is supposed to encourage summer production of vegetables where prices are high. Every year NAMBoard promotes crop production of different varieties of vegetables as a diversification strategy for the summer production. This initiative is undertaken through a National Vegetable Competition (NAVECO) which is administered by the Ministry of Agriculture (MOA) (NAMBoard, 2010). Sithole and Grenoble (1999) highlighted that NAMBoard maintains reliable records of vegetables that are traded through the Encabeni Market and imports coming the formal channels. Similarly they also state that local production is nearly impossible to know although the Marketing Advisory section of the MOAC maintains limited records for use in promoting marketing activities.

METHODOLOGY

The design of the research was descriptive and cross-sectional with an aim of describing the farmer's knowledge of ICT tools for marketing given their characteristics in the Manzini region. Purposive sampling was used in this study. The population of the study was in the Manzini region mainly targeting on vegetable farmers. The sample size of NAMBoard contracted was 41 farmers who were from the population of NAMBoard contracted farmers which was 90 by simple random sampling method and 42 independent farmers engaged vegetable production from the population of independent farmers which was 95 by simple random sampling method. The information was collected through self-designed, well-structured and pre-tested questionnaire which was used by the researcher. This was administered by the researcher through personal interviews with the farmers and extension officers.

RESULTS AND DISCUSSIONS

Table 1 shows the ICT knowledge among the respondents from NAMBoard contracted farmers and independent farmers according to their sex. The results indicate that 52.6% of NAMBoard farmers were male who have knowledge about ICT and 47.4% did not have any knowledge.

Table 1 Distribution of farmer's knowledge of ICT according to sex

Sex	ICT Knowledge					
	NAMBoard farmers			Independent farmers		
	Yes	No	Total	Yes	No	Total
Male	10 (52.6%)	9 (47.4%)	19	13 (65.0%)	7 (35.0%)	20
Female	12 (54.5%)	10 (45.5%)	22	15 (68.1%)	7 (31.8%)	22
Total	22	19	41	28	14	42

About 54.5% of NAMBoard female farmers had knowledge about ICT tools and 65.0% did not have any knowledge on ICT. The results also show that 35.0% of independent farmers were male farmers who had knowledge about ICT and 38.8% did not have any ICT knowledge. About 68.1% of non-NAMBoard farmers were female who had knowledge about ICT tools and 31.8% did not have any knowledge on ICT.

Table 2 shows the ICT knowledge among the respondents from NAMBoard contracted farmers and independent farmers according to their age. The results indicate that 66.6% of NAMBoard farmers aged between 20 to 30 years had knowledge about ICT and 33.3% did not have any knowledge on ICT. The NAMBoard farmers aged between 30 to 40 whom had knowledge about ICT were 63.2, and 36.8% of them did not have the ICT knowledge. The 75% of farmers aged 40 to 50 years did not have knowledge on ICT while 25% had the knowledge. About 67% of NAMBoard farmers aged between 50 to 60 years did not have knowledge related to ICT while 33.3% did have knowledge on ICT.

Results further revealed that about 83% of independent farmers aged between 20 to 30 years have knowledge about ICT and 16.6% do not have any knowledge on ICT. Independent farmers aged between 30 and 40 had knowledge about ICT were 80% and 20% of the same age group did not have knowledge. The 75% independent farmers aged 40 to 50 years had knowledge on ICT while 25% did not have knowledge on ICT. The 60% of independent farmers aged between 50 to 60 years had knowledge related to ICT while 40% did not have the ICT knowledge. The results of the findings also concur with Sibozza (2015) which stated that mostly younger people venture into use of ICT for their production and businesses.

Table 2 Bivariate frequency table showing farmers' knowledge of ICT according to age

Age	ICT Knowledge					
	NAMBoard farmers			Independent farmers		
	Yes	No	Total	Yes	No	Total
20-30	6 (66.6%)	3 (33.3%)	9	10 (83.3%)	2 (16.6%)	12
30-40	12 (63.2%)	7 (36.8%)	19	12 (80.0%)	3 (20.0%)	15
40-50	1 (25.0%)	3 (75.0%)	4	3 (75.0%)	1 (25.0%)	4
50-60	2 (33.3%)	4 (66.7%)	6	3 (60.0%)	2 (40.0%)	5
60+	1 (33.3%)	2 (66.7%)	3	0 (0.0%)	6 (100.0%)	6
Total	22	19	41	28	14	42

Table 3 shows the ICT knowledge among the respondents from NAMBoard contracted farmers and independent farmers according to their academic qualification. The results indicate that 100.0% of NAMBoard farmers who attended primary schooling had knowledge related to ICT. At least 50% of NAMBoard farmers who attended IGCSE/O'level had knowledge while 50% did not have knowledge related to ICT. The 55.5% of NAMBoard farmers who attended tertiary institutions had knowledge on ICT while 44.4% did not have the ICT knowledge.

