# Review on Potential of Mobile Phone Usage in Agricultural Information Dissemination in Ethiopia

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*Abstract-* Globally, agriculture takes center stage as the engine that can transform nations' economies. Smallholder farmers, who produce the majority of agricultural products, face various challenges, including access to adequate information, services, and key value chains. ICT is believed to play a pivotal role in disseminating information and linking farmers with clients in the agricultural value chain. The latest information and training tool, which many famers already carry in their pockets, is the mobile phone. Information plays a vital role in agricultural development and production and their effective communication will help facilitate mutual understanding among farmers, agricultural scientist and extension workers. Increasing production is a major challenge facing present agriculture. Smallholder farmers which dominate the landscape of developing world need to improve farming through acquiring adequate knowledge and information. The objective of seminar is to review the potential of mobile phone usage by farmers for dissemination of agricultural information in Ethiopia. Main factors that influence the use of mobile phone as: high cost of available technologies, inadequate infrastructure and low ICT skills, poor and expensive connectivity, inappropriate ICT policies, language barriers, low bandwidth, inadequate and/or inappropriate credit facilities and systems. The ministry agriculture when designing strategies for effective and efficient use of mobile phone for disseminating agricultural information, they have to consider those identified factors of mobile phone usage.

*Index Terms*- Agriculture, Information, Mobile phone, Ethiopia

## I. INTRODUCTION

### 1.1 Background

Globally, agriculture takes center stage as the engine that can transform nations' economies. Similarly, the place and role of smallholder farmers from local to global levels are recognized by the respective governments and international partners as a way to avoid age-old problems like hunger and miserable lives. Currently, it is believed that smallholder farmers can feed the world's undernourished people (Mammo,2015). Accordingly, agriculture employs about 62% of the population in SSA (excluding South Africa) and generates about 27% of the Gross Domestic Product (Staatz and Dembélé, 2008). Agriculture accounts for the vast majority of the poor's livelihood activities and also holds the most promise for pro-poor economic growth (DFID, 2014). Smallholder farmers, who produce the majority of agricultural products, face various challenges, including access to adequate information, services, and key value chains ( Henze, J.*et al* 2010).

Information and Communication Technology is believed to play a pivotal role in disseminating information and linking farmers with clients in the agricultural value chain ( Bayissa. U, 2014). ICT is helping and has some unlimited potentials to help improve the livelihoods of the rural communities and can increase the income and in the long run help in the fights against poverty ( IFRAH .T,2014). Expansion of mobile phones' coverage is considered one of the remedies for such an information problem. The percentage of the world's population with mobile phone coverage rose from around 12% in 1999 to around 76% in 2009. Almost three-fourths of the world's mobile phones in 2010 were in developing countries (Donovan, 2011). In many developing countries, more people have access to mobile phones than to older technologies like telephone landlines, newspapers, and radio (Zewge, Dittrich, & Bekele. n, 2015). For instance, telephone access in SSA has been much lower than other developing regions, although exponential increase in total of mobile phones subscriptions from 53% at the end of 2005 to 73% at the end of 2010 has now put the region on a path for continued expansion in communications connectivity (ITU, 2010). According to Adam (2010), assessment of the ICT sector performance review states that Ethiopia has some ICT related opportunities that can be utilized in the dissemination of agricultural information to the users. Information is currently regarded as a factor of production like other factors such as labor, capital and land ("Dreibe. K," 2016). Mobile phone is one of the more exciting forms of ICT, particularly in the context of developing nations. It has the potential to allow countries to leapfrog older technologies and begin converging with the rest of the world in terms of economic performance. According to Dutta, & Lanvin, (2013)12% of the world's population lives in areas without mobile coverage. Of those that are uncovered, 92% live in rural areas. An estimated 427 million people without coverage of mobile phone from this number 52% of those without coverage are located in Sub-Saharan Africa, South Asia and South East Asia.

Telecommunication and specifically mobile phones have the potential to provide solution to the existing information asymmetry in the sectors like agriculture (Jehan, Aujla, & Shahzad, 2014). The latest information and training tool, which many famers already carry in their pockets, is the mobile phone. In theory, once set up with the relevant applications, both smart and none-

smart phones have the potential to inform, train and monitor farmers, as well as change operational processes when established as open platforms that include input supplier and markets( Henze. Jet al, 2010). Across urban-rural and rich-poor divides, mobile phones connect individuals to individuals, information, markets, and services. Mobile phones have greatly reduced communication costs, thereby allowing individuals and firms to send and to obtain information quickly and cheaply on a variety of economic, social and political topics (Aker & Mbiti, 2010).The rapid spread of mobile phone networks into rural areas communications infrastructure, has the potential to connect people in all the ways that global telecommunications now offers (local, national, international) (Owiny & Maretzki, 2014). Simultaneously, innovators across emerging markets are creating mobile-enabled solutions that serve market needs, building new businesses, benefiting consumers and bolstering emerging market economies ("Mobile For Development mobile operators & start-ups," 2016).

In rural parts of Ethiopia, where access to information on individual basis may be costly and also unavailable, such arrangements are believed to have the potential to bring the required information to the rural community in the most cost effective way (Bwalya *et al*., 2012). In agriculture, like in many other sectors, information is becoming a major input, whilst, knowledge and information plays a central role for farmers to respond to opportunities that could improve their agricultural productivity (Nyamba & Mlozi, 2012). Agricultural information is a key component in improving small-scale agricultural production(Masuki, K. F. G," n.d.).Information plays a vital role in agricultural development and production and their effective communication will help facilitate mutual understanding among farmers, agricultural scientist and extension workers. Knowledge and information are basic ingredients for increased agricultural production and productivity (Hasan, 2015). Lack of access to vital agricultural information, as well as training and advice on topics such as pests and diseases, proven farming practices and weather, has been cited as part of the causes of the current problems (Mwangi, 2012).

