



Tomato Value Chain Information System in Tanzania: Lessons from Kilolo District and Dodoma Municipality, Tanzania

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Abstract

The major challenge for the tomato farmers is getting a fair price at the market price given that there are many actors involved in the tomato value chain. Given this situation, this project's goal was to improve communication pathways in dissemination of agricultural market information in tomato value chains in Iringa and Dodoma Regions in Tanzania. The specific objectives were to: identify and assess the status of tomato production and information sharing among the various actors in every node in the tomato value chain; identify the communication and knowledge dissemination pathways in tomato value chain; examine the efficacy of communication and knowledge dissemination pathways in tomato value chain; establish the innovative communication and knowledge dissemination pathways in tomato value chain, and enhance capacity and empower the various stakeholders involved in the tomato value chain. One way of achieving the goal of the study was to come up with an innovative communication pathway that would improve the marketing of tomatoes by directly linking farmers to markets. The study has developed a system called Tomato Value Chain Information System (ToVCIS). The system links farmers to different markets in the Tanzania by sending text messages to a control centre which is fed with prices on a daily basis by government employed market monitors in the different towns listed above. Therefore, this paper details on how the system will help farmers through ToVCIS to mitigate vulnerability. Equally, it offers some recommendations for improving the efficiency as well as the sustainability of the system.

Keywords:
Information system,
Marketing information,
ToVCIS,
Tanzania

1. Introduction

The leading tomato producing areas in Tanzania are Iringa with an acreage of 4,248 ha, Tanga (1,289 ha), Kilimanjaro (900 ha), Mbeya (380 ha), and Dar es Salaam (Temeke district) (353 ha) (MAFS 2002). Other regions with significant tomato production include Dodoma, Arusha, Mwanza and Morogoro. In all tomato producing areas almost the entire tomato harvest is intended for the market in major urban markets such as those in Dar es Salaam, Arusha, Zanzibar and even as far as Nairobi and Mombasa in Kenya.

Tomato production is a major activity for the majority of the farmers in Ilula in Kilolo District and villages within Dodoma Municipality, namely, Matumbulu, Mpunguzi and Mbabala (A and B). According to the Kilolo District Socio-economic Profile, the district has 2035 hectares under irrigation in seven irrigation projects in Irindi, Nyanzwa, Mgambalenga, Msosa, Ruaha Mbuyuni, Ukumbi and Ihimbo (Matamwa, 2011). Much of this irrigated land is devoted to tomato production. The situation is not exactly the same in the much drier Dodoma where only small scale irrigation is done in valley bottoms or dams such as the Mtangwi Dam in Chamwino

district. Tomato farmers in Dodoma rely solely on rainfall or water reservoirs such as the Mtatangwi dam for much of the tomato production (Mvena et al., 1998).

In both study sites, tomato production comes first with 74% of the respondents reporting producing it among the list of vegetables produced. Other vegetables commonly produced in these two areas include: spinach, okra, Chinese, the African eggplant, green pepper, onions, figiri and lettuce.

Table 1. The relative importance of tomatoes and other vegetables in the two study areas

Vegetable	Frequency	Percentage
Spinach	4	4.55%
Okra	2	2.27%
Chinese	6	6.82%
Tomato	65	73.86%
Green pepper	3	3.41%
African egg plant	2	2.27%
Brassica carinata-Figiri	2	2.27%
Onion	2	2.27%
Lettuce	2	2.27%
Total	88	100.00%

Much of the tomato production is for the market and involves many actors in the process who are not necessarily confined in one geographical area. Tomato production in the study sites is reported to have significantly transformed the livelihoods of farmers in these areas. In Ilula, for example, the baseline data shows that some tomato farmers have bought transport facilities and especially lorries which currently transport tomatoes to distant markets such as Morogoro and Dar es Salaam. It is also reported that farmers have made investments in improved housing, social facilities such as halls and guesthouses (Mvena et al., 2012).