Table 3 Bivariate frequency table of farmer's knowledge of ICT according to academic qualification

Academic Qualification	ICT Knowledge					
	NAMBoard farmers			Independent farmers		
	Yes	No	Total	Yes	No	Total
Primary	2 (100.0%)	0 (0.0%)	2	5 (83.3%)	1 (16.6%)	6
IGCSE/O'level	15 (50.0%)	15 (50.0%)	30	15 (60.0%)	10 (40.0%)	25
Tertiary	5 (55.5%)	4 (44.4%)	9	8 (72.7%)	3 (27.3)	11
Total	22	19	41	28	14	42

Table 4 shows the ICT knowledge among the respondents from NAMBoard contracted farmers and independent farmers according to their farm incomes. The results indicate that 56.3% of NAMBoard farmers who earn less than E5000 had knowledge related to ICT while 40.0% did not have such knowledge. The 57.1% of NAMBoard farmers who earn E 5000 to E10000 had knowledge related to ICT while 42.8% did not have such knowledge.

Table 4 Bivariate frequency table showing farmers according to farm income

Farm Income (Emalangi)	ICT Knowledge					
	NAMBoard			Independent		
	Yes	No	Total	Yes	No	Total
Less than E 5000	9 (56.3%)	6 (40.0%)	15	5 (71.4%)	2 (28.6%)	7
E 5000- E10000	4 (57.1%)	3 (42.8%)	7	9 (52.9%)	8 (47.1%)	17
E10000 -E15000	4 (44.4%)	5 (55.5%)	9	7 (77.7%)	2 (22.2%)	9
E15000 -E20000	3 (60.0%)	2 (40.0%)	5	5 (83.3%)	1 (16.6%)	6
More than E20000	2 (40.0%)	3 (60.0%)	5	2 (66.6%)	1 (33.3%)	3
Total	22	19	41	28	14	42

About 44% of NAMBoardfarmers who earn E10000 to E 15000 had knowledge on ICT while 55.5% of them did not, 60% of NAMBoard farmers who earn E15000 to E20000 had knowledge on ICT while 40% did not. The 40% of NAMBoard farmers who earn more than E20000 had knowledge on ICT while 60% did not. The results also indicate among independent farmers, 71.4% of them who earn less than E5000 had knowledge on ICT while 28.6% did not have knowledge on ICT. About 53 % of independent farmers who earn E 5000 to E10000 had knowledge on ICT while 47.9% did not have such knowledge. The 77.7% of independent farmers who earn E10000 to E 15000 had knowledge on ICT while 22.2% of them did not. About 83.3% of independent farmers who earn E15000 to E20000 had knowledge on ICT while 16.6 % did not. Sixty seven percent independent farmers who earn more than E20000 had knowledge on ICT while 33.3% did not have such knowledge.

Table 5, results indicate that amongst NAMBoard contracted farmers, 26.8% use ICT tools only for market information and communication purposes, 24.4% use only for both agricultural marketing and information as well as news and weather, 12.2% use ICT tools only for news and communication, 9.7% use ICT tools only for agricultural programmes and weather, and 2.4%

use it only for listening to news.Among independent farmers, 23.8 % use ICT tools for news and communication as well as all purposes mentioned above on table 4. 19% use ICT tools only for market information and communication, 14.2% use ICT tools only for news and weather, and 7.1% use ICT tools only for agricultural programmes and weather as well as agricultural and marketing information. Only 4.76% of independent farmers do not ICT tools for any agricultural purpose at all.

