

# Exploring the Effect of Mobile Phone on Smallholder Farmers' Livelihood

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**Abstract:** This article is based on a sequential exploratory mixed method research which carried in-depth interviews, content analysis, semi-structured participant observation, and administered a survey to 422 smallholder farmers in Machakos County in Kenya. The study was premised on combined concepts of information needs assessment (INAM), Sustainable Livelihood Framework (SLF), and ICT4D value chain analysis models to explore the effect of mobile phones on smallholder farmers' livelihoods. The study found out that mobile phones are not used by smallholder farmers' in the same way and therefore its effect on their livelihood is not uniform. On the one hand, mobile phone has negligible effect on subsistence smallholder farmers on-farm activities, and on the other hand, mobile phone usage has huge impact on market-oriented smallholder farming because it improves the relationships and interactions between the farmer and other rural livelihoods stakeholders.

**Keywords:** Mobile phone, smallholder farmers, mixed method research, rural livelihood

**Abstrak:** Artikel ini merupakan hasil penelitian mixed method research. Studi ini menggunakan kombinasi konsep penilaian kebutuhan informasi (information needs assessment), kerangka kerja mata pencaharian berkelanjutan (sustainable livelihood framework), dan model analisis mata-rantai nilai ICT4D untuk membahas efek telepon seluler pada mata pencaharian petani kecil di Kenya. Melalui wawancara mendalam, analisis konten, observasi partisipatoris semi-terstruktur, dan survei ke 422 petani kecil di Kabupaten Machakos Kenya, studi ini menemukan bahwa penggunaan telepon seluler dilakukan secara berbeda-beda dan mempunyai efek beragam. Di satu sisi, telepon seluler (Ponsel) tidak mempunyai efek pada kegiatan petani subsisten, dan di sisi lain, penggunaan Ponsel memiliki dampak besar pada petani yang berorientasi pasar karena untuk meningkatkan hubungan antara petani dan stakeholders penghidupan di desa.

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## Introduction

Mobile phones can be defined as devices and services that support social connectivity while the users are in physical motion. This mediation can take place through voice, text, picture or video. This is as opposed to the landline telephone whose major characteristic is its immobility and the interaction taking place only via audio. Also mobile phone communication technology is not only restricted to direct human interaction, but also it supports other forms of media consumption, information exchange, and even tracing the movement of objects that are in motion (Campbell, 2013).

Majority in rural villages in developing countries rely primarily on mobile phone as the only affordable and accessible means of interacting with individuals and institutions. Compared to other new media, mobile phone communication is affordable and accessible mainly because the transmission towers are relatively cheap to build, prepay is easy to administer, mobile infrastructure, devices, and services are simply more affordable than other wireless and fixed media providing opportunities for connectivity in developing societies that were previously isolated and marginalized (Campbell, 2013). Several scholars have theorized about the relational implications of the anytime-anywhere and individual address ability that mobile phones afford especially for isolated groups such as smallholder farmers in remote rural areas (Duncombe, 2013). Mobile phone communication affords people with what Licoppe (2003) calls “connected presence” where friends and family members stay connected through short, frequent calls and messages throughout daily life.

The power of mobile phone communication to connect people, especially the marginalized and isolated, smallholder farmers’ communities is important for rural livelihoods, bearing in mind; more than 75% of the populations live in rural areas and contributes 26% of GDP of the Kenyan economy (Njeru, et al., 2008). Majority of smallholder farmers live in isolated and marginalized areas that have no access to basic infrastructure such as roads, water, and electricity. Therefore a means of connecting them to the outside world and among

themselves would be important for infusion of new practices and ideas therefore improving their livelihoods.

There is consensus that the rapid adoption of mobile phone technology may be utilized to spur rural development. But the exact ways to accomplish this have elicited mixed reaction among scholars and practitioners, with some expressing optimism while others are skeptical. In fact some skeptics have argued that the poor do not need ICTs, and that they are a luxury that people living on less than \$1 a day cannot afford. McNamara (2003) argues what the poor need is economic opportunity, improved nutrition and health care, healthy environments, education, and other components of a rewarding and sustainable livelihood. This study explores the effect of mobile phones on smallholder farmers' livelihoods.

Regarding to this, this article considers Sood's assertion (2006) about levels and dimensions of mobile phone use to explore its effect on smallholder farmers. Sood's level and dimensions of mobile phone are the different ways that mobile phone are used to access and share information based on the information sought and how it is sought. He identified the following levels:

- Level I : To provide communication
- Level II : To provide access to information
- Level III : To provide passive or inter-passive consumption of media and
- Level IV : To interact with systems, institutions, communities and other users.

At level I and II (basic levels) mobile phone are used for communication by use of voice or texts while at higher levels (III and IV) mobile phones are used to interact with other communication channels, systems or community of users

Literature  
Review

Research has shown that in rural areas information search contributes to a significant part of the total cost incurred by farmers during the agricultural production cycle (Donner, 2010; Mittal et al., 2010). Duncombe and Heeks, (2002) argue that for the information to be effective its content should be relevant to the users' context, aligned with their interests and the information source should embody a certain level of trust, whilst recipients must have sufficient knowledge and understanding to be able to assimilate and assess the information provided.

This is the reason mobile phones are thought to be powerful tools that can provide rural livelihood information because they can be able to enhance or amplify other existing community communication systems. Donner (2010a) adds that mobile phones have the capacity to expand the users' freedom of choice by providing not only different types of information but also options such as text, voice or video.

The concept of a livelihood is widely used in contemporary writing on poverty and rural development, but its meaning can often appear elusive, either due to vagueness or to different definitions being encountered in different sources (Ellis 2000). Dictionary define livelihood as a 'means to a living' which according to Ellis (2000), makes it more than merely synonymous with income because it directs attention to the way in which a living is obtained, not just the net results in terms of income received or consumption attained. A popular definition is provided by Chambers and Conway (1992, p.7) wherein "a livelihood comprises the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living." This definition with minor modifications has been utilised by several

researchers and organizations adopting a livelihood approach.

According to Ellis (2000) the important feature of this livelihood definition and approach is to direct attention to the links between assets and the options people possess in practice to pursue alternative activities that can generate income level required for survival. For example, lack of education means low human capital, one of the several types of asset, and this excludes the individual from activities that require a particular level of education or skill attainment for participation in them. The term ‘capabilities’ also draws from Sen (1999) and refers to the ability of individuals to realize their potential as human beings, in the sense of being (i.e. to be adequately nourished and free from illness) and doing (exercise choices, develop skills and experience, participate socially and so on). Ellis (2000) combines Sen’s capabilities notion and Chambers and Conway (1992) definition of livelihood to come up with the following working definition of livelihood:

“A livelihood comprises the assets (natural, physical, human, financial, and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by individual household” (Ellis, 2000, p. 10).

The practical application of mobile phones in supporting livelihoods is expanding rapidly, but conceptualisation of the interrelationship between mobile phones and livelihoods is lagging behind. Thus, whilst it is assumed that mobile phones provide a new and innovative tool in the support of the livelihoods of the poor, there is lack of understanding of the interrelationships between the technological arte-fact and socio-economic development processes, as well as assessment of the outcomes that arise from its use (Duncombe, 2012). For example smallholder farmers have two types of livelihoods- subsistence or market-oriented farming and mobile phone is used differently in each. While subsistence smallholder farmers use mobile phone mainly to establish and maintain social relationships, market-oriented (dairy and cash crop farmers) use mobile phones for social purposes and also to access agricultural information such as market

prices, new practices and contact veterinary and extension officers. The difference in the two livelihoods is based on the livelihood assets that they utilize to earn their daily living.