## 1.2 Statement of problem

Increasing production is a major challenge facing present agriculture. Smallholder farmers which dominate the landscape of developing world need to improve farming through acquiring adequate knowledge and information (Aker, 2010). Farmers exhibit ambiguous risk-averse behavior when they lack information pertaining to the likelihood of occurrence of the possible outcomes of new technology, which might have a detrimental impact on adoption (Tessema, et al.,2016). A mix of several factors prevents the adoption of new agricultural technology and innovation by farmers and involves the level of education, individual risk preferences, capital, perception, as well as inputs such as land, labour and credit, as well as access to information (Aker, 2010). Relevant and suitable information on best practices, new technologies, post-harvest handling, and value-addition are key in order to boost productivity (Henze. J, 2010).

According to Asayehegn et al, (2012), In Ethiopia most agents use individual extension methods (farm or home visits and use of contact farmers) to communicate and to disseminate agricultural technologies to farmers. Agents are also working under areas characterized by lack of infrastructural facilities such as transportation. Conventional extension methods such as farm or home visits and the use of contact farmers do not provide the needed agricultural information on timely basis (Deribe.K, 2011). The impact of mobile phones on development will, however, in the end be determined not only by the number of owners of SIM cards and subscription rates, but also by the actual ways in which mobile phones are used and the benefits that Africans derive from using mobile phones (Bornman, 2012).

According to Deribe.K (2016), Moreover in Ethiopia one kebele, where three DAs each for crops, livestock and natural resource management are deployed, has approximately 800 -1200 farm households. This makes it practically difficult to reach the farmers by face-to-face or individual contact methods. The above mentioned problems calls for the use of ICTs to support agricultural extension services, because ICTs, particularly mobile phones, can be very effective in delivering timely and relevant information to farmers, even to those living in remote areas. Though the potential of mobile phones is vast, little is known regarding the use of mobile phones in agriculture in Ethiopia.

## 1.3 Objective of the seminar
### 1.3.1General objective
The overall objective of this seminar was to review the potential of mobile phone usage by farmers for dissemination of agricultural information in Ethiopia

### 1.3.2 Specific objective:
- To review penetration  of mobile phone across in Ethiopia
- To review role of mobile phone usage in disseminating  agricultural information in Ethiopia
- To review factor affecting mobile phone usage of farmer in Ethiopia
- To review mobile phone initiatives and policy intervention in Ethiopia

## 1.4 Significance of study
There are not much review related to this title so, it can be an opportunity to the next students or other researchers who study related to this title use as reference and the university organize document that can serve as a guideline in the future. In addition, it can indicate directions and supply information for further research, extension and development efforts for non-governmental organizations whose main concern with agricultural information by ICT or by mobile phone in general.

<div align="center">II.    POTENTIAL OF MOBILE USAGE IN DISSEMINATION OF AGRICULTURAL INFORMATION</div>

**2.1 Conceptual understanding of mobile phone and agricultural information dissemination**

The mobile phone is the primary connection tool for most people in the world. The mobile phone now with significant computing power of primary internet connection and the only one for a majority of the people across the world, providing information in a portable, well-connected form at a relatively low price (Lee Rainie and Janna Anderson, 2008). Mobile phones-as information platforms that receive short message service, menu or voice message information-provide the ability to get connected to new knowledge and information sources not previously available with the possibility of real-time, highly tailored information delivery (Mwangi, 2012). Mobile phone usage by farmers reduced the information search costs, thereby dramatically lowering transaction costs and enabling greater farmer participation in commercial agriculture (Ogboma, 2010).

Information has a vital role to play in improving and sustaining agricultural production of any nation. Therefore, it is necessary to identify the nature and type of information that farmers need so as to provide them with relevant, reliable, and timely information not only to help them make accurate decisions, but also contribute to increase productivity ("Deribe .K," 2016). The broad categories of information required by farmers can be categorized as know-how, which helps a farmer with fundamental information such as what to plant and which seed varieties to use; contextual information such as weather, best practice for cultivation in the locality; and market information such as prices, demand indicators, and logistical information (Mittal et al., 2010).

Information from external sources, such as agricultural extension agents, m-services, radio, TV or newspapers, can play a central role in the assessment of suitability and risk of a technology (Woodill and Udell, 2012). Importantly, farmers will also require the necessary information to assess the suitability of the technology for their farming system and to understand the potential risks associated with the use of the technology. For instance, farmers may be uncertain about the profitability of the new technology or differences in economic returns between new and old technologies. Such uncertainties may arise due to insufficient knowledge about yields of new technologies, the types and costs of needed inputs, or expected market prices and demand for the produce (Baumüller, 2012). Farmers also often lack information on current market prices to be able to negotiate better deals. Disseminating price information, for instance through mobile phones, is seen as a way of reducing information asymmetries and increasing the bargaining power of farmers (Baumüller, 2012).

M-Agriculture is the more resent term used to describe the various mobile technology based services, which are used in the agriculture sector. Term has evolved from the term e-agriculture, to specifically mean the mobile phone services developed in the past few decades. Globally there are few hundred different services in use, developed by both the private companies and international organizations (OXFAM, 2013). Several m services have already been developed that deliver information to farmers either on demand or by sending updates via SMS or audio recordings. M-services may also serve to facilitate farmer-to farmer or farmer-to-buyer relations, such as sharing of experiences on farming practices and market information related to prices, supply and demand (Baumüller, 2012).

**2.2 Mobile phone and agricultural information dissemination in Ethiopia**

*2.2.1 An overview of agricultural extension service in Ethiopia*

In Ethiopia, public agricultural extension services have been in action for about half a century. Studies show that Ethiopia has the largest agricultural extension system in Sub-Saharan Africa, and third largest in the world after China and India (Swanson and Rajalahti, 2010). According to the Bill and Melinda Gates Foundation (2010), a total of 8,500 farmers training centers have been established and 63,000 field extension workers (known as development agents-DAs) have been trained. Agricultural extension services include transferring knowledge to farmers, advising and educating farmers in their decision making, enabling farmers to clarify their own goals and possibilities, and stimulating desirable agricultural developments. Traditional public-sector extension services use a variety of extension programs to overcome barriers to technological adoption without much success (Aker 2010).