Table 5 Frequency table showing farmers using ICT for agricultural purposes

Agricultural Purpose	NAMBoard farmers		Independent farmers	
	Frequency	Percentage	Frequency	Percentage
Listening to news	1	2.4	0	0
Agricultural programmes and weather	4	9.7	3	7.1
Market information and communication	11	26.8	8	19.0
News and communication	5	12.2	10	23.8
Agricultural and marketing information	10	24.4	3	7.1
News + weather	10	24.4	6	14.2
All the above	0	0	10	23.8
none	0	0	2	4.76
Total	41	100.0	42	100.0

Farmer's perceptions using ICT for their businesses

Table6 presents the farmer's perceptions in descriptive statistics form where by the farmers used this method to answer it 5 = Strongly Agree (SA), 4 = Agree (A), 3 = Do not Know (DK), 2 = Disagree (D) and 1 = Strongly Disagree (SD). Then the averages of all the responses as well as the average of the above likened scale were computed and if it is less than 3 it means disagree to strongly disagree and if it is more than 3 it means agree to strongly agree and if it equal to 3 it means do not know. Table 6 shows that the average for the NAMBoard farmers which perceive that ICT can help in farming is 4.06 and the average for the independent farmers which perceive that ICT can help in farming is 4.23. This shows that both groups agree that indeed ICT tools do help in their farming.The results also present that the average of NAMBoard farmers who perceive that ICT can improve vegetable production is 4.44, while the average of independent farmers who perceive that ICT can improve vegetable production is 4.26. The average for NAMBoard farmers who perceive that ICT can improve their production is 3.98 and for independent farmers are 4.12. The NAMBoard farmers who perceive that farmers do communicate using ICT are 4.20 and for independent farmers are 4.38. The results continue to indicate the average of the response of NAMBoard farmers who perceived that ICT has improved communication with extension officers is 3.88 and for independent farmers is 4.36.The NAMBoard farmers who perceive that ICT has enhanced farmers communication is 3.93 and for independent farmers it was 4.26

The averages for NAMBoard farmers who believe that the current ICT infrastructure is adequate is 3.48 and for independent farmers are 3.55. The averages for NAMBoard farmers who perceive that farmers need to be sensitized and have knowledge about ICT tools are 3.87 and for independent farmers are 4.2.

Table 6 Descriptive statistics of farmers' perceptions on ICT tools

Parameter	NAMBoard farmers				Independent farmers			
	Min	Max	Mean	SD	Min	Max	Mean	SD
ICT tools can help farmers as they do their farming businesses	3	5	4.78	.57	1	5	4.64	.90
ICT tools can improve vegetable production	2	5	4.44	.78	1	5	4.26	.99
ICT tools can improve farmers production	3	5	3.98	.52	2	5	4.12	.89
I do communicate with other farmers on farming issues when using an ICT tool.	3	5	4.12	.56	2	5	4.38	.80
Use of ICT has improved the efficiency of communication with extension officers	2	5	3.88	.90	2	5	4.36	.85
Use of ICT has enhanced communication amongst farmers and their market places.	1	5	3.93	1.0	1	5	4.26	.91
The available ICT tools infrastructure is adequate for farmers	1	5	3.49	1.2	1	5	3.55	1.3
Farmers needs to be sensitized and knowledgeable about ICT tools	1	5	3.88	.98	1	5	4.24	.98

Where: Min = Minimum, Max = Maximum and SD = Standard deviation

Marketing challenges and constraints faced by vegetable farmers

Table 7 presents the farmer's challenges and constraints when marketing their produce in descriptive statistics form where by the farmers used this method to answer it 5 = Strongly Agree (SA), 4 = Agree (A), 3 = Do not Know (DK), 2 = Disagree (D) and 1 = Strongly Disagree (SD). Then the averages of all the responses as well as the average of the above likened scale were computed and if it is less than 3 it means disagree to strongly disagree and if it is more than 3 it means agree to strongly agree and if it is equal to 3 this means do not know. Table 7 shows that the average score of NAMBoard farmers who face high transportation costs as a challenge when marketing their produce is 4.9, while the average score of independent farmers who face high transportation costs as a challenge when marketing their produce is 4.9. The average score for NAMBoard farmers who have poor communications when marketing and confine sales to nearby consumers is 4.34 and for independent farmers were 4.48. The NAMBoard farmers whose suffers losses through deterioration in quality reduce the value of the vegetable scored this statement 4.27 while the independent farmers scored the same statement as 4.31.

averagely as 4.32 while the independent farmers scored the same statement with an average of 4.38. The averagescore for NAMBoard farmers who believe that lack of government support can also affect vegetable production was 4.07 and for independent farmers scored the same statement as 3.93 on average. The averages scores for NAMBoard farmers who believe that price fluctuations can also affect the marketing of vegetables were 4.07 and for independent farmers score was 4.36.