There are several models of using mobile phones, but Kenya like many other Africa, Caribbean and Pacific (ACP) countries use Any Handset Any Network (AHAN) model (Internews Europe, 2008). In this model the mobile phone users are free to use handset of their choice on any of the registered mobile phone service providers. This model allows users to own several subscriber identification module (SIM) cards that they use with one handset or to own SIM cards without handsets.

Crandall's, *Kenyan Farmer's Use of Cell phone: calling preferred over SMS* (Crandall, 2012) study revealed that Kenyan cell phone users still prefer to call rather than text (SMS) and recommended that SMS-based information providers should, therefore consider adding voice-based products to their services in order to expand their market reach. This is attested by failure of the mobile based information services that use SMS to send information to take root in rural areas. SMS mobile based information services have not been a runaway success in Kenya but there a few notable examples such as NAFIS, M-farm, KACE, icow, Drumnet and Kilimo Salama which are currently being used by a very small percentage of smallholder farmers. As of the time of this study DRUMnet, one of the earliest mobile based information services run by an NGO, Pride Africa had gone out of operation.

The money transfer service has been one of the most successful uses of mobile phones to improve rural and urban livelihoods. All other mobile phone based apps and services such as M-farm that enable smallholder farmers to connect with one another to access financing or bulk purchase of farm inputs which reduces the cost of production leverage on mobile money transfer to popularize their services. Mobile phone has been successfully used to raise funds to help natural disaster victims in Kenya. For instance during the 2010/2011 drought in North Eastern Kenya, mobile phones were used to create awareness and also raise money for the drought victims through *Kenya*

for Kenyans and to fund a spinal injury rehabilitation hospital through *Bring Zack Home* initiative.

Mobile telephony, Aker and Mbiti, (2010) argue cannot serve as the “silver bullet” for rural development because, like all technologies, it faces limitations and challenges, including: high costs, especially for new generation handsets, and the potential trade-offs being made by rural individuals and communities to find funds to acquire and use phones compared to other information sources; limited network coverage and low bandwidth in some rural areas, which could lead to further marginalization of certain individuals and groups and limited capacity of rural people to use the technology, particularly for more complicated applications for images, GPS data, etc. But the above limitations, notwithstanding mobile phones have more benefits in sustainable rural livelihood.

The linkage between mobile phones and development is an echo of older discourses on development communication that expounded on the positive links between communications, access to information and development (Sife, et al. 2010). Batchelor and Scott, (2001), ODI/FAO (2003), McNamara, (2003), Duncombe, (2006), Donner 2009 and Aker and Mbiti, (2010), are some of studies that attempted to investigate the relationship between ICT and rural development by looking for connections between contexts of the rural poor and the perceived benefits of ICTs. Batchelor and Scott (2001) identified the impacts of ICT on capital (livelihood) assets as the connection between ICTs and sustainable rural livelihoods. According to McNamara (2008), applications of ICT have also been directly related to rural development by helping to map the vulnerability contexts of rural households such floods, droughts and pests.

Donner (2009) notes that since the mobile phone based information services in Africa are quite new, there are few detailed scholarly analyses or independent evaluations available. There are even fewer studies that have been done in Kenya with a few notable exceptions; Mukhebi and Kundu. (2009); Gakuru et al, (2009), Tickner (2009) and Waema, and Okinda (2010). Tickner’s (2009) review also notes the paucity of available evidence and recommends

further research into the impacts, both positive and negative, of digital market information systems in developing countries.

There are very few empirical studies on use of mobile phone in subsistence smallholder farming in Kenya and East Africa in general. Studies done prior to 2010 by Souter et al. (2005) Jensen (2007), Burrell (2008), Donner (2008), and Mukhebi and Kundu (2009) describe use of mobile phone in market-oriented enterprises in developing countries, for example communicating fish price information among fishermen in Tanzania and SMS access to real-time market inventory in Kenya. Furuholt and Matatoya (2011) argue that empirical data on general mobile phone use in rural areas is limited and only covers sporadic cases.

Mittal et al (2010) found that while mobile phones are currently being used in ways that contribute to farm productivity, they are not being used to their full potential. Infrastructure and farmers' capacity to use the information need to be improved in order to realize their full information dissemination potential. Furuholt and Matatoya (2011) investigated the levels of mobile phone use among farmers in rural Tanzania and using Sood (2006) Nokia Mobile Development Report found out that farmers in rural areas of Tanzania used only the basic level of mobile phone-mainly to communicate with family members and friends. This is corroborated by Ramburn and van Belle, (2011) who showed that even in Mauritius, which has one of the most sophisticated cellular markets in Africa, advanced mobile data services (apart from SMS) have still not entered the lives of most mobile subscribers.



This study combined information needs assessment (INAM), Sustainable Livelihood Framework (SLF) and ICT4D value chain analysis models to explore the ways that mobile phones affect rural livelihoods and the optimal way to use them. One of the advantages of the information needs assessment and ICTs within livelihoods framework is that it does not dwell on constraints, but instead focuses on existing strengths and assets (Chapman and Slaymaker, 2001). Duncombe (2010) assessed what has been achieved in academic-orientated research directed at Mobiles for Development (M4D) and suggests that the bulk of studies have focused on assessing readiness, uptake and immediate outputs associated with mobile phones, with only few studies providing evidence of outcomes and broader societal impact.

Souter et al. (2005) state that the potential of mobile phones to reduce vulnerability lies in people's ability to obtain information that allows them to deal with seasonal factors (e.g. weather information), to reduce the imbalance between themselves and those they trade with (e.g. price information) and to respond more quickly and effectively to shocks. The results of Sife et al. (2010) survey on the contribution of mobile phones to rural livelihoods and poverty reduction in Tanzania correspond with those of Souter et al. (2005) and Hellstrom (2010) and conclude that the mobile phones contribute by expanding and strengthening social networks therefore increasing people's ability to deal with emergencies and increase the efficiency of travel and business activities.

## Methodology

This study used a sequential exploratory mixed method research design. In this research method, qualitative data was collected and analysed first, then the result used to design quantitative data collection tools. The qualitative data was collected using key informant interviews from M4D experts and policy makers who included academicians, e-government, BPO, CCK and KICT Board officials, Mobile based information services providers (M-farm, NAFIS, Kilimo Salama) and Mobile service providers (Safaricom, Airtel, and Orange). Also mobile phone usage in rural areas was analysed and semi-structured participant observation conducted. The results were used to design the survey questionnaire which was administered to 422 smallholder farmers in Machakos County, Kenya. The survey questionnaires were cleaned, coded and analysed using SPSS.