While farmers have made economic gains from tomato farming, this promising situation may not reflect the actual situation at a local level in relation to the profitability of tomato production. Theoretically, when the demand for tomatoes is high as given above, prices are supposed to go up. In many areas, however, seasonal variation in production coupled with disconnected markets for such products leads to low profitability in the tomato business. Three main factors come into play, one; tomato being perishable with unreliable markets hence pushing the price down. Two, oversupply during the peak season (between March and May in Ilula Township) also pushes the prices down. And three, the market being manipulated by a few actors, mainly the market masters, along the tomato value chain between producers and the ultimate consumers. These complex factors makes the farmer vulnerable and

much of this vulnerability is due to disconnect between the producer and the consumer, the latter being the distant markets where these tomatoes are sold. The farmers' access to market information is largely manipulated by the market masters nearest to them. This lack of market information on the part of farmers was the motive force behind the conception of this research with the main goal being to improve communication pathways in dissemination of agricultural technologies as well as market information in tomato value chains in Iringa and Dodoma regions in Tanzania. The specific objectives were: To identify and assess the current status of tomato production and information sharing among the various actors in every node in the tomato value chain, to identify the communication and knowledge dissemination pathways in tomato value chain, to examine the efficacy of communication and knowledge dissemination pathways in tomato value chain, and to establish the innovative communication and knowledge dissemination pathways in tomato value chain, and to enhance capacity and empower the various stakeholders involved in the tomato value chain. This paper covers the second part of the project goal and that is to improve the market information in the tomato value chain.

Theoretical Framework

This study adopted the innovation-diffusion model (Fig. 1), which is also referred to as Rogers' innovation diffusion theory (Rogers, 2003). Understanding the mechanisms of the diffusion process was essential as it informed us on how the adoption process of the system we were establishing could actually come about and why it may be slow at times across individuals. The theory explains adoption process and the determinants of technology adoption. With regard to technology adoption, the underlying assumption of diffusion of innovation theory is that the technology could be both technically and culturally sound but adoption may be hampered by one's behavioural jurisdiction (Shampine, 1998). On the other hand, adopters' perception on the perceived attributes of the technology can also largely determine adoption behaviour of an adopter unit. This means that, even with full farm household information, farmers may subjectively evaluate the technology differently from scientists. This further implies that adopters' characteristics could determine the adoption behaviour of adopter unit. Basically, all parameters of the theory are grouped into three groups, which are receiver variables, social system and the perceived characteristics of the innovations. So, is a rule that, unless many users adopt a new technology, it can contribute little to the well-being.

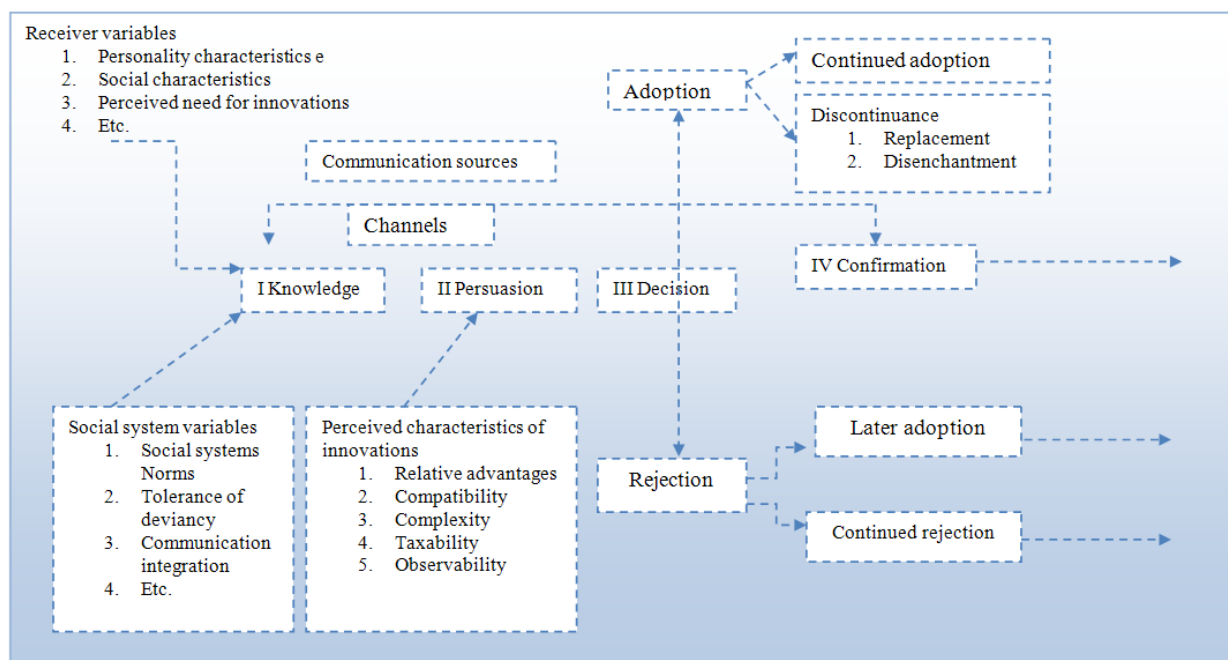


Figure 1. Diffusion of innovation model, adapted from Rogers (2003)