CONCLUSIONS

The study identified the marketing constraints and perceptions as well as farmers' knowledge which contribute to the use of ICT for marketing. The results show that 100.0% of NAMBoard farmers who attended primary schooling had knowledge on ICT. The 50% of NAMBoard farmers who attended IGCSE/O'level had knowledge while 50% did not have knowledge on ICT. About 56% of NAMBoard farmers who attended tertiary institutions had knowledge on ICT while 44.4% did not have knowledge on ICT. Thus the more educated an individual farmer is, the more he/ she get exposed to the use of ICT in many activities including farming.

Table 7 Descriptive statistics of marketing challenges and constraints faced by farmers

Parameter	NAMBoard farmers				Independent farmers			
	Min	Max	Mean	SD	Min	Max	Mean	SD
High transportation costs are challenge when farmers market their produce.	4.00	5.00	4.90	.30	4.00	5.00	4.90	.30
Poor communications limit the range of marketing and confine sales to nearby consumers.	2.00	5.00	4.34	.76	2.00	5.00	4.48	.67
Losses through deterioration in quality reduce the value of the vegetables	1.00	5.00	4.27	.87	2.00	5.00	4.31	.68
No or little access to farm inputs (seed, fertilizer, pesticide etc.) can affect the marketing of vegetable produce.	1.00	5.00	4.39	.77	2.00	5.00	4.38	.85
Poor market information or extension services can greatly affect vegetables	2.00	5.00	4.32	.72	2.00	5.00	4.38	.76
Lack of government support can also affect vegetable production.	1.00	5.00	4.07	.88	1.00	5.00	3.93	1.3
Price fluctuations can also affect the marketing of vegetables	2.00	5.00	4.07	.79	3.00	5.00	4.36	.66

The results also to indicate the average score of the response of NAMBoard farmers who haveno or little access to farm inputs (seed, fertilizer, pesticide etc.) which affects the marketing of vegetable produce was 4.39 while independent farmers scored the same statement as 4.38. The NAMBoard farmers who havepoor market information or extension service which greatly affects vegetable production scored the statement

Education also equips the farmer with sufficient knowledge to easily utilize and appreciate the use of ICT for marketing purposes.

Age also plays a major role in enabling the farmer to adopt and ICT in that, technology revolve now and again and each new gadget comes a bit different from the previous one. The results

indicate that 66.6% of NAMBoard farmers aged between 20 and 30 years had knowledge about ICT and 33.3% did not have any knowledge on ICT. The NAMBoard farmers between ages 30 and 40 who had knowledge on ICT were about 63.2% and 36.8% of the same age category did not have knowledge. Independent farmers between ages 30 to 40 who had knowledge on ICT were about 80% and 20% of them did not have such knowledge. About 75% of farmers aged 40 to 50 years had knowledge on ICT while 25% did have knowledge on ICT among the independent farmers. The average score for the NAMBoard farmers who perceived that ICT can help in farming was 4.06 and the average score for the independent farmers who perceived that ICT can help in farming was 4.23. This shows that both groups agree that indeed ICT tools do help in their farming.

ICT usage also improves farmers' income enabling him/her to attract new customers from a wider platform using an ICT tool. The study proves that indeed farmers do utilize ICTs and they use a variety of these ICTs gadgets and items as they do farming. Most of the gadgets they possess and use most frequent are cell phones, radio and computers for communicating, listening news, weather and as well for agricultural and marketing information. The NAMBoard contracted farmers, 26.8% use ICT tools only for market information and communication purposes, 24.4% use only for agricultural marketing and information as well as news and weather. Among independent farmers, 23.8 % use ICT tools for news and communication as well as all other agricultural purposes. Therefore, based on the results of the study, adoption of ICT tools has a significant impact to enhance marketing to vegetable farmers in Manzini region.