## Findings and Discussion

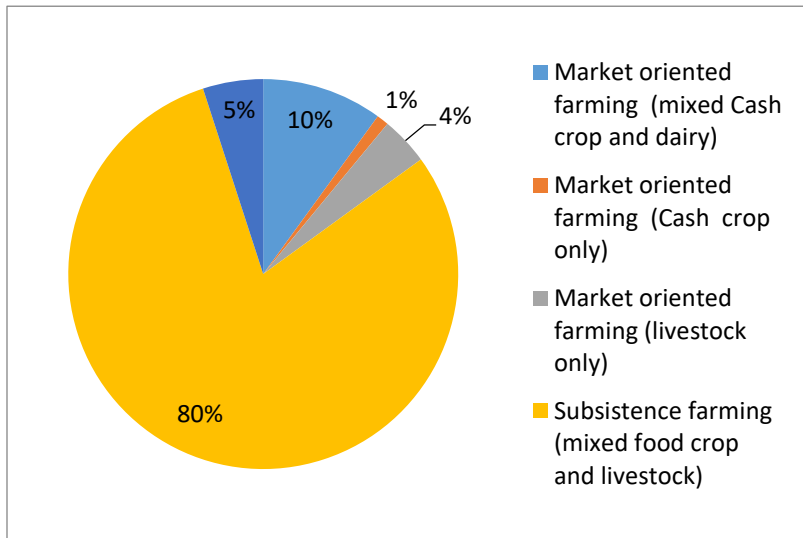
### Qualitative Data Analysis

#### *Livelihood and livelihood assets*

This study found that smallholder farmers pursue two types of livelihoods; subsistence farming or market-oriented (cash crop or dairy farming). We observed that the two districts of Mwala and Kangundo in Machakos County are semi-arid but Mwala district is the more arid of the two. Kangundo district is more arable and had more progressive farmers who practice market-oriented food crop, cash crop or dairy farming or market-oriented mixed farming while in Mwala district smallholder farmers practice subsistence food crop farming and kept livestock (chicken, goats, sheep and cows) for milk, manure and draught power in crop production, and security against crop failures.

Majority (80%) of the smallholder farmers in the two districts were subsistence farmers mainly producing

maize, beans, and cowpeas and poultry, cows and sheep. The food crops and livestock are meant for household consumption with very little surplus for market. A minority group of smallholder farmers (10%) are market oriented livestock and cash crop producers. The main market-oriented livestock kept are dairy cows with smallholder farmers rearing between 1-3 dairy cows. Coffee was the only cash crop produced with farmers having between 100-1000 coffee bushes. The key informants noted that livestock and cash crop smallholder farmers belonged to crop or livestock producers' farmer groups, but subsistence smallholder farmers did not belong to any group and did not consider access to information important in their farming activities (Chart 1).



**Chart 1** 'Smallholder farmers' livelihoods'

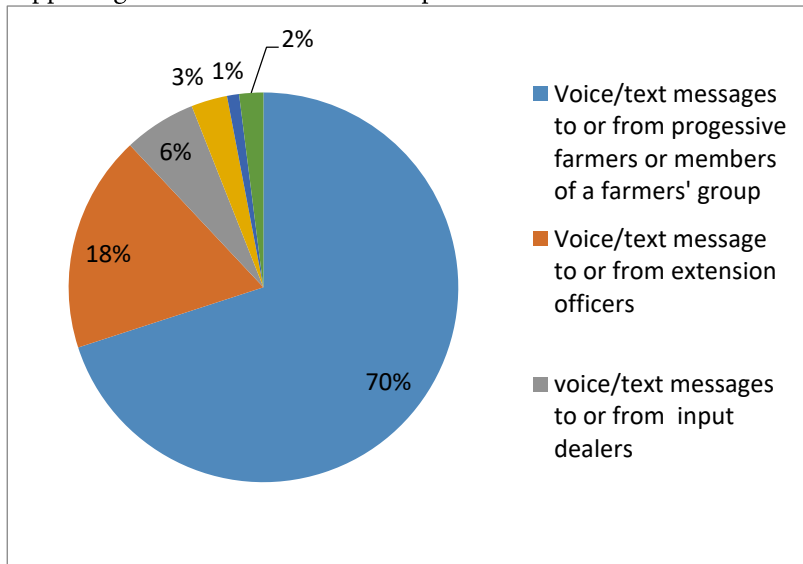
### *Level and dimension of mobile phone use in rural areas*

The study found that generally smallholder farmers and agricultural development stakeholders such as extension officers and input dealers used level I (basic level) of mobile phone communication. Mobile phones were basically used to send and receive voice and text messages. A small group of dairy farmers used level II –to get

agricultural information by calling vets, input dealers or extension officers.

Advanced levels (III and IV) passive and inter-passive interaction with media and interacting organization and other users were not used in rural areas. None of the extension officers interviewed received alerts and updates from mobile information based services or any other organization. Mobile phone information service providers (NAFIS, M-farm, Kilimo Salama)

Mobile Network Operators (Safaricom, Airtel and Orange) officers interviewed said that higher levels of mobile phone use required skills and are expensive to use. It was observed that mobile phone used at the basic level offered limited ways that it can be used to support agricultural and rural development.



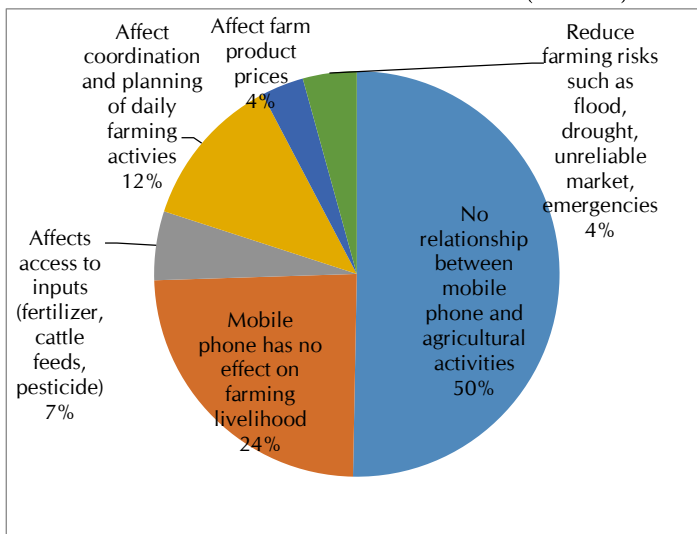
**Chart 2** 'Level and dimension of mobile phones use to support agricultural and rural development'

### *Effects of mobile phone on smallholder farmers' livelihood*

There was lack of consensus among the key informants on the effect of mobile phone on rural livelihood. Extension officers felt that

mobile phone had no effect on smallholder farmers livelihood while, M4D expert and policy makers argued that mobile phone had effect and this could be measured by evaluating their extent of use. The findings indicated that 50.3% argued that there was no relationship between mobile and smallholder farming, 24.2% said mobile phone had no effects on smallholder farmers' livelihood, 12.3% said it could help in the planning and coordination of daily farming activities, 5.5% said it could help farmers to acquire farming inputs, 4.3% said that it could help farmers reduce farming risks and 3.4% said that it could help farmers to access market information.

We observed that awareness of how mobile phone could be used to support smallholder farmers' livelihood was an important step in ensuring that the services were used effectively and made a difference in people's lives. The respondents mainly the agricultural extension officers said that mobile phone had a lot of impact on their social life but little or no impact on agricultural activities. Among extension officers reported convenience they got from using their mobile phones but did not see its direct impact on how they accessed and shared agricultural information with smallholder farmers (Chart 3).

