

# The Diffusion of Mobile Agricultural Information Services in Ghana: A Case study

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**Abstract:** Dissemination of information has always been an important topic in agriculture as information educates farmers and helps them to make the right decisions on agricultural practices and marketing. The main objective of this research is to explore how social networks could be deployed in order to stimulate the diffusion of mobile agricultural information services among small scale farmers.

A theoretical framework has been built on Rogers' ideas on social systems in relation to the diffusion of innovation complemented by theories on adoption applicable to the agricultural development sector. In addition, two services have served as case studies, namely the Esoko (previously called Ecamic) service in the Eastern Corridor and the Rite FM Farmers Fone in the Eastern Region of Ghana. With respect to social network characteristics, factors which have been addressed are homogeneity, opinion leadership and the strength of ties.

This study has resulted in a better understanding of the mechanisms at play in the diffusion of mobile agricultural information services and has shown that social networks influence diffusion differently in different contexts. A better understanding of this helps stakeholders aiming to scale mobile agricultural information services in designing their marketing approach. However, as this study is based on only two cases, more systematic case study analysis is required.

**Keywords:** social entrepreneurs, diffusion and adoption of agricultural information services, social network characteristics, local cultural dynamics.

## 1. Introduction

In developing countries agriculture can significantly contribute to economic growth and development. The sector can enhance economic development, food security and the livelihoods of more than 80% of the rural population in developing countries engaged in agriculture [1]. However the agricultural sector faces many challenges, one of these is the dissemination of information. Dissemination of information has always been an important topic in agriculture [2] as information educates farmers and helps them to make the right decisions on agricultural practices and marketing. The challenge with the dissemination of information primarily lies in the fact that many small scale farmers live in remote areas where information does not get through. Since the emergence of new Information and Communication Technologies (ICTs) such as mobile phones and internet the topic has acquired renewed interest. In the relatively new domain of ICT for Development (ICT4D) special attention is given to the role of ICTs in agriculture. The fact that powerful ICT tools such as mobile phones and internet have become accessible to small scale farmers all over the world has made sure that it is now seen as one of the solutions to 'address both the long- and short-term challenges in agriculture'[2]. There is a wide range of purposes for which mobile phones can be used in agriculture namely to '(1) educate and raise awareness, (2) distribute price information, (3) collect data, and (4) track pests and diseases' [2].

Over the past decade numerous mobile agricultural information services have been developed and implemented but the reach of these services remains limited. A vast number of farmers does not have the opportunity to access agricultural information through their mobile phones. This raises the question whether and how the use of mobile phones for agricultural purposes can be scaled. To find an answer to this question it is important to have a good understanding of how mobile agricultural information services spread and what factors influence the diffusion of these services. Therefore this research draws on theories on diffusion of innovation with a specific focus on ICT for Development (ICT4D). Within this context the influence of social factors on the innovation process is of particular interest as it has long been overlooked [3] [4].

## **2. Objectives**

Over the past twenty years, the number of mobile phone subscriptions has risen from 12.4 million to more than six billion worldwide, creating renewed opportunities for development [13]. While numerous programs are initiated, the number of farmers using their mobile phone to gather agricultural information remains limited. Theories on diffusion of innovation propose various factors that may affect the spread of innovations such as ICT4D. One of these factors is the influence of social networks. While the relevance of the social influence is acknowledged [3] there is a limited understanding of how social relations and social networks influence the use of mobile phones among small scale farmers in developing countries. The main objective of this research is therefore to explore how social networks could be deployed in order to stimulate the diffusion of mobile agricultural information services. A better understanding of this role can help stakeholders aiming to scale mobile agricultural information services in designing their marketing approach.

This research was performed as a part of the VOICES project, which is partially funded by the European Commission under the 7th Framework Programme. The goal of the VOICES project is to facilitate diffusion and exploitation of European ICT research results by helping to unleash the potential of mobile ICT services for developing economies and resolving existing content and access barriers for such services. The success of VOICES depends on economic and social viability of the VOICE based services developed, to create community ownership of the services and to ensure a long lasting impact. This study tackles the influence of social networks on the adoption.