The current extension approach, therefore, follows FTC-based extension system. The FTCs are positioned to facilitate agricultural knowledge and information exchange among researchers, extension workers and farmers. Woreda level agricultural offices are responsible for managing the operation of FTCs with the support of zonal and regional agriculture bureaus and are the frontline administrative structure for implementing agricultural extension services in the country ("Promoting ICT based agricultural knowledge management," 2012). Despite the potential role that FTCs and DAs can play in knowledge and information dissemination, a number of factors pose limits to the proper implementation and success of the program. In this regard, inadequate infrastructure and localized technical information, as well as budgetary shortfalls are some of the major constraints that inhibit effective agricultural knowledge management and delivery of agricultural extension services in Ethiopia (Davis et al, 2010 and BMFG, 2010).

*2.2.2 Knowledge management and information in Ethiopia*

Knowledge is power and agriculture is no exception. However, information and communication technologies (ICTs) are deeply implicated in knowledge flow and innovation ( Masuki, K. F. G," n.d.). Knowledge management deals with the process of capturing, sharing and using of knowledge and techniques ("Promoting ICT based agricultural knowledge management," 2012). In agriculture, education and access to knowledge creates conditions that enable farmers to acquire and use information for decision making regarding allocates and technical matters effectively. This leads to growth in the adoption of technology; the use of modern inputs like machines and fertilizers improves yield (Mittal & Mehar, 2012). Knowledge is considered as the fourth production factor after labor, land and capital and is particularly critical in the agricultural sector. Making relevant knowledge accessible to the farming community helps improve production, productivity and brings higher returns (AFAAS, 2011).

Agricultural information and knowledge created from these sources is stored in various forms before it is disseminated for use. The stored knowledge and information is then disseminated to users, such as rural farmers, through intermediaries notably during trainings, field visits, exhibitions, publications, and using traditional forms of ICT (TV and radio), modern forms of ICT (internet, mobile phone, etc.), and others ("Promoting ICT based agricultural knowledge management," 2012).

*Figure 1.Knowledge and information dissemination*
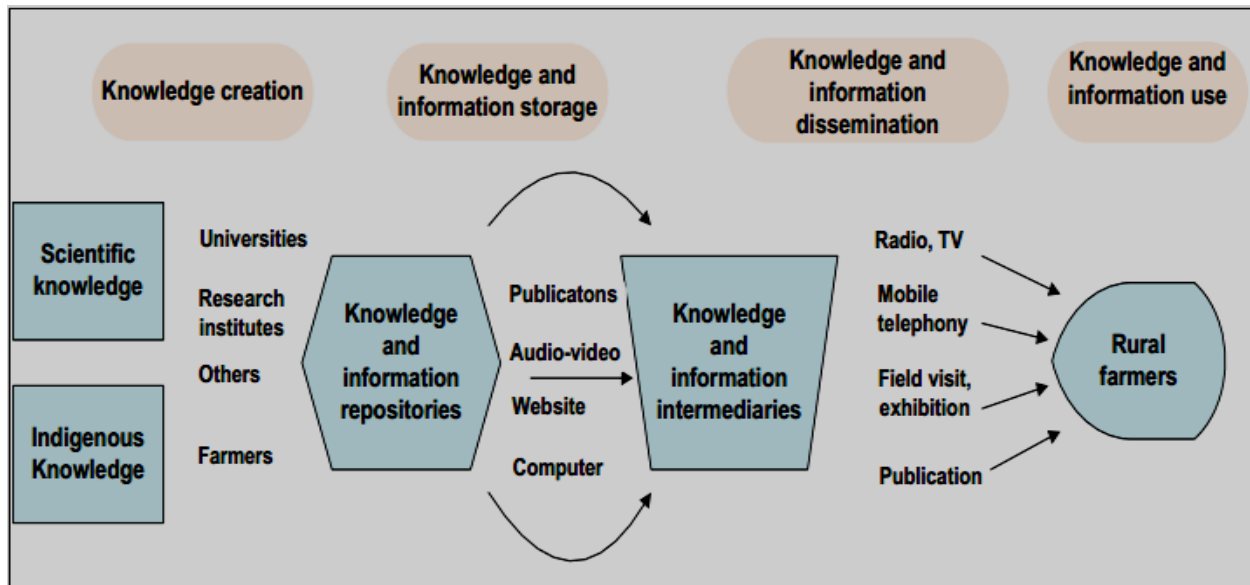


*Source :-Promoting ICT based agricultural knowledge management," 2012).*

Effective knowledge management is achieved when the right knowledge and information is delivered to the right person at the right time in a user friendly and accessible manner that helps the recipients to perform their jobs efficiently (Islam, 2010).

*2.2.3 Agricultural information dissemination in Ethiopia*

A better understanding of farmers' agricultural information needs and information seeking behaviors could support extension system to better target specific groups of farmers according to their preferences (Babu et al., 2012; Deribe.K, 2011; Ogboma, 2010;). Smallholder farmers in Ethiopia as well as elsewhere in the developing world require up to date knowledge and information in order to effectively and efficiently perform their farming practices. The information that farmers demand ranges from accessibility of new farming methods, availability of weather forecast and supply as well as price of inputs and outputs, among others. In Ethiopia, various institutions and organizations are engaged in the creation, collection, storing, and dissemination of agricultural information ("Promoting ICT based agricultural knowledge management," 2012). Print formats and ICTs such as radio, mobile phones, Internet, and emails can be used to share and distribute knowledge among farming communities to supplement what was gained verbally (Lwoga et al., 2011).

In Ethiopia extension services help to disseminate information regarding the technology relevant for their geographical areas and cropping system and generate awareness among farmers by recommending the appropriate quantity and quality of inputs and their timely use (Mittal & Mehar, 2012). Reducing the costs of disseminating information could increase the extension system's geographic scope and scale, as well as facilitate more frequent and timely communications between extension agents and farmers. Yet the impact of these reduced costs on farmers' adoption decisions will depend upon the ability of such information to serve as substitute for in-person mechanisms(Adongo, 2013).The information needs of the farming community are partly addressed by the public extension system in FTCs supported 3 by trained Development Agents assigned at FTCs (Davis et al., 2010).