Table 2. Assessment of communication pathways amongst actors in tomato value chain

Communication Pathway	benefits	Challenges
Mobile phone	Easy and fast communication	It is expensive Lack of network Lack of electricity for charging
Email	Easy and fast communication	Expensive, Need to be technically competent, Not many have email addresses, Not being able to read emails on time
Face to face	Easy and fast communication More detailed information	Not very efficient way of delivering information because it is difficult to reach many people
Office visit	You get accurate information	It is expensive
Seminars and meetings	Detailed communication	It is expensive in terms of money and time Longer time to prepare
Letters	Communicate in detail	Late delivery of the message Some stakeholders do not know how to read and write It costs money to post
Exchange visits	Seeing is believing Learn by doing	It is expensive
Mass media	It allows exchange of ideas Detailed information It reaches many people at one go	It is expensive Not all have facilities such as radios and Television

2. Materials and methods

The choice of the mobile phone as the key component of the innovative communication and knowledge dissemination pathways was not made by the researchers but rather by actors. The choice was an outcome of a series of participatory processes that included key actors in the tomato value chain. The starting point of this process was to first identify the actors and the mechanisms of communication they use. The baseline data showed that communication between farmers and other actors in the value chain can be through one or more of the following means: mobile phone, Email, face-to-face, office visit, seminars and meetings, letters, exchange visits, and mass media such as radio and news papers. After the identification of the mechanisms of communication actors were tasked to evaluate these mechanisms and the results of the evaluation are shown in Table 2.

Through a series of these participatory meetings involving identification and evaluation of the mechanisms of communication, and then finally leading to ranking of these mechanisms of communication, the actors agreed to select the mobile phone to be used in improving communication or information sharing system. The actors' choice led to the development of the mobile phone based information sharing system which is hereafter referred to as the Tomato Value Chain Information System which is described later.

3. Results and discussion

3.1 Mobile phone use in accessing agricultural information

Mobile phone adoption in Africa is cited as one of the success stories in the adoption of innovations. Such widespread adoption of mobile phones presents both opportunities and challenges. Mobile phones offer vast possibilities for sharing information while at the same time can present insurmountable adverse impacts to society (Kelvin, 2011). Aker and Mbiti (2010) report that the introduction of mobile phones in Niger enabled farmers, consumers, and merchants to access better quality marketing information

Munyua et al. (2009) investigated the potential of mobile phone in revitalizing small-scale agriculture in Africa and found that cellular phones were important tools in improving small-scale agriculture in rural areas. On the other hand, Bolarinwa and Oyeyinka (2011) reported that farmers using cell phones are well informed and they were able to make use of current production techniques that lead to higher production level and income status. Mobile phones may help users to substitute phone calls for travel. Where distances are great, substituting phone calls for travel reduces farmers'

time and cost burdens. Time savings are important for agricultural households, because many crops have extremely time-sensitive and labor-intensive production cycles (Kelvin, 2011).

Mobile phones have the potential to raise farmers' incomes, making agricultural marketing more efficient, lowering information costs, reducing transport costs, and providing a platform to deliver services and innovate (Kelvin, 2011; Sife et al., 2010; Donner 2007). Access to mobile phones has been associated with increased agricultural income. A World Bank study conducted in the Philippines found strong evidence that purchasing a mobile phone is associated with higher growth rates of incomes, in the range of 11–17 % (World Bank 2011; Akinyemi, 2013) investigated the extent to which the Rwanda e-Soko initiative has improved the agro-marketing sector. The results captured the level of awareness of e-Soko use among farmers and agricultural traders. Overall, agricultural traders using the e-Soko service claimed that it improved their trade. The evaluation of the data also confirmed that indeed the income of those who used e-Soko improved. A study by Sife et al. (2010) on contribution of mobile phones to rural livelihoods and poverty reduction in Tanzania indicated that mobile phones have significantly changed the way rural businesses are being conducted. Given this vast potential of the mobile phone in transforming incomes of rural farmers, it is likely that this technology can change the lives of the tomato farmers in the study areas.