## **3. Methodology**

This current study draws on two realms of research. In the first place information has been gathered through secondary sources. Theories on diffusion of innovation serve as the basis of the theoretical framework. Studies on technology adoption applied to agricultural development add on to this framework and provide the contextual insights. In addition, two services have served as case studies, namely the Esoko (previously called Ecamic) service in the Eastern Corridor and the Rite FM Farmers Fone in the Eastern Region of Ghana. Primary research has been performed in the form of questionnaires and interviews.

## **4. Technology Description**

The process of diffusion of innovation is a widely studied concept which presents many useful insights for the purpose of this study. Rogers has been one of the first authors to theorise diffusion of innovation and he describes four main elements of diffusion of innovation. These are 'the innovation, communication channels, time, 'attributes of the innovation' and the 'social systems' [5]. Each of these elements has been looked at in more detail by numerous researchers but the 'social system' factors were overlooked, something which has been identified as the 'root of a number of ICT4D failures' [3]. Rogers describes

the structure of a social system in terms of ‘patterned social relations’ and ‘patterned communication flows’ [5]. We refer to these patterns as social networks and understand them to be people-to-people networks along which resources such as information, services or support can be exchanged (based on [6] and [7]).

In general diffusion of innovation theory three main characteristics of social networks have been identified namely ‘degree of homogeneity, leadership and social norms’ [10]. Closely related to homogeneity but given explicit attention in agricultural innovation research is the concept of the strength of ties.

In this study, specific focus was given to three characteristics, namely homogeneity within a community, opinion leaders and the strength of ties. These three characteristics and how they may influence diffusion are elaborately discussed in the next section.

#### *4.1 Homogeneity*

One important social network characteristic that influences the diffusion of innovation is member homogeneity. Homogeneity can be defined as ‘the degree to which pairs of individuals who communicate are similar’ [5]. Homogeneity can be defined according to different attributes ‘such as beliefs, education, social status and alike’ [5] or in terms of the ‘actors’ goals, knowledge, competences, perceptions, position and cultures’ [11]. In this study homogeneity is measured in terms of six attributes, namely: age, wealth, education, gender, ethnicity and farm size. The more homogenous two members within a social network are, the easier the communication between them. Communication between two homogenous individuals is more likely to be effective and rewarding [5]. This means that homogeneity can enhance innovation diffusion. However, for an innovation to diffuse a first condition is that information about the innovation disseminates. When individuals are fully homogenous ‘diffusion cannot occur as there is no new information to exchange’ [5]. This means a certain degree of heterogeneity, ‘the degree to which two individuals who interact are different in certain attributes’ [5], is required for effective diffusion of innovations. In relation to the influence of the degree of homogeneity/heterogeneity, Rogers links his ideas to Granovetter’s theory on ‘the-strength-of-weak-ties’. Weak ties can bridge heterogeneous groups and facilitate the exchange of new ideas, this will be discussed in more detail in the ‘strength of ties’-section of this chapter.

#### *4.2 Opinion leaders*

Another way of characterizing a social network is by describing the nodes within it. The nodes are the members within the network, these are not necessarily individuals but can also be organisation and alike. The network members who have a ‘unique and influential position’ are referred to as opinion leaders [5]. Their ability to influence others’ attitudes and knowledge brings them in the position to influence the diffusion of an innovation [8]. Next to that opinion leaders are often ‘more exposed to external sources of information’ [8] and as such can become the bottleneck for the dissemination of information. Opinion leaders are most effective when they are socio-economically superior to their followers, but not excessively so [8] [5]. Closely related to the notion of opinion leaders is the concept of change agents. Change agents are often found outside of the social system while opinion leaders are found within the social system. A change agent is an individual who tries to influence the diffusion process ‘in a direction desirable by a change agency’ [5]. Where a change agent actively aims to facilitate the diffusion of an innovation this is not necessarily the case for opinion leaders. Local champions are opinion leaders who are in fact actively involved and promote the diffusion of an innovation.