**2.3 Mobile subscription and penetration in Ethiopia**

The number of mobile phone subscriptions in Ethiopia has been rising by a compound annual rate of 128% ( ITU, 2009), which is the second-highest rate in Africa, after Guinea-Bissau. The Ethiopian government is currently undertaking a number of reforms to improve the existing telecommunications infrastructures and to expand the telecommunication services both in rural and urban areas. The Ethiopian mobile-cellular telephone subscriptions and penetration show dramatic change starting from year 2009 (Deribe.K, 2016 and ITU, 2012). Comparative analysis of the communications market in Ethiopia with neighboring countries like Kenya and Sudan shows that Ethiopia lags far behind its neighbors and is unlikely to catch up with the rest of the world unless it develops competitive policies that stimulate sector growth (Adam, 2010).

*Table 1: Mobile Penetration Ethiopia with Neighbors*

| | Ethiopia | Kenya | Sudan |
|---|---|---|---|
| Mobile (2008) | 3% | 39% | 30% |
| Internet Users (2009) | 360,000 | 3,360,000 | 3,800,000 |
| Broadband Penetration (2008) | .0005% | 0.01% | 0.02% |
| Driver of Universal Access | Incumbent | CCK | NTC |
| Regulator | Partially independent | Fully independent | Partially independent |

*Figure 2: Ethiopia mobile penetrations with neighbors' countries*
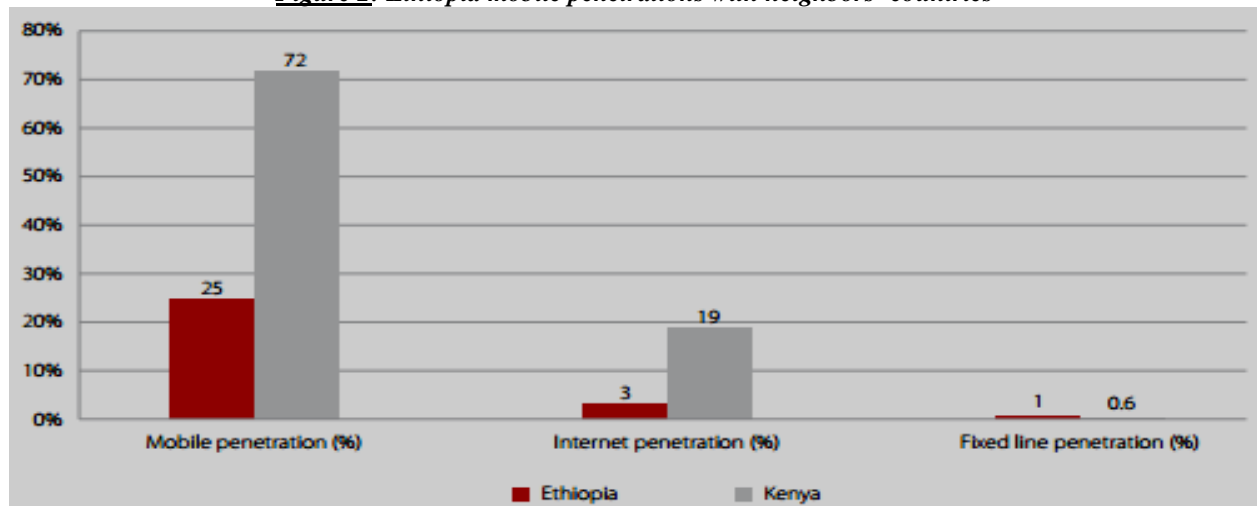


*Source: Ethiopian Telecommunications Corporation, Annual Statistical Bulletin, 2008/2009*

Ethiopia telecom has been aggressively expanding rural connectivity. Technologies and services that have particularly experienced expansion include telephone infrastructure and services, mobile/cellular telephone, mobile radio communication, pay-phones, the internet, internet cafe services and community centers, which provide a broad range of multipurpose communication (Deribe.K, 2016 and FDRE, 2009).

*Table2: Ethiopia rural mobile phone coverage compare to other countries*

| Country | Percent of World's Population Living Outside Coverage | Rural Population Outside Coverage | Number of People Living Outside of Coverage (Millions) |
|---|---|---|---|
| Bangladesh | 0.15% | 0.7% | 0.8 |
| Ethiopia | 9.92% | 95.5% | 81.4 |
| Indonesia | 4.6% | 26% | 38 |
| Kenya | 0.4% | 11.5% | 3 |
| Nigeria | 4.7% | 31.9% | 38.8 |
| Pakistan | 1% | 7.8% | 7.9 |
| Tanzania | 0.4% | 8.7% | 3.4 |
| Uganda | 0.1% | 3.4% | 1 |

*Source: Ethiopian Telecommunications Corporation, Annual Statistical Bulletin, 2008/2009*

*Table 3: Ethiopia mobile subscription and penetration*

| S.N. | ICT development | Performance |
|---|---|---|
| 1 | Mobile subscriptions | 23 756 607 |
| 2 | Internet and data subscribers | 4 430 032 |
| 3 | Fixed line | 790 168 |
| 4 | Fixed wired (ADSL subscribers) | 13 699 |
| 5 | Mobile penetration | 27.6% |
| 6 | Population covered by mobile signal | 65% |
| 7 | Fixed density | 0.9% |
| 8 | Internet penetration | 5.2% |

*Source: Ethio telecom (2012) Annual performance report*

However, in Ethiopia, the use of ICT for the accumulation and dissemination of knowledge and information is still low Adam (2010). This conclusion is shared by Bwalya *et al*. (2012) who accentuate that apart from traditional ICT tools (i.e. radio and TV), the use of modern ICT (computer, internet, mobile telephone, etc.) remains low in the country. In 2010, a composite index made up of 11 indicators covering ICT access, use and skills, ranked Ethiopia 150th among 152 countries (ITU, 2011).