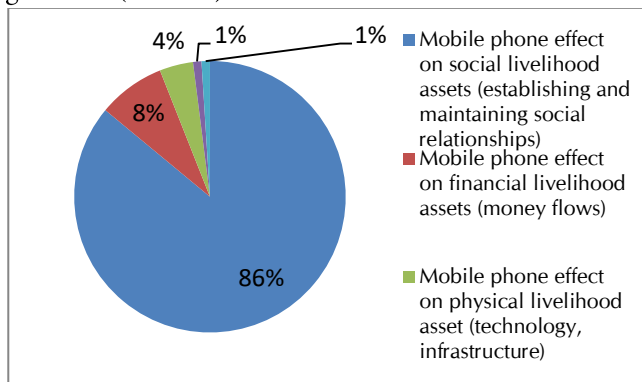


**Chart 3** 'Effect of mobile phone use on smallholder farmers' livelihoods'

*Effects of mobile phone use on smallholder farmers' livelihood assets*

The study indicated that the type of livelihood assets available to smallholder farmers determines the type of livelihood they pursue. According to the participant observation and key informant responses land was the greatest livelihood asset with only 1% arguing that human capital (skills and knowledge) were a livelihood asset in rural areas. There were very few natural assets (river, springs, and pasture) and as such only very negligible rural dwellers earned their livelihood from wood carving, harvesting sand or breaking stones to make ballast for sale.

The findings showed that 86% of the key informants agreed that mobile phone was mainly used to establish and maintain social relationships. They noted that in rural areas social capital is important because by nature most of activities were done communally by the household, family or even village. M4D experts and policy makers said that it was very difficult to quantify the value of social capital in the lives of smallholder farmers because sometimes it contributes indirectly to other livelihood assets. Eight percent of the informants felt that mobile phones affected smallholder farmers' financial livelihood assets by making it easier and faster to carry out financial transactions. It was observed that to some extent mobile phone use affected the physical livelihood assets in rural areas because it encouraged use and consumption of other communication technologies such as radio and banking services (Chart 4).



**Chart 4** 'Effects of mobile phone use on smallholder farmers' livelihood assets'

*Readiness of mobile phone to support agricultural and rural Development*

M4D experts viewed readiness as the software (including skills and knowledge, institutional policies and regulations) and hardware (infrastructure) that are required for mobile phone to support agricultural and rural development. The findings revealed that mobile phone was not ready to support agricultural and rural development due to inadequacy in skills and knowledge of the farmers and supporting infrastructure. Though the systemic requirements such as mobile networks are available, smallholder farmers do not have skills to access high level mobile phone uses. Level II and III of mobile phones are very crucial in sharing agriculture information, but unfortunately they require higher levels of mobile phone literacy which most of the smallholder farmers' lack.

Higher level of mobile phone require investment in terms of databases and regular updates that need infrastructure support and advanced handsets to access the information. It was also noted that there was lack of coherent policies and regulations and adequate infrastructure to encourage mobile phone use in rural areas.

*Challenges of using mobile phones to access, share and disseminate agricultural information*

Key informant interviews and participant observation indicated that mobile phone has potential to support agricultural and rural development livelihood when used at all levels and dimensions. Smallholder farmers do not use mobile phone maximally because of the following challenges; nature of agricultural information, inadequate skills and knowledge among smallholder farmers, attitude of the subsistence farmers and lack of mobile phone in agricultural and rural development champions.

The findings revealed that the greatest challenge that hindered mobile phone use to support agricultural and rural development was the attitude of the subsistence farmers. By nature subsistence farming is averse to using of inputs such as fertilizer and pesticides, new farming practices hence it does not encourage use of mobile phone to access and share agricultural information. 50% of the key informants felt this

farming method hindered use of mobile phone in agricultural and rural development while thirty percent identified lack of awareness as hindrance. Smallholder farmers are not aware of the different ways that mobile phones can be used to improve their farming activities. 7% identified lack mobile literacy among smallholder farmers as a challenge. Due to lack of mobile literacy and low level of education smallholder farmers used mobile phone at the basic level. 3% of informants indicated that agricultural information by nature required lengthy explanation which was not effective when transmitted via mobile phone. An extension gave the following comment;

“Mobile phone is effective when disseminating short messages that do not require a lot of explanation such as commodity prices, but most of agricultural information such as how to prepare a seedbed need detailed explanation or even demonstration”.

We found that there were no mobile-phone-use champions to mainstream its use in all agricultural and rural development programmes and projects. Extension officers indicated that mobile phone was not mainstreamed and integrated in extension services. Also mobile phone based information service providers indicated that there were no incentives from government and non-governmental institutions to provide agricultural information in rural areas. Mobile network operators noted that they did not subsidize or offer toll-free agricultural information services and had no plans to do so in future.

Lastly, lack of supporting infrastructure such as electricity, water, health services and road was also identified as a challenge. We observed that electricity power supply in Machakos County is available only at the main urban centers and few residential homes of progressive farmers in close proximity to urban centers or highways. Generally there is lack of evenly distributed mains electricity to the village level. Some of the progressive farmers had installed solar panels to generate electricity while dairy farmers generated electricity from biogas.

In Mwala districts which had a large percentage of smallholder farmers with no access to electricity, the farmers had devised creative ways to use mobile phone in this context by either switching off their



phones when not expecting urgent messages while others had a spare battery, when one battery was being charged at the shopping centre they used the spare battery (Chart 5).

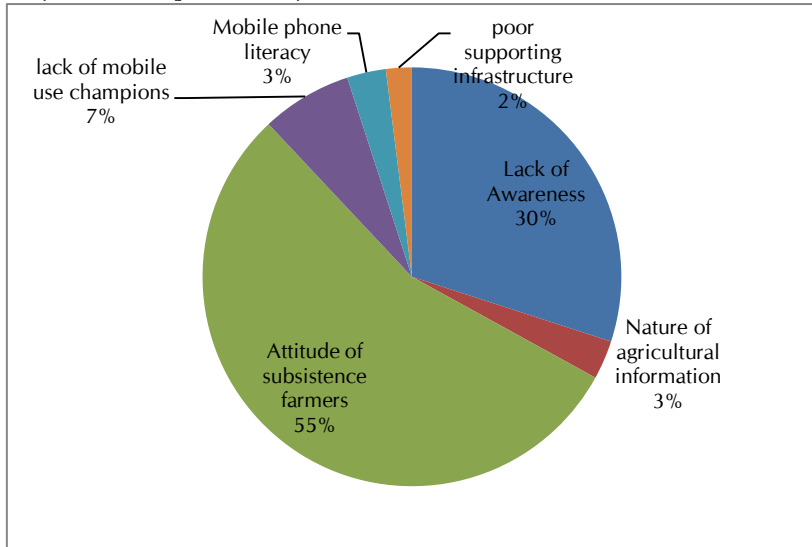


Chart 5 'Challenges of using mobile phone in agricultural and rural development'

## Quantitative data analysis

### *Livelihood assets*

The findings show that 73.3% of the respondents considered land as their greatest livelihood asset, 12.44% indicated skills and knowledge as their main livelihood asset. Men, who form the majority of those interviewed, indicated that they also relied on manual work and therefore considered skills in various on-farm and off-farm activities as a crucial livelihood asset. Only 2.67% considered natural assets (river, springs, and pasture) as their main livelihood asset. Those were mainly those who did wood carving, harvested sand or crashed stones to make ballast for sale (Table 6).