### 4.3 *Strength of Ties*

Social networks can not only be characterized by the nodes but also by the connections within it. The strength of ties is defined by the nature of a relationship, based on the amount of time spent together, emotional intensity, intimacy and reciprocal services [9]. Based on this definition, weak ties are here said to be characterized by few interactions (less than weekly), no emotional bond (no friends or close family) and little reciprocation while strong ties are here said to be characterized by frequent interactions (daily), a strong emotional bond (friends or close family) and reciprocation. Within a social network weak ties and strong ties can coexist and can both be used. As Hossain and de Silva [7] explain weak ties can provide information from outside the standard network while strong ties can provide assistance often without reciprocation. This means that the weak ties can be important as a source of ideas while strong ties are important in terms of support for the implementation of new ideas [7] [12]. Van Rijn et al. [12] use the terminology of bridging and bonding network, referring to weak and strong ties respectively. The first type indicates networks in which the members do not share characteristics and the relations can be seen as vertical. The latter refers to networks of people who have identical characteristics and in which the relations are horizontal [12]. Rogers ideas on homogeneity are reflected in this terminology, according to him communication with homogenous groups remains horizontal which makes this type of communication easy and frequent. Still, vertical communication between heterogeneous groups through weak ties may be much more ‘crucial [...] in diffusing innovations’ [5]. Rost acknowledges the importance of weak ties for the entrance of information but claims that for effective diffusion of innovations a balance of strong and weak ties is of importance, ‘strong ties [...] become most beneficial when combined with weak network architecture’ [9].

## 5. **Developments**

Two mobile agricultural information services been selected as case studies for this research. In this section the case studies and research performed are discussed.

### 5.1 *Case Studies*

#### 5.1.1 *Ecamic Case Study*

In 2005 SEND foundation started the Eastern Corridor Agricultural Market Information (Ecamic) project supported by IICD and Cordaid. The main aim of the project was to provide farmers with up-to-date market prices of the most important commodities traded. As a result of this project, in 2007 the Tradenet Platform (now called Esoko) was created, a free mobile agricultural information service. The Esoko service has been active for five years now and as such the service is well established within the project communities. In 2010, a total of 26,000 individuals in 15 African countries were profiled through various public partner deployments.

#### 5.1.2 *Rite FM Case Study*

Supported by Farm Radio International Rite FM introduced the ‘Farmers Fone’ service in 2010 and is only available in Ghana. The Farmers Fone gives farmers, or anyone else interested, the chance to ring one of the four available phone numbers, either to obtain information or to leave a message. Upon calling the Farmers Fone the caller is presented with three menu options. They can request market prices, the weather forecast or choose to leave a message. The weather forecast can be listened to in English or in the local language Krobo. The information provided on the Farmers Fone is updated daily and is the same as is broadcast on the radio. The information messages are cut down to approximately two

minutes both for the weather forecast as well as for the market prices. As opposed to agricultural SMS services the Farmers Fone is a voice-based service which means it is accessible to illiterate farmers. Besides that the menu and the information are in Twi, a language spoken by most Ghanaians.

### 5.1.3 Comparing Case Studies

Two major differences between the services are the time of introduction and the reach of the service. Furthermore, the services' features are also profoundly different. Esoko works with text message while the Farmers Fone service is voice based; users of Esoko do not pay for the messages they receive while users of the Farmers Fone directly pay for the service through their phone credit; and lastly the Ecamic project reached farmers through the SEND cooperatives while the target group of the Farmers Fone is primarily reach via radio broadcasts. These differences with respect to accessibility for illiterates, economic sustainability and accessibility for individual farmers make the Rite FM Farmers Fone case study a good complement to the Ecamic case study. Next to that the setting of the services is considerably different as the Ecamic project is situated in one of Ghana's poorest and most rural areas, the Easter Corridor in the Northern Region. Rite FM is located in Somanya a two hour drive from the country's capital and the Farmers Fone target group lives in relatively prosperous regions namely the Easter Region, Greater Accra Region and the Volta Region. By reviewing these two cases in detail it is possible to identify the mechanisms at work in two different settings.