Recommendations

The study recommends that adequate information on various relevant ICT suitable for marketing should be given to farmers so that they can improve their knowledge on it and also help them to develop more positive perception that will enhance the future use of these ICT in marketing their produce. ICT can enable the farmers to get tailor made solution and reduce the many workshops and seminars which the farmers are made to attend now again. In the process they leave their farms to attend these meetings, which take time, money and efforts. From the findings of the study also recommend that government and all other stakeholders to ensure the effective ICT usage by farmers for marketing and arrangement of ICT facilities for agricultural market information centres and trainings of farmers and extension officers so that they can be the major source of information to most of the farmers in the country and also focus on adoption of ICTs for agricultural marketing and information on recent trend and development.

References

- Barnard, F., Akridge, J., Dooley, F., & Foltz, J. (2012). *Agribusiness Management*. New York: Routledge.
- Casaburi, L., Kremer, M., Mullainathan, S., & Ramrattan, R. (2014). *Harnessing ICT to Increase Agricultural Production: Evidence From Kenya*. Unpublished.
- Central Intelligence Agency . (2014, January 7). *Communications Swaziland*. Retrieved January 20, 2014, from *The World Factbook*: <https://www.cia.gov/library/publications/the-world-factbook/geos/wz.html>
- Chadha, M. L., Mkhathshwa, P. D., Gama, D. M., & Nono-Womdim, R. (1999). *Vegetable Research and Development in Swaziland*. In B. Diwakar (Ed.), *AVRDC African Regional Program.2000-3*, pp. 6-7. Arusha: African Regional Program.
- CTA. (2003). *CTS- Transforming agricultural extension*. CTA Observatory. Wageningen: WICC/CTA.
- FAO. (2010). *Annual Report: Using ICT's to improve rural markets in developing countries*. Rome: FAO.
- FAO. (2013). *ICT Uses of Agricultural inclusive value chains*. In C. Miller, V. Saroja, & C. Linder, *ICT Uses of Agricultural inclusive value chains* (p. 1). Rome: FAO.
- Field Survey. (2016).
- Griffon, F. (2007). *Contract Farming and Organic Farming*. Retrieved February 25, 2013, from www.wikipedia.org
- Jensen, R. T. (2007). *The Digital Divide: Information (Technology), Market Performance and Welfare in South Indian Fisheries Sector*. *Quarterly Journal of Economics*, 879-924.
- Kiveu, M., & Ofafa, G. (2013). *Enhancing market access in Kenyan SME's using ICT*. *Global Business and Economics Research Project*.
- Kleih, U. (1999). *Community Access to Marketing opportunities: Options for remote areas*. Chatham.
- Kohls, R. L., & Uhl, J. N. (2002). *Marketing of Agricultural Products*. Upper Saddle River, New Jersey: Prentice Hall.
- Langwenya, S. M. (2011). *Production constraints faced by smallholder vegetable producers on Swazi Nation Land (SNL): a case study of Mbekelweni*. University of Swaziland, Department of Agriculture Economics and Agribusiness Management. Luyengo, Swaziland: Unpublished research project.
- Magesa, M. M., Kisangari, M., & Ko, J. (2014). *Agricultural Market Information Services in Developing Countries; A Review*. *Advances in Computer Science, an International Journal*, 3(3), 38-40.
- Makhura, T. (2001). *Overcoming transaction costs barriers to market participation of smallholder farmers in the Northern Province of South Africa*. University of Pretoria: Unpublished PhD dissertation.
- Mathunjwa. (2007). *The factors affecting farmers' choice of vegetable marketing channels, case study of Ngwempisi area*. University of Swaziland, Department of Agricultural Economics and Agribusiness Management. Luyengo, Swaziland: Unpublished research paper.
- McNamara, K., Belden, C., Kelly, T., Pehu, E., & Donovan, K. (2011). *Overview of ICT in Agriculture: Opportunities, Access, and Cross-Cutting Themes*. Washington D.C: World Bank.
- Megumi, M., & Yamano, T. (2009). *The Impact of Mobile Participation: Panel Data Evidence from Uganda*. World Development.
- Najafadabi, M. O., Ahmadi, M., & Lashgarara, F. (2014). *Identifying Requirements of Agricultural Mobile*