Livelihood Assets	Frequency	Percent
Land	309	73.33%
Livestock	26	6.22%

Livelihood Assets	Frequency	Percent
Skills and knowledge	53	12.44%
Financial (savings, remittances)	17	4.00%
Natural resources (river, springs, pasture)	11	2.67%
No response	6	1.33%
Total	422	100%

**Table 1** 'Summary of main livelihood assets'

### *Information most sought by farmers*

The findings indicated that smallholder farmers had a wide range of agricultural information needs, which varied according to production season and livelihood (crop, livestock or mixed farming). However, the study found that the information required were common to all of them, irrespective of their livelihood. The study findings summarized the information sought in the following categories: farm planning activities, weather patterns and best time to plant, farming inputs, harvest and storage and selling and marketing.

The study found that small farmers prioritised farming inputs (fertilizer, pesticides, cattle feeds), with 36.2% indicating that they required information on the type of inputs required in their farming, 24.4% of the respondents indicated that they sought information about farm planning activities such as tilling and spacing, 23.1% mostly sought information on where to sell their farm produce, 11.2% indicated that they prioritised information on weather patterns and best time to plant while only 5.0% sought information on harvesting and storage of farm produce.

Information Most Sought	Responses	
	N	Percent
Farm planning activities	103	24.4%
Weather patterns and best time to plant	47	11.2%
Farming inputs (fertilizer, pesticides, cattle feeds)	153	36.2%
Harvesting and storage	22	5.0%
Selling and marketing	97	23.1%
Total	422	100.0%

**Table 2** 'A summary of the information mostly sought by farmers'

*Level of mobile phone use*

The respondents were asked how they used their mobile phones to access and share agricultural and rural development information. Majority of them, 38.4% said that they used their phones to send and receive both text and voice messages, 27.3% used their mobile phones to send or receive only voice based messages, 12.5% used text (SMS) to send or receive messages while only 1.2% and 0.25% used mobile phone to access internet and mobile based information services respectively. The limited use of higher levels of mobile phone (to access internet or mobile based information service) was due to low level of education in the rural population of this study. This was supported by earlier findings that showed 55% of the respondents' had primary level education or lower. Those using SMS were found to have higher level of education mostly secondary level of education compared to the individuals not using SMS. Farmers indicated that they preferred voice to SMS because calling required less effort and time to get a final response (there is much back and forth with SMS). These findings suggest that use of mobile phones for development purposes favours voice-based communication and user interfaces that could be used by those with low education level. Though mobile phone money transfer was not one of the goals of the study, 20.4% of the respondents indicated that they used mobile phones to send or receive money (Table 8).

Level of Mobile Phone Use	Responses		Percent of Cases
	N	Percent	
Text / SMS	94	12.5%	43.9%
Used both text and voice	300	38.4%	140%
Voice/ calling	213	27.3%	99.5%
Money transfer	160	20.4%	74.8%
Mobile based information service	1	0.2%	0.5%
Internet	10	1.2%	4.7%
Total	778	100.0%	363.4%

**Table 3** 'level of mobile phone use'

*Effect of Mobile phones on rural livelihoods*

The findings show that 32.4% of the respondents indicated that mobile phones had a positive effect on their agricultural livelihoods. Of those who agreed, one farmer in Makutano, Mwala district said, “*I use the mobile phone to enquire about availability of casual jobs in Machakos town and I then negotiate for higher pay before accepting the job*” This was contrasted by 67.6% who indicated that mobile phones had no effect on their farming activities. Those were mainly the subsistence smallholder farmers who spent most time working as casual employees in progressive farmers farms or in urban centers. Therefore they used mobile phone to establish and maintain contacts who could inform them when there were job opening.

Effect of Mobile phones on rural livelihoods	N	Percent
Yes	138	32,4
No	284	67,6
Total	422	100

**Table 4** ‘Effect of mobile phones on rural livelihoods’

*Use of information accessed through mobile phone to create favourable livelihood outcomes*

The respondents were asked if the information they accessed through mobile phone helped them create favourable livelihood outcome. 56% percentage of the respondents said that the information they accessed through mobile phones did not help them to create positive outcomes in farming activities while 43.1% of the respondents indicated that the information the accessed using mobile phones helped to create favourable livelihood outcomes, though not only through farming activities but also from off-farm activities such part-time wage employment Table (10).

Use of information accessed through mobile phone to create favourable livelihood outcomes	N	Percent
Yes	182	43,1%
No	236	56%
Non-response	4	0,9%
Total	422	100

**Table 5** 'Use of information accessed through mobile phone to create favorable livelihood outcomes'

*Farmers satisfaction with use of mobile phone to access and share agricultural information*

The respondents were if they were satisfied or whether they felt that got value for money when they used mobile phones to share and access agricultural information. The findings show that 63.6% of the smallholder farmers felt that they did not get value for their money when they used mobile phone to access and share agricultural information. This was in line with earlier findings that showed 64.9% of the respondents felt mobile phones did not help to reduce farming risks such as floods, drought and diseases among other catastrophes. But 35.6% of the respondents indicated that they were satisfied with using mobile phone to access and share agricultural information and felt that they got value for money (Table 11).

Farmers satisfaction of using mobile phone to access agricultural information	N	Percent
Yes	150	35,6
No	268	63,6
Non-response	4	0,8
Total	422	100

**Table 6** 'Farmers satisfaction with use of mobile phone to access agricultural information'

*Challenges of using mobile phone in agricultural and rural development*

The study found that the mobile phone had the potential to support agricultural and rural development if it was used at all levels and dimensions. 55% of the respondents indicated that the type of

farming system (subsistence farming) was the major challenge that limited use of mobile phone communication in agricultural and rural development, 30 % said that lack of awareness on how mobile phone communication can be used in agricultural and rural development was a challenge, 7% of the respondents said that mobile phone was not mainstreamed in agricultural and rural development activities, 3% of the respondents indicated that skills and knowledge and the nature of agriculture information limited use of mobile phone while 2% indicated that lack of supporting infrastructure such as electricity reduced the effectiveness of mobile phone in agricultural and rural development. Table 12 below summarises the challenges of using mobile phones in agricultural and rural development.

Challenges of using mobile phone in agricultural and rural development	Responses		Percent of Cases
	N	Percent	
Lack of awareness	338	30	126.7
Nature of agricultural information	34	3	12.66
Type of the farming method (subsistence or market-oriented)	619	55	232.1
Lack of mainstreaming mobile phone use in agricultural and rural development activities	79	7	29.54
Skills and knowledge	34	3	12.66
Lack of supporting infrastructure	23	2	8.44
No Response	10	0.9	3.798
Total	1137	100.0	425.0

**Table 7** 'Challenges of using mobile phone in agricultural and rural development'

The findings show that mobile phone effect on livelihood depend on the type of farming being practiced (subsistence or market oriented farming) and the major asset used to earn the living. Smallholder farmers' used mobile phones in the context of irregular income, inadequate skills and knowledge, inadequate supporting infrastructure and poor policies and regulations context. Mobile phone does not create positive livelihood outcomes in form of increased farm productivity or more income from farm activities for subsistence farmers. On the other hand, it positively affected agricultural livelihood assets when it was used in the context of market-oriented farming by increasing farm productivity, increasing income and reduction in losses.