*Table 4: Ethiopia regional mobile phone coverage*

| No. | Administrative Region | Radio Network Capacity* | Population | % Coverage |
|---|---|---|---|---|
| 1 | Tigray | 279,821 | 4,664,071 | 6 |
| 2 | Afar | 18,286 | 1,494,199 | 1 |
| 3 | Amhara | 651,242 | 18,167,982 | 4 |
| 4 | Oromiya | 869,515 | 29,737,371 | 3 |
| 5 | Somali | 79,531 | 4,713,619 | 2 |
| 6 | Benishangul Gumuz | 3,812 | 735,430 | 1 |
| 7 | S.N.N.P | 213,794 | 15,995,819 | 1 |
| 8 | Gambella | 6,746 | 358,511 | 2 |
| 9 | Hareri | 133,712 | 198,980 | 67 |
| 10 | Addis Ababa | 2,368,267 | 2,917,295 | 81 |
| 11 | Dire Dawa | 183,522 | 369,641 | 50 |
| Total subscribers = Pre-paid 3,996,177 Post-paid 55,526 Total 4,051,703 | | Total Circuit 4,808,248 | 79,352,918 | 6 |

*Source: Ethiotelecom (2012) Annual performance report*

The most notable opportunity is the presence of ICT infrastructure which is referred to as Woreda Net which reportedly links up to 631 districts to a national data Centre located in Addis Ababa. Agri.net is also another project connecting 49 agricultural research institutions. According to Mobile & Trends (2014) over 9.92% of the world's uncovered live here in Ethiopia. About 89.3% of the population lives outside of mobile coverage which means over 81.4 million people. From total 88.6% of rural population of 95.5% of the rural population lives outside of mobile coverage.

## 2.4 Role of mobile phone usage in dissemination of agricultural information

New mobile phone-based agriculture extension services are increasingly offering solutions to address challenges as traditionally extension services are struggling to fill the knowledge gap and drive structural changes. Other extension channels for agriculture information are TV, radio and print media and manuals that might create initial interest in new systems with farmers, but are static tools and do not allow questions, clarification or in-depth training. These tools and extension services primarily address the information gap, yet do little to address the structural challenges farmers face, and hence lack the transformative power required (Henze. J. et al, 2010). Mobile phones may help users to substitute phone calls for travel, which reduced farmers' time and cost burdens. Time savings are important for agricultural households, because many crops have extremely time-sensitive and labor intensive production cycles. Farmers receive calls with potentially useful agricultural information on their mobile phones and need not leave their fields to access the information. In case a farmer misses a call, she can call back and listen to that information on the main line (Cole, Fernando, & Cole, n.d.).

*2.4.1 Phone usage and agricultural productivity*

Ethiopian rural areas are populated by small-scale subsistence farmers who cultivate 95% of all crop land and account for 90% of the national production. However, despite the prevalence of agriculture across the society, Ethiopia remains dependent on food aid because of inefficient and ecosystem-degrading farming practices (Mojo et al., 2010). Early in the season, the phones are used to inquire about time of planting, source and availability of seeds and other inputs. During mid-season, most farmers use the phone to inquire about availability of pesticides for pest and disease management. Later in the season during harvesting, the phones are used to inquire about the prevailing market prices for agricultural commodities (Masuki, et al, 2007).

*2.4.2 Phone usage and market access*

In the last number of decades, different formats and channels (containers of information) were used to provide market and price information, particularly for rural smallholder farmers. According Mammo, (2015), to a key informant, in West Hararege, Ethiopia in the 1950s, agricultural market and price information about different commodities was provided from person to person, with people travelling from one place to another on horseback. After that the same information was provided through post offices. Currently, globally market, price and mobile commodity exchanges offices provide other market-related information. Agricultural marketing information available to farmers would not only help farmers to sell their products at better prices, but also provide reliable food price information to policy makers to prevent price volatility and speculation (Sustainability, Program, Papo, Jessee, & Moorthy, n.d.).

*Figure 3: Market information from horses to post and to mobile in Ethiopia*
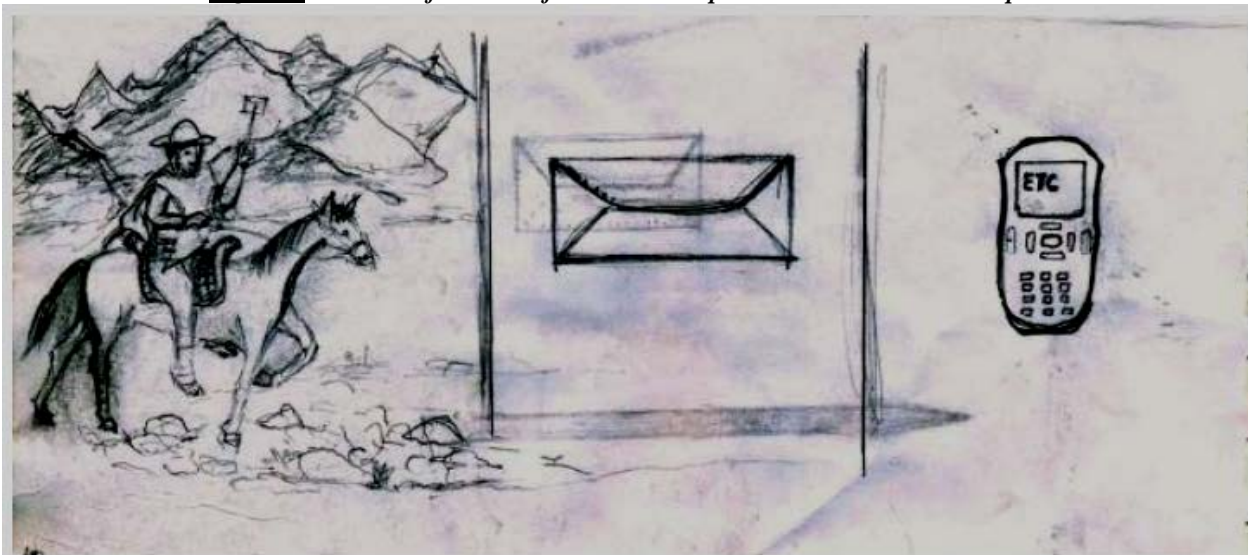