3.2 Description of ToVCIS

ToVCIS is an acronym which stands for Tomato Value Chain Information System. This software is designed to provide information access to farmers and other users so that they meet new business opportunities through SMS. It uses standardized communication protocols to allow mobile phone devices to exchange SMS.

How it works?

First, a user of the system needs to register.

How to register?

- Send the word JIUNGE to number +255687 884 762

- The system will reply "Chagua Soko" 1. Kariakootomato market, 2. Morogorotomato market, 3. Iringa tomato market, 4. Dodomatomato market, etc.

- If for example you intend to register for Iringa tomato market updates, then send the word Jiunge 3, *How to send market prices?*

- Send the word SOKO to number +255687 884 762
- You will receive a message, "Chagua Soko" 1. Kariakoo, 2. Morogoro, 3. Iringa, 4. Dodoma, etc.

- You reply by writing SOKO 2 if you want Morogoro market tomato prices
- You will receive a reply, "Chagua kipimo" 1. 2kg, 2. Lumbesa, 3. Tenga, 4. Crate, etc.
- Send back SOKO 3 if you choose Tenga
- It goes on like this.

3.3 Bridging the communication gap through ToVCIS in Tomato value chain

ToVCIS can be used to link users to other actors in the tomato value chain in order to tap new business opportunities by using the short messaging services or SMS. It uses standardized communication protocols to allow mobile phone devices to exchange short text messages. For this project, it involves linking some key actors in the tomato value chain for marketing purposes. In this case then, the key actors are the farmers, input dealers, market masters, extension staff and the market monitors.

Farmers need to have an idea on prices of their tomatoes beyond the farm gate. They also need to know the availability and prices of the inputs they use which are purchased from the input dealers. Extension staff provides advice in the production of quality tomatoes but they can also stretch their mandate by providing advices related to production, acquisition of quality and type of inputs, linking farmers to tomato buyers, in this case market masters and coordinating all activities related to production and selling agricultural and livestock products. Under the existing conditions, farmers will have no information regarding marketing of tomatoes beyond market masters. Since information is power, it was thus deemed necessary to have farmers linked to market monitors in order to enhance their bargaining chip during negotiations on pricing their commodities.

Based on the baseline survey data, it was reported that the main market outlets for the tomatoes are Iringa, Morogoro and Dodoma municipalities as well as Dar es Salaam. A few tomatoes were sold to other markets in the country and outside the country mainly Kenya. The mandate of this project was limited to the major markets in Iringa, Morogoro, Dodoma and Dar es Salaam. To be able to link the farmers to these distant markets, the project identified market monitors under the umbrella of the Ministry of Industries and Trade. The market monitors are responsible for the collection of prices in their respective major markets on a daily basis and these prices are disseminated through selected mass media such as TBC radio and in some newspapers.

Through the Ministry of Industries and Trade, market monitors were requested to devote part of their time to making available the prices of tomatoes to the project. These prices would be fed to ToVCIS so that when farmers send their messages to

a number used by the ToVCIS, they will be able to get prices of tomatoes at any particular market for different measures such as in kilograms, a bag, a crate or a "tenga" of tomatoes using a series of steps. Farmers will then be able to send a text message to a given number and then be able to get a response.

3.4 Mitigating Farmer Vulnerability

The Cambridge English Dictionary defines vulnerability as the situation of being easily physically, emotionally, or mentally hurt, influenced, or attacked. It is the probability or risk of being in poverty or to fall into deeper poverty in the future. A well-informed and well-organized community that meets to talk about what they are going to about the natural hazards is less vulnerable than a community that is unaware of them. In a broader context, this vulnerability is not confined to natural hazards but can also include social and economic causes of vulnerability. Thus, when a farmer or farmers are not aware of the behaviour of markets beyond his/her immediate environment can be considered to more vulnerable than a farmer or farmers who are aware of the market situation where their agricultural products are ultimately sold. Tomato farmers and in this case even businessmen may become more vulnerable if they do not have the full picture of the tomato market situation in Dar es Salaam because they are not well informed of the deliveries of tomatoes from other tomato growing areas such as Arusha or Mbeya. For example, in the case of the fresh fruit and vegetable value chains, the vulnerability approach was adopted to assess the strengths and weaknesses of Mediterranean productions facing an increasing competition from South East Mediterranean countries (Raston et.al (2007) cited by Prospero et.al. (2014). The concept of vulnerability can also be applied to food security (Dilley and Boudreau, 2001), climate change, political and even emotions.