This was mainly because subsistence farmers earned their income from off-farm activities such as art and craft and part-time employment in progressive farmers' farms and therefore did not prioritise agricultural information. Smallholder farmers use mobile phones in a way similar to interpersonal communication to establish social networks and information on livelihoods came as a by-the way. This was attested by participant observation which showed that smallholder farmers used mobile phones to request for their favourite music, participate in lotteries or send greetings to family members, friends and neighbours through radio as opposed to requesting information on certified seeds, novel farming methods or when and how to plant.

Market-oriented cash crop and dairy farmers used mobile phone to get agricultural information such as input prices from dealers or how to prepare fodder from extension officers. Market-oriented dairy farmers also used phones to access and share

agricultural information more than cash crop farmers. In support of the above observation, an extension officer from Kangundo gave the following comment;

“Dairy farming is information intensive and requires round the clock real-time information that could only be accessed via mobile phone compared to crop farmers. I get more calls or SMSs at any time of the day from dairy farmers enquiring about the type of feed, how to eradicate ticks, preparation of fodder and where to get A.I services among other things”.

We found that though mobile phones were not effective in disseminating agricultural information when used in the context of subsistence farming, they increased the social capital of the smallholder farmers. This should be understood from the perspective that the smallholder subsistence farmers do not view subsistence farming as a means of livelihood but rather as the last resort while searching for part-time or permanent employment. This was supported by a smallholder subsistence farmer from Makutano division in Mwala district:

“I use mobile phone weekly to send or receive messages from family members and friends on social issues but not from extension officers or other government officers such as chiefs regarding farming activities. I do subsistence farming as the last resort while searching for employment in town or in the village. I do not want to invest money in farming because I don't consider it as an income generating activity. I would rather call my friends who work in town to enquire about job opening than call or text seeking agricultural information.

We can argue that the above sums the use of mobile phone in the context of smallholder subsistence farming. Subsistence farming is practiced to provide food and not an income generating activity hence it is practiced while waiting for job openings that guarantee income.

This is supported by the reviewed literature that shows that all successful documented cases of mobile phone in rural livelihoods are based on market-oriented context. Therefore we can argue that mobile



phone used in market-oriented farming context is effective and lead to favourable livelihood outcomes such as increased farm production or reduction of losses. Studies (Duncombe, 2006; Jensen, 2007; Donner, 2010; Aker and Mbiti, 2010) that have shown mobile phone creating favourable income outcome are based on market oriented activities or situations. For example Jensen's (2007) study in India showed that fishermen who were previously ignorant of daily prices in different markets were able to contact various ports to find the best offer for their catch. Aker's (2010) study in Niger showed that as mobile networks have expanded, grain price differences have decreased by 20 percent, traders' search costs have decreased by 50 percent, scarce resources have been better allocated, and consumers paid, on average, 3.5 percent less for grain, which is equivalent to 5–10 days of grain consumption annually.

With regard to challenges of using mobile phones to access and share rural livelihood information and messages by smallholder farmers, the study found out that, though mobile phone had great potential in agricultural and rural development as evident from its frequency of use and reliability in provision of information, it was not used optimally by smallholder farmers. Therefore, despite its higher adoption and use in rural areas we found that mobile phone had little effect on smallholder farmers' agricultural livelihoods. We identified the following as the challenges that had made smallholder farmers not to benefit from mobile phone in their daily activities as follows: *First*, lack of awareness on how mobile phone can be used to support agricultural activities. Mobile phones have great potential in agricultural and rural development because of their wider use. But unfortunately this wide use has not been converted into positive outcomes in agricultural and rural development. We found that lack of awareness on how mobile phones could be used to support farming activities as one of the challenges. It was also interesting to note that m-farm, one of the most popular mobile based information service created a lot of awareness through the media and in partnership with other agricultural and rural development stakeholders before launching

the service. One of the founder members of m-farm gave the following comment on the importance of creating awareness:

“We started creating awareness of our information service during the development stage. We interviewed farmers, input dealers and extension officers regarding the farmers’ information needs and included their suggestions in our design. We piloted the information service, created awareness on the information sources it offered and trained smallholder farmers on how to access the information. We are still creating awareness by engaging with agricultural and rural development stakeholders’ every time we update the platform or add a new interface.”

The importance of creating awareness was also underscored by an extension officer who when asked why he did not use the National Farmers Information Service (NAFIS) mobile based information service yet it was run by Ministry of Agriculture and Livestock production answered;

“I am not aware that such an information service exists. If the extension officers are not aware also the farmers are not aware”.

*Second*, the nature of agricultural information makes its provision via mobile phone ineffective. Findings show that agricultural information by nature requires a lot of explanation which is not always effective when passed via mobile phone. An extension officer captured these sentiments by pointing out that some agricultural terminologies have no vernacular language equivalence hence have to be explained in details to the farmers which is not possible via phone.

“Mobile phones are not effective because only little information can be shared through the mobile phone. We use the phones to call and request for face-to-face meeting where a lot of information can be shared.”

Agricultural information on how-to such as how to prepare a seedbed are hard to access as text or voice, the basic ways used by smallholder farmers to access information. This may require higher level of mobile phone use such as internet. But due to their low

education they are unable to access it. As indicated in table 3.3 and chart 3.2, level and dimension of mobile phone use and farming activities coordinated, extension offices used mobile phones mainly to book appointments or call barazas where agricultural information is disseminated.

*Third*, subsistence farming discourages use of mobile phone to access and share agricultural information for making decisions. Subsistence farming is carried out more to provide food for the household than it is for sale. It uses simple production systems, outdated technologies, low returns, and high seasonal labour fluctuations and nearly all the crops grown and livestock reared are used to maintain the household with little surplus left for sale or trade which reduces the need for information in making decisions. Therefore, subsistence farmers invest minimal effort and resources because their income comes from off-farm activities such as crafts, casual employment in the urban centers or progressive farmers farms. Since use of mobile phone to access agricultural information has some financial implications they shy away from using it to access agricultural information but use it to get contacts who can help them secure wage employment in permanent or seasonal basis. Unlike Furuholt and Matotay's (2011) study which found that though people in rural Tanzania, in general, are poor, they are willing to spend a remarkable amount of money on mobile phones to access agricultural information; we found that subsistence farmers in Kenya invested minimum effort, money and technology in their farming activities. We agree with Munyua (2007) that small-scale farmers in Africa could utilize their small farms more efficiently and effectively by adopting commercial agricultural practices by producing high value crops and livestock instead of relying on traditional food crops and livestock.

*Forth*, lack of mainstreaming and integration of mobile phone in agricultural and rural development activities. There were also no mobile-phones-in-agricultural-development champions to promote its use in rural areas. For example, we observed that National Agriculture and Livestock Extension Programme (NALEP) programme that runs NAFIS mobile phone based information service was not mainstreamed

in the extension services and there were no efforts to encourage its integration in extension services by giving field officers mobile phone credit or a toll-free service that may encourage its use by smallholder farmers. We observed that unlike in the mobile phone based money transfer services the government had not tailored regulations and acted as the innovation champion to promote use of mobile phone in agricultural development and also m-agriculture has not been fostered and adopted in the national development strategy and this has led to its low uptake by smallholder farmers. It was observed that other than NAFIS which is government-run, all other mobile based services such as m-farm, Kilimo Salama, i-Cow and KACE are privately run and target market-oriented farmers who can afford their services and do not benefit subsistence farmers. Therefore, there is need to mainstream and integrate mobile phone communication into the core agricultural and rural development activities and programmes through public private partnerships to reduce the cost. A mobile phone based information service provider observed that;

“The license fees for the short codes for agricultural and rural development information services are not subsidised and therefore we run them as commercial enterprises. This makes it costly to access the service because we charge users between Kshs. 5 -20 above the normal calling or texting rates”.