*Source by Samson Mammo, 2013*

Phones also enabled farmers to know the prevailing market prices of agricultural commodities in various markets in community and elsewhere, which enabled them to negotiate and sell produce at competitive prices. It is probable that new contacts with buyers were established during these transactions. The link to market was also related to acquisition of inputs (seed and pesticides) and accessing price and market information in order to match harvesting and bulking of agricultural product with better prices (Masuki et al., 2007). Price information has an impact by improving the bargaining capability of farmers with traders, better price realization and reduction in arbitrage, wastage or spoilage. An integrated mobile platform for knowledge and information can help in strengthening the value chain and help the farmer gain by reducing transaction costs (Mittal & Mehar, 2012).

*2.4.3 Phone usage and natural resource management*

The phone was not specifically used to seek information or advice on natural resource management because such information was thought to require lengthy explanations which would be expensive to follow on phone (Masuki et al., 2007). A lack of information has been cited as the main barrier to Ethiopian farmers' adoption of more sustainable and effective practices. Since 1970, agricultural experts have reportedly increased their efforts to improve information dissemination within the sector but with little success (Matous, 2014).

*2.4.4 Phone usage and knowledge base*

The presence and usage of the phones built self confidence in the farmers some of whom managed to buy their own. The experience in using the village phone contributed to building confidence in using any other phone, knowing phone alerts, for example, when the phone is busy, not available, dropped calls, low credit, low battery, unstable network and using extra phone features like short message services, checking credit, alerting (beeping), playing phone games and changing ringing tones. The greatest contribution of phone usage especially on accessing markets is farmers realizing the necessity of prior knowledge of prevailing market

prices so as to enhance negotiation for better prices for their commodities (Masuki et al., 2007). The concept of utilizing mobile phones to bridge information and knowledge gaps among farmers and rural service providers is based on two assumptions. The first is the near ubiquity of access and use of mobile phones. The second is that farmers (especially in developing economies) have specific information and knowledge needs that are currently only met partially, if at all (Hasan, 2015).

## 2.5. Information need by farmers and sources of agricultural information

Agriculture-related information has been produced and published by a number of government agencies and academic sectors as well as relevant private companies. The agricultural information has been available in either primary or secondary form according to the purpose of use. Product market price, for example, may be more accurate if it is directly gathered from local markets. On the other hand, a proper use of new agricultural technology, for example, dissemination of real-time data or information through wireless sensor network, may be more reliable if it is proved and delivered from government bodies or research centers ("communities in Thailand . Edith Cowan University," 2011).

*Table 5: Farmers Information Needs Prioritization*

| AGRICULTURE | NATURAL RESOURCES MANAGEMENT | MARKETING |
|---|---|---|
| • Source of quality seeds<br>• Knowledge on what grows in which soils<br>• Source of pesticide and its application<br>• Management of diseases and pests in animals and crops<br>• Nursery bed preparation<br>• Post harvest handling<br>• Formulating byelaws | • Soil erosion prevention and control<br>• Soil fertility management<br>• Soil moisture control<br>• Tree planting<br>• Control and management of water sources<br>• Byelaws formulation | • Where to sale produce (market)<br>• Sorting and grading<br>• Market prices<br>• Customer care<br>• Sales promotion |

*Source: Masuki, K. F. G," n.d.*

*Table 6: Source of agricultural information*

| Source | Information provided |
|---|---|
| Government extension service provide | Management |
| Agro dealers | Inputs |
| Veterinary personnel | Disease control and treatment |
| Others progressive farmers | Management |
| Markets | Commodity prices and market |
| Brokers | Marketing |