- Marketing from Experts' Perception. International Journal of u- and e- Service, Science and Technology, 7(1), 113-118.
- NAMBoard. (2009). Annual report for National Agricultural Marketing Board. Manzini.
- NAMBoard. (2011). Annual Report. Manzini.
- Nmadu, J. N., Aiyelitsoya, F. A., & Sallawu, H. (2013, January 28). Use of ICT in Securing Marketing Information among Small Scale Farmers in Niger State, Nigeria. Niger State, Nigeria.
- Ogbonna, O., & Agwu, A. E. (2013). Access and use of information communication technologies by rural farmers in Enugu north senatorial zone, Enugu state. *Scholarly Journal of Agricultural Sciences*, 264-265.
- Oyeyinka, R. A., & Bello, R. O. (2013). Farmers Use of Icts for Marketing Outlets in Oyo State, Nigeria. *Journal of Agricultural Science*, 151.
- Palmer, N. (2011). Strengthening Agricultural Marketing with ICT.
- Payne, J. (2010). Using Ict To Provide Agriculture Market Price Information In Africa. Retrieved September 11, 2015, from https://www.microlinks.org/sites/.../files/.../FACETMarketInfo_Jan11.pdf: https://www.microlinks.org/sites/.../files/.../FACETMarketInfo_Jan11.pdf
- personal communication. (2015, September 10). Use of ICT tools to enhance the flow of market information to farmers in the National Agricultural Marketing Board. (S. T. Sebuliba, Interviewer) Manzini, Swaziland.
- Pswarayi-Riddihough, I., & Jones, N. (1995). Some Marketing Problems faced by agroforestry farmers in Asia. Washington D.C.: FAO.
- Rodrigues, M. (2012). ICTs as a tool for overcoming assymetries in Latin America Agriculture. *Agriculture and ICT*, p. 3.
- Saghir, A., Chaudhary, K. M., Muhammad, S., & Maan, A. A. (2013). Role of ICTs in Bridging the Gender gap of Information Regarding Livestock Production Technologies. University of Agriculture, Institute of Agriculture Extension and Rural Development, Faisalabad.
- Shepard, A. W. (2011). Understanding and Using Market Information. Rome: FAO.
- Shongwe, M. S. (2010). Problems faced by small scale vegetable farmers in Ntfontjeni in marketing their vegetables. University of Swaziland, Department of Agriculture Economics and Agribusiness Management. Luyengo, Swaziland: Unpubilshed research project.
- Siboza, A. M. (2015). Farmers Use of Information and Communication Technology (ICT): A case of farmers under Swaziland Water and Agricultural Development Enterprises (SWADE) and Komati Downstream Development Project (KDDP). University of Swaziland, Department of Agricultural Economics and Agribusiness Management. Luyengo: Unpublished research project.
- Sifundza, S. (2013). Productivity of conventional vegetable farmers in the Shiselweni region: A case study of NAMBOARD contracted farmers. University of Swaziland, Department of Agricultural Economics and Agribusiness Management. Luyengo, Swaziland: Unpublished research project.
- Sithole, D., & Grenoble, D. (1999). Status of Production and Marketing of Vegetables in Swaziland and Role of National Agriculture Marketing Board. Arusha: AVRDC.
- Stienen, J., Bruinsma, W., & Neuman, F. (2007). How ICT can make a difference in agricultural livelihoods. Commonwealth Ministers References Book.
- Taylor, M. (2003). Organic and Conventional Vegetable Production in Oklahoma,.
- Technopedia. (2014). Mobile phone. Retrieved October 25, 2014, from www.technopedia.com: <https://www.techopedia.com/definition/2955/mobile-phone>
- Thompson, C. F. (2007). Swaziland Business Year Book. Mbabane.
- Thompson, C. F. (2011). Swaziland Business Year Book. Mbabane.
- UNDP. (2001). Information Communications Technology for Development. New York: UNDP.
- Vilakati, M. (2009). Production and Marketing Strategies of Conventional Vegetable Farmers. A case study of NAMBoard Programmed farmers in the Manzini Region, Luyengo: Unpublished research project.
- Xaba, B., & Masuku, M. (2013). Analysis of the vegetable supply chain in Swaziland. Sustainable Agricultural Research, 1.