*Fifth*, lack of m-skills and knowledge to use mobile phone at higher level. The findings show that using mobile phone at higher level such as passive and inter-passive consumption of media and interaction with systems, institutions, communities and other users requires knowledge and skills. There was low uptake of mobile phone at higher level due to low education level and lack of training among smallholder farmers. This was supported by our observation that smallholder farmers and agricultural extension officers mainly use their mobile phones to send and receive voice based calls. A farmer in Mwala said;

“I do not use mobile phone to get information from mobile based information services such as NAFIS, m-farm or Kilimo salama because of the price charged above the normal SMS rate and I also I do not know how to access that information.”

Our findings concur with Munyua (2007) who identified various gaps such as inadequate skills in the use and application of ICTs, inadequate human resources with the capacity to generate, repackage and digitise local content that need to be bridged to enhance skills and facilitate the exchange and sharing of information and knowledge as challenges to use mobile phone in agricultural and rural development. It also echoes McNamara (2003) who points out that many ICTs require a certain level of skills, including literacy, which means that they risk reinforcing existing inequalities in capacity and therefore in access to services, rights and even assets. More generally, when ICTs are introduced into a poor community, those who already have more power, higher income, greater skills, and higher social status are more likely to gain access to those tools and use them to their benefit. Farmers require the necessary knowledge and information to use technologies and adoption and use of new technologies is positively correlated with the farmer's level of education.

*Sixth*, poor supporting infrastructure. Smallholder farmers live in rural areas physically isolated and marginalized from physical infrastructure such as roads, electricity, health services and public administrative and governance structures (extension services, security). Development of supporting infrastructures, such as the telecommunication network, roads and electricity supply play a complimentary role and increase the uptake of ICTs such as mobile phones. Participant observation indicated that most of the rural areas under study were not connected to electricity power grid. An extension officer in Ikalaasa said; "people have to travel sometimes for between 2-5 kilometers to urban centers and pay between Kes. 10-20 to charge phones thereby increasing the cost of using mobile phones."

This observation agrees with Hellstrom (2011) who notes that the main barrier to mobile phone use, especially in rural areas, is access to reliable electricity. The majority of farmers in Kenya lack access to reliable energy, making it difficult and costly for people to charge their phones. One of the complaints made by extension officers was that most of the times when they call farmers their phones are switched off or no one picks them up. Farmers indicated that due to limited access

to electricity they usually switch off their phones and only switch them on when calling or expecting a call or text message.

Another thing worth noting in the discussion is the type of rural livelihood information best suited to be accessed and shared by smallholder farmers via mobile phones. Findings showed that majority of the smallholder farmers used mobile phone at the basic level. This was evident from 79.1% of the respondents who indicated that they used mobile phone daily and 78.2% who said that they mainly used it to send and receive text and voice messages. At the same time 99.1% of the smallholder farmers as was indicated earlier showed that they did not receive any alerts and updates via mobile phone. A negligible 1% accessed mobile based information services (see table 3.3 and chart 3.2 level of mobile phone use).

Mobile based information service providers argued that basic skills and knowledge are required in order to use mobile phone at higher level as such as passive and inter-passive media consumption and interacting with systems, institutions, communities and other users. The fact that according to the findings only 4.9% of the respondents had post-secondary level of education and 55% had primary level of education and below was pointer that smallholder farmers had no capacity to use mobile phone at higher level.

According to the findings there was a relationship between level of mobile phone use and how mobile phone affected smallholder farmers' livelihood. Participant observation and key informant interview show that all mobile based information services require higher level of mobile phone use. This as seen in the findings reduced the number of farmers who could access the information and hence the low uptake of these services. The higher the level of mobile phone use, the more ways available to access a variety of information but unfortunately since smallholder farmers use lower level they access and share limited agricultural information. This resonates with Molony's (2008) who argue that smallholder farmers were unable to exploit new mobile phone-based services to seek information on market prices because they use mobile phones at the basic level.

## Conclusion

Building on literature reviewed and the findings, this study concludes that mobile phones are not used by smallholder farmers' in the same way and therefore its effect on their livelihood is not uniform. Its effect depends on smallholder farmers' livelihood assets, and the context at which it is used. Smallholder farmers use mobile phones in the context of either subsistence or market-oriented farming, in the context of inadequate skills and knowledge, in the context of inadequate supporting infrastructure and in the context of weak M4D regulations and policies.

Mobile phone affects subsistence and market-oriented smallholder farmer's livelihood differently because their information needs are different. This is supported by Ozowa (1997) as cited in Mtega (2012) who argues that people have specific information needs which relate to the specific problems they face and the decision they have to make. Information needs of smallholder farmers relate to their occupations and their basic survival goals.

Subsistence smallholder farming by its very nature is not amenable to information because it is based on family ties and personal relationships and most of the activities are performed communally. Subsistence farming produces mainly for household consumption and supplements this with off-farm activities, with farmers spending more time as casual labourers in construction sites, shamba boys and herdsmen in progressive farmers' homesteads. They therefore spend more time, effort and resources seeking information that can increase the contacts who can inform them when these opportunities are available.

On the other hand market-oriented smallholder farming is an agricultural system in which farmers produce to sell to consumers and recognizes the importance of relationships and interaction with other stakeholders such as input dealers, buyers, extension officers and vet. These interactions give information on market, when and how to plant and input application which creates favourable livelihood outcomes such as better market prices, increased farm productivity, increased income or reduction in losses.

This study identified, lack of awareness of the different ways that mobile phone could be used in agricultural and rural development; The nature of subsistence smallholder farming does not value agricultural information because it uses traditional methods of farming land farmers work as part-time or permanent wage workers in and out of the village; .lack of m-skills and knowledge to use higher level of mobile phone among smallholder farmers and lack of supporting infrastructure such as electricity as the challenges that hinder smallholder farmers from utilizing mobile phone maximally to support rural livelihoods.

### Reference

- Aker, J. and I.M. Mbiti. (2010). Mobile phones and economic development in Africa – *Working Paper 211*. 5-44 . Retrive from <https://www.cgdev.org/publication/mobile-phones-and-economic-development-africa-working-paper-211>.
- Ashraf, M. M., & Malik, B. T. (2010). ICT for Development (ICT4D) projects in developing countries: A proposed conceptual framework. In National ICT Approaches for Socioeconomic Development E-strategies for Technological diffusion and adoption, pp. 180-187, USA: IGI Global.
- Batchelor, S. and Scott, N. (2001). *The role of ICTs in the development of sustainable livelihoods: A set of tables*. London: Gamos Ltd.
- Burrell, J. (2008). *Livelihoods and the Mobile Phone in Rural Uganda*. USA: Grameen Foundation
- Campbell, S. W. (2013) Mobile media and communication: A new field, or just a new journal? *Mobile Media and communication*. 1(1), 8–13, Retrieved from <http://mmc.sagepub.com/content/1/1/8>
- Chambers, R., & Conway, G. R. (1992). Sustainable rural livelihoods: practical concepts for the 21st century. *Discussion paper 296*. Institute for Development Studies, University of Sussex, UK.