## 5.2 Analysis

As explained before, primary research has been performed in the form of questionnaires and interviews as shown in Table 1 below. The questionnaire was made up of four parts: mapping of social network; social network of small-scale farmers agriculturally related; use of ICT for agricultural purposes; use of the specific Esoko and Farmers fone service and demographics. The questionnaire was composed of both open-ended and closed-ended questions these were analysed accordingly. Descriptive statistics as well as correlations were derived from the questionnaire data and these insights were added on to the findings from the interviews.

Table 1: List of Collected Primary Data

|                                 | Ecamic    | Farmers Fone |
|---------------------------------|-----------|--------------|
| Questionnaires users            | 21        | 9            |
| Questionnaires non-users        | 46        | 11           |
| In-depth interview farmers      | 6         | -            |
| Interviews staff                | 4         | 6            |
| Interviews extension agents     | 5         | 4            |
| Interviews related organisation | 1 (Esoko) | 1 (FRI)      |

In the next section the details are discussed for both cases.

### 5.2.1 Ecamic Case Study

A total of 67 questionnaires were conducted in the research area. Around Salaga and Chamba a total of six villages were visited for the conducting of questionnaires. As Esoko has exclusively been introduced through the SEND Foundation cooperatives only villages where these cooperatives were present were selected. When selecting community members two criteria were taken into account, cooperative membership and gender. The aim was to find a balance between members and non-members as well as between men and women.

Various interviews were conducted in Salaga and Chamba. The program manager for SEND's Eastern Corridor program was interviewed. In Salaga the Cooperative



Development Officers (CDO) started working for SEND during the research period and was not officially interviewed as he could not draw on previous experiences. Instead an intern, who had worked for SEND during two consecutive summers and is originally from the Salaga area, was interviewed. At the Chamba office the CDO was available and with eight years of experience within the organisation could provide valuable insights. SEND's program officer at the Tamale office was also interviewed as he was located in Salaga at the time the Esoko service was introduced in the Eastern Corridor. The Mofa extension agents working in the visited communities were invited for interviews. In Salaga the extension agents were interviewed separately, in Chamba a focus group was organised with the three extension agents. In addition six community members were invited for an in-depth interview.

### *5.2.2 Rite FM Case Study*

The research area has been defined as the Rite FM catchment area this expands a large area in the Greater Accra Region, the Eastern Region and the Volta Region. Interviews were conducted with Rite FM staff members and with Mofa extension agents working in the Rite FM catchment area. Questionnaires were conducted among small-scale farmers throughout the Rite FM catchment area. The Eastern Region is important to Ghana's agricultural sector. About 60% of the population engages in agriculture, most farmers are part-time subsistence farmers but commercial farming is also common in the region.

Questionnaires were conducted with small-scale farmers within the Rite FM catchment area. The sampling of users and non-users of the Farmers Fone took on different forms. Users were defined as farmers who made a relevant call to the Farmers Fone on at least two different occasions. Most of the users were crop producers, all were male and they lived in communities throughout the Rite FM catchment area. These characteristics were taken in to account in the sampling of non-users. A total of eleven non-users were interviewed. The questionnaire among users was conducted over the phone as the respondents were scattered over the whole catchment area of Rite FM. Non-users were interviewed face-to-face. One major limitation to the sampling of non-users is the fact that they all belong to formal farmer organizations (the Asudok Agricultural Cooperative Society Ltd and Aveyimey ADI Rice Farmers Association) while most of the users indicated not to belong to any farmer organization or group.