Farmers in the study sites are socially and economically vulnerable due to controlled information flow on the market for tomatoes. In both Iringa and Dodoma, farmers are largely at risk of receiving manipulated information that does not reflect the prevailing market for the tomatoes they sell. The information is largely controlled by market masters who may release prices for the tomatoes that are in their favour and not to the advantage of the farmers.

Producers or farmers have no say with their produce. Middlemen or the market masters are the ones who control the whole business. Market masters have several roles, they are the buyers of tomatoes from the farmers, they sell the tomatoes to wholesale buyers and they also control other actors like transporters and coolies. They also control marketing information by communicating directly with their

counterparts where the tomatoes are sold. Market masters do not allow buyers from outside to come into direct contact with farmers. For this reason, when farmers approach the market where the market masters are, the latter would make sure that the farmer does not reach the marketplace with the produce. The price of the produce is negotiated and the farmer is paid and then leaves the market. Sometimes, the middlemen enter unwritten inputs supply contract with farmers. Then provide credit to farmers and recover whatever they incurred when selling the tomatoes. The prices offered are usually highly unreliable. At the end of the day, farmers always become losers in the whole process.

"...The informal interaction between the farmer and the market master usually leads farmers to always become losers in the whole process..." Said by one farmer and village Executive Officer at Ikokoto in Ilula, Kilolo District, Iringa region

3.5 Mitigation of vulnerability through ToVCIS

Information or knowledge is power. The more one knows, the more one will be able to control events. It is against this fact that the spirit behind the development of ToVCIS is out of the belief that when farmers have full information about what goes on in the marketplace in Dar es Salaam, Morogoro, Dodoma, even Mombasa makes farmers to be in a position to negotiate for better prices after taking into account other costs incurred by the middleman such as transportation and time invested in undertaking the activity.

ToVCIS will enable farmers to monitor crop deliveries in the markets they often sell tomatoes such as the Kariakoo market whether such markets have been flooded by tomatoes from other production zones such as Lushoto, Arusha, Mbeya and the southern regions. Given the many information options the ToVCIS has, farmers will be able access prices of tomatoes on a daily basis and therefore be able to make production and marketing decisions as to what to produce and when to sell. The farmer will also be able to seek for specific information from the extension staff as well as input dealers in a relatively short time. With full information about the market situation farmers are more likely to benefit more economically than if they did not have such information.

After testing the application in the research sites, different stakeholders had their own views on this innovation. Farmers were impressed with the speed at which they could access information from markets of their choice. They were convinced that, given this situation, they had a better bargaining chip in terms of negotiating for the price of the commodities they sell. But one of their serious

concerns was on the wanton selling of fake seeds and fertilisers. As for the market masters, it was feared that they would resist the innovation as it would potentially erode their monopoly of the market information. To the contrary, market masters were positive of the innovation in that it would dispel the fear from farmers that the prices offered to farmers are made up capitalizing on the farmers' ignorance of the market situation. Extension staffs also were positive about the innovation in that it would enhance information exchange between different actors. That move is likely to reduce the work burden on the part of extension staff.

4. Conclusion and Recommendations

The ToVCIS has enormous potential in improving communication between different actors in the tomato value chain. Farmers are likely to get a better deal in the market place in case the innovation works well. The innovation will not only lead to better and fully informed decisions but it will also lead to farmer empowerment as they become fully aware of what is taking place in the marketplace. It is thus recommended that efforts should be made to fully coordinate the interactions between the farmers, extension staff, input dealers and market monitors. The system should be improved so as to accommodate more functions such as giving information on the status of input supply in terms of quantity and quality. Where possible, the system should allow for more actors to exchange information for better agricultural productivity.

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