- Chapman, R. & Slaymaker, T. (2002). ICTs and rural development: review of literature, current interventions and opportunities for action. *Working Paper 192*. London: Overseas Development Institute.
- Chapman, R., Slaymaker, T. & Young, J. (2005). *Livelihoods approaches to information and communication in support of rural poverty elimination and food security*. London: Overseas Development Institute.
- Crandall, A. (2012). Kenyan farmer's use of cell phones: Calling preferred over SMS. *Proceedings of mobile for development (M4D 2012)*. Karlstad University, Karlstad.
- Donner, J., & Tellez, C. A. (2008). Mobile banking and economic development: Linking adoption, impact, and use. *Asian journal of communication, 18*(4), 318-332.
- Donner, J. (2010). Framing M4D: the utility of continuity and the dual heritage of “Mobiles and Development”. *The Electronic Journal of Information Systems in Developing Countries, 44*(1), 1-16.
- Duncombe, R. (2006). Using the livelihoods framework to analyse ICT applications for poverty reduction through microenterprise. *Information Technologies and International Development 3* (3), 81–100.
- Duncombe, R. (2010). Mobiles for development research: Quality and Impact. M4D 2010, 12.
- Duncombe, R. (2012). Understanding Mobile phone impact on livelihoods in developing countries: New Research Framework. *Centre for Development Informatics*. University of Manchester, UK.
- Duncombe, R. & Heeks, R. (2002). Enterprise across the digital divide: information systems and rural microenterprise in Botswana. *Journal of International Development, 14*(1), 61–74.

- Ellis, F. (2000). *Rural livelihoods and diversity in developing countries*. Oxford: Oxford University Press
- Ellis, F., & G. Bahiigwa. (2003). Livelihoods and rural poverty reduction in Uganda. *World Development*, 31(6), 997-1013
- Furuholt, B. & Matotay, E. (2011). *The Development Contribution from Mobile Phones Across the Agricultural Value Chain in Rural Africa*. *The Electronic Journal of Information Systems in Developing Countries*, EJISDC, 48 (7), 1-16.
- Gakuru, M. & Stepman, F. (2009). The Farmers information matrix: Lessons learned from deploying a voice information service for farmers in Kenya. *IST-Africa 2009 Conference Proceedings*.
- Gakuru, M.; Kristen, W. & Stepman, F. (2009). Inventory of innovative farmer advisory services using information communications, technologies. *The Forum for Agricultural Research in Africa*.
- Grimshaw, D. J. & Kala, S. (Ed). (2011). *Strengthening rural livelihoods: The impact of information and communication technologies in Asia*. Ottawa: International Development Research Centre.
- Hellström, J., & Tröften, P. E. (2010). *The innovative use of mobile applications in East Africa*. Swedish international development cooperation agency (Sida).
- West, J. (2008). *The promise of ubiquity: Mobile as media platform in the global south*. Paris, France: Internews Europe
- Jensen, K.B. (2013). What's mobile in mobile communication? Mobile Media and Communication . *Mobile Media & Communication*. 1(1), 26-31. DOI: 10.1177/2050157912459493,
- Licoppe, C. (2003). *Two modes of maintaining interpersonal relations through telephone: From the domestic to the mobile phone*. In Katz, J. 2008). (ed.), *Machines that become us: The social context of communication technology*, pp. 171–186, New Brunswick, NJ: Transaction Publishers.

- McNamara, K.(2003). Information and *communication technologies, poverty and development: Learning from experience, framework for thinking about ICTs, poverty, and development*. Washington, DC: Information for Development Program (InfoDev), World Bank.
- McNamara, K. (2008). Enhancing the livelihoods of the rural poor through ICT: A knowledge map Tanzania country study. Retrieved from <http://www.infodev.org/en/Publication>.
- Mittal, S., Gandhi, S., & Tripathi, G. (2010). Socio-economic impact of mobile phones on Indian agriculture. *Working paper no. 246*. New Delhi India:Indian Council for Research on International Economic Relations.
- Mtega, W.P.(2012). Access to and usage of information among rural communities: A case study of Kilosa District Morogoro Region in Tanzania. *The Canadian Journal of Library and Information Practice and Research*. 7 (1), 2-11.<https://doi.org/10.21083/partnership.v7i1.1646>
- Mtega, W.P. & Ronald, B. (2013). The state of rural information and communication services in Tanzania: A Meta-Analysis. *International Journal of Information and Communication Technology Research*, 3(2). 65-73
- Mukhebi, A., & J. Kundu. (2009). KACE: Linking farmers to markets. UNCTAD. Retrieved from <http://www.unctad.info/upload/SUC/LusakaWorkshop/KenyanCommodityExchanges>.
- Munyua, H. (2007). ICTs and small-scale Agriculture in Africa: A scoping study. *Ottawa: IDRC*.
- Njeru, J., Gitonga, L. & Machira, V. (2008). Assessment of agricultural information needs in Africa. *Caribbean and Pacific (ACP) States-Kenya Country Report, CTA*
- Ozowa, V. N. (1997). Information needs of small scale farmers in Africa: The Nigerian example. *Consultative Group on International Agricultural Research*, 40 (1).

- Ramburn, H. & Van Belle, Jean-Paul. (2011). Inhibitors and enablers of mobile data services use in South Africa. *Communications of the IBIMA, 2011 (1)*, 4-11. DOI: 10.5171/2011.710870
- Sen, A. (1999). *Development as freedom*. Oxford: Oxford University Press.
- Sife, A.S., Kiondo, E. & Lyimo-Macha, J.G., (2010). Contribution of mobile phones to rural livelihoods and poverty reduction in Morogoro Region, Tanzania. *The Electronic Journal of Information Systems in Developing Countries, 42(1)*.
- Sood, A.D. (2006). The mobile development report – The socio-economic dynamics of mobile communications in rural areas and their consequences for development. Retrieved from <http://www.cks.in/mdr/Mobile%20Development%20Reportupdate.d>.
- Souter, D., Scott, N., Garforth, C., Jain, R., Mascarenhas, O. & McKemey, K. (2005). The economic impact of telecommunications on rural livelihoods and poverty reduction: A study of rural communities in India (Gujarat), Mozambique and Tanzania. *Report of Department for International Development (DFID) KaR Project 8374*.
- Tickner, V. (2009). *Agricultural marketing systems and the development and spread of mobile phone use and other Information Communications Technologies (ICTs) in “developing” countries – experiences and directions forward*. Brighton, UK: Government and Agricultural Marketing Consultants
- Vodafone\_Accenture.(2011). Connected agriculture: The role of mobile in driving efficiency and sustainability in the food and agriculture chain. Retrieved from [www.vodafone.com/sustainability/2011/pdf/connected](http://www.vodafone.com/sustainability/2011/pdf/connected)
- Waema, T. & Okinda, O. (2010). Policy implications of the relationship between ICT access and usage and well-being: A Case study of Kenya. *African Journal of Science, Technology, Innovation and Development, 3(3)*, 30 – 56.