*Source:- Mwangi, J. W. (2012).*

## 2.6 Mobile applications in agriculture of Ethiopia

Information provided by the application should be relevant to the farmer's location, climatic zone, current position in the agricultural cycle, income level and availability of agricultural inputs (OXFAM, 2013). In Ethiopia appropriate mobile technologies are being assembled even in-country, which are suitable for different mobile applications and which practically overcome our existing infrastructure and network problems. The idea of using mobile computing in agriculture (also known as m-Agriculture) is a new concept in North America, while m-Agriculture in the developing world has been known and written about for almost a decade (Woodill and Udell, 2012). Mobile financial services are among the most promising mobile applications in the developing world. Mobile money could become a general platform that transforms entire economies, as it is adopted across commerce, health care, agriculture and other sectors (World Bank, 2012). Mobile applications in agriculture in Ethiopia is a new phenomenon, despite that there are many and various mobile applications in agriculture in many African countries (Mammo, 2015). In Ethiopia appropriate mobile technologies are being assembled even in-country, which are suitable for different mobile applications and which practically overcome our existing infrastructure and network problems. The farmers know well that 'the use of mobile is more than just talking on it.' It is obvious that ICTs are the future of extension. Put differently, the time has come to move from accessibility of mobile-to-mobile applications. Actually, agriculture does not lack resources; it lacks policy and ICT application (Yared.M, 2015).
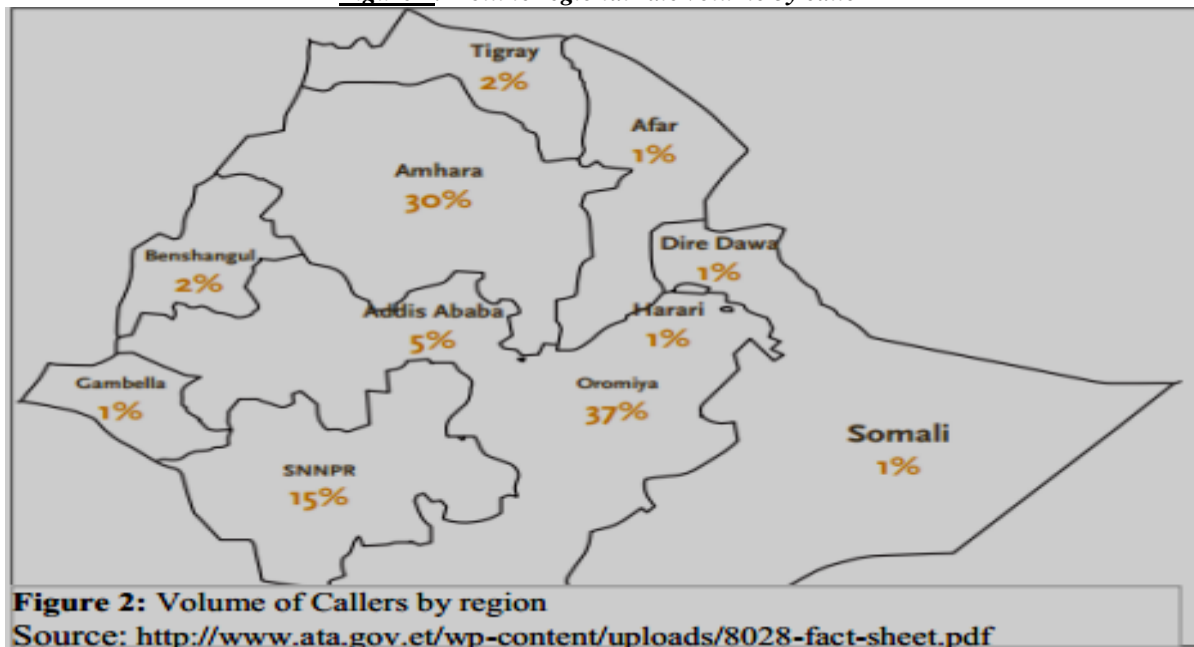
## 2.7. Mobile-based initiative on agricultural information in Ethiopia
*2.7.1 The 8028 hotline information service initiative in Ethiopia*

Agricultural Transformation Agency (ATA) started by collaborative effort between the Ministry of Agriculture (MoA), the Ethiopian Institute of Agricultural Research (EIAR) and Ethiopia Telecommunication ,since 2014. ATA, the 8028 hotline is revolutionizing traditional agricultural extension services by providing smallholder farmers with direct access to "best practice" agronomic advice (Telecom & Wondirad, 2015). As an Interactive Voice Response (IVR)/Short Message Service (SMS) system, the 8028 hotline currently provides smallholder farmers free access to information on cereal, horticulture, and pulse/oil seed crops, as well as a wide range of general agriculture-related activities. Automated and voice-recorded information on pre-planting, planting, crop protection, post-harvest, fertilizer application, processing, and irrigation is accessible to callers through 90 service lines (Telecom & Wondirad, 2015).

Twelve weeks after its launch in the Oromia, Amhara, Tigray and SNNP regions, the hotline received nearly 1.5 million calls from 300 000 farmers. There were more than 90 lines taking an average of 35,000 calls a day. Within 6 months of its launch, the system handled approximately 3 million phone calls from over 500,000 registered callers. On the average, the system received 176,431 new and 879,573 return calls in a month. Of the total number of callers, 86% were farmers, 5% were development agents and 2.2% were agricultural experts. Women made up 19% of total callers. The service was available in three of Ethiopia's main languages: Amharic, Oromiffa and Tigringa. The responsible agency, ATA, worked closely with the gates foundation, the Netherlands embassy in Ethiopia and Canada's department of foreign affairs, trade and development (ATA, 2014b).

*Figure 4: Hotline regional rate volume by caller*



**Figure 2:** Volume of Callers by region
Source: http://www.ata.gov.et/wp-content/uploads/8028-fact-sheet.pdf

Currently, 90 service lines connect smallholder farmers to automated and voice-recorded information on pre-planting, planting, crop protection, post-harvest, fertilizer application, processing, irrigation and weather content. Also, a push-based voice and SMS alert system notifies extension workers and smallholder farmers of any pertinent agriculture issues (ATA, 2014).

*2.7.2 Ethiopia commodity exchange*

The Ethiopian Commodity Exchange (ECX) is another organization that has embarked on some modern types of ICT-based information management system. In addition, ECX has developed a prototype for data dissemination using short message services (SMS) and interactive voice response (IVR) (Bwalya *et al*., 2012). ECX also provides market data in four local languages via automatic telephone messaging. According to the executive director of ECX, on average, about 20,000 calls are made daily via a toll free number seeking for price information, while SMS service applies mobile telephony for market information delivery to users (World Bank, 2011).

*2.7.3 Ethiopian livestock market information system*

The Ethiopian Livestock Market Information System (ETLMIS) provides regular livestock prices and volume information on most of the major livestock markets in Ethiopia. This system provides near real time market information which is available on request via SMS text message system, email, world space radio systems and on the Internet. The ETLMIS was created as part of the links sub-project within the global livestock collaborative research support Programme being implemented by texas and university and funded by United States Agency for International Development (USAID).

*2.7.4 Kifiya financial technology in Ethiopia*

Kifiya is a digital service provider leveraging innovative technology to enable and provide electronic, branchless banking and mobile money services. Kifiya financial technology was established in February 2010 by global computing solutions plc. Mobile money enables customers to make transactions using the power of their mobile phones. Products range from utility bill payments to electronic airtime top-up, bank balance enquiry, and money transfer. Mobile agents are equipped with end point devices (EPDs), allowing customers in remote, rural areas to conduct transactions and access previously unavailable financial services with simple biometric authentication (Kifiya, 2014). The additional money spent on mobile phone had effect on the use of mobile for agricultural purposes. Spending more money on mobile communication had positive effects on mobile phone usage.

*2.7.5 Improving productivity and market success*

The IPMS project only operates in the ten pilot learning woreda in Ethiopia (Deribe.K, 2016 and Lemma et al., 2011). In addition, IPMS project has also developed web-based portal called the Ethiopian agriculture portal. This portal aggregates information from diverse national and international sources. It contains technology, market related as well as extension packages for a wide range of crops, forest products, and livestock.