A total of six Rite FM staff members have been interviewed, five presenters of agriculture related programmes and the Rite FM director. Farm Radio International's (FRI) regional programme officer stationed in Accra was also interviewed. Next to that four extension agents of the Ministry of Food and Agriculture were interviewed in Dodowa, one district extension agent, and three community extension agents.

## **6. Results**

From the data the following preliminary results have been derived:

### *6.1 Homogeneity*

The general conception in innovation literature is that higher levels of homogeneity increase adoption rates. Homogeneity within a social network can facilitate diffusion of innovation within the network as communication is 'relatively easy and requires little effort' [5], at the same time homogeneity can also hamper the diffusion of innovation as new ideas do not easily enter the network [5].

At first sight the community members in visited Ecamic villages seem to have a lot in common. The general perception is that 'they are all one people' and 'everyone knows the same'. If this were to be true, information on the innovations would be expected to

disseminate rapidly and as such be an important social network characteristic enhancing diffusion. Looking more closely at the data shows reality is in fact more complicated. The Esoko users are homogenous in terms of education, gender and ethnicity which implies that the diffusion does not easily cross borders of different educational levels, gender or ethnicity. The Esoko users are not homogenous in terms of age and wealth which implies that the diffusion does easily cross borders of age and wealth. That the service does not easily diffuse among men and women or among different ethnicities could be linked to the norms and values of the local cultures. There is the idea that ‘men should speak, not women’, these kinds of ideas could possibly exclude women from information services such as Esoko. In a similar way cultural norms demarcate the borders of ethnicity, especially after a recent conflict. Information and cooperation then remain within an ethnic group just as had been observed in the case of Kalande. The concept of heterogeneity, the degree to which individuals are not similar, has been linked to weak ties [5]. It is often through weak ties, which could link heterogeneous groups, that new information about innovations enters a social network [12]. Whether the relations between community members of different ages or wealth have indeed facilitated the entrance of new information about Esoko could be a subject of future research.

## 6.2 *Opinion Leaders*

Opinion leaders have a ‘unique and influential position’ and can influence the diffusion process [8], especially when they occupy a ‘hub’ or entrance point to the social network.

The contact farmers who work for the SEND Foundation served as the local champions of the Esoko service. They were responsible for the information provision towards their fellow farmers and at the same time acted as the information channel from farmer to the SEND Foundation. The dissemination of information is crucial for the diffusion of the mobile agricultural information services this brought them in an important position. However, the results of this research show that the contract farmers’ contribution to the diffusion of the service was only limited. Contact farmers attended the Esoko workshop after which they were supposed to pass on the information but apparently they did not fully succeed in conveying the message to their fellow farmers. There are many farmers subscribed to Esoko who do not know how to use the service effectively and non-users do not know how to subscribe to Esoko or are not aware of Esoko at all.

Local champions are often approached and supported by change agents. Change agents are professionals who try to influence the diffusion process ‘in a direction desirable by a change agency’ [5]. With respect to the Esoko service in the SEND communities the SEND Cooperative Development Officer (CDO) acted as the change agent aiming at a widespread use of the Esoko service. Another important change agent active among small scale farmers are the Mofa extension agents. They are responsible for improvements in the agricultural sector through the spreading of innovations and the adoption of better agricultural techniques. However the extension agents were not aware of the Esoko service which means they cannot spread the information about the service either. This is a lost chance as from the questionnaire became clear that farmers regard the extension agents as the most trustworthy source of information when it concerns agricultural topics.

## 6.3 *Strength of Ties*

The strength of ties among members within a social network can influence the diffusion process. The weak ties can be important as a source of ideas while strong ties are important in terms of support for the implementation of new ideas [7] [12].

In the diffusion of the Esoko service in the Ecamic project it were indeed weak ties, between the contact farmer and the SEND Foundation, through which initial information

about the services became available. Dissemination of information is a necessary but not sufficient condition for the diffusion of an innovation. For the Ecamic project holds that cooperation was needed for successful adoption of the Esoko service. Subscription took place collectively and the learning process about the use of the service also required a collective effort. Strong ties are most suitable for cooperation [12] but in relation to this service they were not effectively used. A considerable number of people said to be in touch with Esoko users on a daily basis but to never have learned neither about the service nor to have ever received the Esoko market prices from them. This is also reflected in the discussion on local champions where became apparent that the contact farmers did not succeed in informing and instructing their fellow farmers about the Esoko service. Rost [9] explains that ‘strong ties [...] become most beneficial when combined with weak network architectures’. The Ecamic case study shows that the reverse also holds: weak ties are most fruitful when strong ties can be employed effectively. The users of the Rite FM Farmers Fone service indicated not to have made use of any social network ties for the adoption of the service. They learned about the service through radio and did not get support or cooperation from others to make use of it. Only one of the users knew someone else who had once called the Farmers Fone and also at Farm Radio International there was the impression that farmers did not learn about the service through their social network ties. As the Rite FM Farmers Fone service is still in its infancy no definitive conclusions can be drawn from this, but it is noteworthy to see that radio can serve as an effective way of disseminating information about a mobile agricultural information service.

## **7. Business Benefits**

The findings of this research provide first insights in how social networks could be deployed in order to stimulate the diffusion of mobile agricultural information services. The case studies reflect the importance of social network characteristics identified in literature but also underline their intricate relationships and thus characteristics should not be analysed in isolation. Moreover the results underline the importance of cultural factors such as gender relations and traditional agricultural practices. For social entrepreneurs this entails that they have to pay generous attention to all the cultural differences among the small local social networks if they wish to achieve high adoption rates. Furthermore, social entrepreneurs are advised to take ample consideration of the large differences that exist between social networks that may appear homogenous at first sight.

Though the conclusions of this study could help social entrepreneurs in stimulating diffusion, the actual implementation of the findings is difficult. Especially the small differences between and within social networks make it challenging to design effective marketing plans.

## **8. Conclusions**

The main objective of this research has been to explore how social networks influence the diffusion of mobile agricultural information services among small scale farmers in Ghana. The theoretical framework has been built on Rogers’ ideas on social systems in relation to the diffusion of innovation complemented by theories on adoption applicable to the agricultural development sector. The current study has resulted in a better understanding of the mechanisms at play in the diffusion of mobile agricultural information services.

The case studies provide first insights into which social network characteristics may have stimulated or hampered the diffusion of the Esoko service and Farmers Fone in specific regions in Ghana. With respect to social network characteristics, factors which have been addressed are homogeneity, opinion leadership and the strength of ties. The findings of this research show that diffusion of the mobile agricultural information services



does not take place across borders of gender, different ethnicities or different educational levels. Opinion leaders play a role as local champions but their contribution to the diffusion process could be enhanced if agricultural extension agents are actively involved as change agents. Weak ties facilitated the entrance of information about the innovation into the social network but strong ties were not effectively used for the further diffusion of the service.

The current study has shown that social networks influence diffusion differently in different contexts. However, as this study is based on only two cases, more systematic case study analysis is required. Furthermore, statistical analysis could provide more reliable evidence on the correlation between social network characteristics and diffusion. In addition subsequent research could dive deeper into the separate aspects touched upon in this research.

In this respect, it would be interesting to further study questions like the following:

- How can social network characteristics effectively be combined with other factors stimulating diffusion, such as communication channels?
- Can different types of social networks be distinguished within specific regions? In what way are these social networks different? Should they also be approached differently?
- What is the role of norms within social networks and how they influence the diffusion of mobile agricultural information services either directly or indirectly?
- How can other new social media tools (Facebook, Twitter, etc.) be used to achieve diffusion? Do farmers use them?
- How can other new social media tools (Facebook, Twitter, etc.) be used to achieve diffusion? Do farmers use them?

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