## 2.8 The Combination mobile phone with radio

Nowadays mobile phone devices include FM radio applications, and this allows smallholder farmers to listen to radio programs and also call into live programs. Therefore, farmers in rural communities who have mobile phones can interact easily with agricultural radio program broadcasters. In Ethiopia, over the last two decades the dramatic improvement of broadcasting sector has been seen with the growth in government, commercial and community radio stations (Adam, 2010). According to Deribe.K (2016), as expected mobile phone with handset FM radio had positive relationship with the use of mobile phones for agricultural purposes. Mobile radio coverage and quality is generally uneven across the country, with the capital Addis Ababa the most connected, and some regions, such as Southern Nations and Nationalities People (SNNP) and Benshagul-Gumuz, barely connected with only about 1% population coverage (Adam, 2010). About 90% of the country is covered by radio signal (EBA, 2012). Therefore, these technologies have the potential to completely transform the relationship between listeners and content providers.

## 2.9. Factor affecting mobile phone access and usage of farmers in Ethiopia

According to Falola and Adewumi (2011), main factors that influence the use of mobile phone has, high cost of available technologies, inadequate infrastructure and low ICT skills, poor and expensive connectivity, inappropriate ICT policies, language barriers, low bandwidth, inadequate or inappropriate credit facilities and systems. In effect, the combination of these constraints would result in a digital divide between the urban and rural areas. Yakubu *et al*. (2013), on socio-economic factors affecting the adoption of mobile phone by extension workers revealed that education, income, training, awareness, access, age and membership of agricultural organizations were significant factors to mobile phone adoption. According to Hasan (2015), The growth of mobile phone uses for disseminating the information towards the farmers for the development of agricultural is obstacle over the years for so many factors. Some of those factors are been mentioned below:

- *Education*

Education, which is the backbone of a nation, is unfortunately seen as a corrupted sector in a developing country. Although the percentage of literacy is been increasing day by day in written but the matter-of-fact is that their education is limited only to put the signature. But to get the maximum benefit from the technological aspect the real education is been required and there is a huge lacking on it. The assumption that basic skills of literacy and numeracy can make a difference to productivity in the home, farm or household enterprise has long informed research around skills development and agriculture (King and Palmer, 2010). For instance, UNESCO (2014*a*, p. 147), cites evidence that educated farmers were more likely to make better use of technologies (irrigation technology in China, increased fertilizer use in Ethiopia) and move into higher-value crops. Education may facilitate the rural people to be simply adopting the technology which helps them increase their awareness towards using mobile phone for market information gaining.

- *Language proficiency, native language content*

Language barrier was also another problem that they were facing, and make them not to use mobile phone. Language plays an important role in influencing internet usage as well as mobile usage. Since the Internet is dominated by English language content, English speaking countries have a strategic advantage in popularization of the Internet use. On the other hand, non-English speaking countries face enormous difficulty in tapping into the potential of the Internet as an information source (Ensafi. R et al, 2007).

- *Lacks of Public Awareness and Knowledge of ICT*

The public ICT literacy is still very low and almost nothing for the farmers. What concerned us the most is that ICT literacy among students and teachers are also low, especially those that live in the perimeters or remote areas. Here public awareness campaign through various media is absent. The problem is that many computer literacy and information technology programs are still in the infant stage (USECO, 2014a).

- *Lacks of initiatives from the government*

The way all modern facilities are available in city places are not been available in remote areas. The farmers who are living in the remote areas are still in the dark. They are deprived from all facilities what they should get. And because of that they are not been able to implement the latest technological aspect in their farming process.

- *Lack of financial solvency*

The farmers are not financially solvent enough. Most of them lead their lives from hand to mouth. So they are not been in a position to use the latest technology like mobile phone to get the latest information for their betterment. Mobile phones can facilitate a greater export orientation in agricultural practices and marketing, potentially bringing higher incomes for farmers. Farmers felt that mobile phones had helped to raise incomes by improving their ability to deal with risks and take advantage of income opportunities (Furuholt and Matotay, 2011).

- *Inadequate infrastructure*

The access to ICT infrastructure in Ethiopia is still very low despite some noticeable improvements registered in recent years. According to the country diagnostic report of the World Bank issued in March 2010, the coverage of ICT in Ethiopia is one of the lowest in Africa("Promoting ICT based agricultural knowledge management," 2012).The ICT infrastructure in rural areas is very limited. According to (Zewge et al., n.d.)The findings from this study that, In Ethiopia 62%of the rural people lived without electricity, which also implies the lack of landline telephony.

## 2.10 Policy and investment priorities for effective agriculture information in Ethiopia

In Ethiopia the application of mobile phonies very limited except for few programs and initiatives whose coverage is currently very low to generate the desired agricultural production and productivity outcomes. As a result, policy and investment priorities are identified and recommended to help make smallholder farmers benefit from ICT based agricultural knowledge and information management("Promoting ICT based agricultural knowledge management," 2012). Ethiopian government has naturally made the development of ICT one of its strategic priorities and has placed a significant emphasis on its role of economic infrastructure as set out in the second Growth and Transformation Plan (GTPII). This stems from the recognition that ICT especially mobile phone is a key driver and facilitator for transforming Ethiopia's predominantly subsistence-agriculture economy to a knowledge-based economy and information society. It put that ICT will be fundamental for Ethiopia's aspiration to become a middle income country. The Ethiopian government established the Ministry of Communication and Information Technology (MCIT) in 2010 recognizing this critical role of ICT to national development.

III.   CONCLUSION AND RECOMMENDATION

### 3.1 Conclusion

Among modern ICT modes, mobile telephony has been most recent and widely accepted mode of delivering information not only in Ethiopia but also in other South Asian and other African countries. According to Baumüller  (2015), Several studies conclude that the general use of mobile phones to access information has helped to reduce search times and costs. Increasing mobile phone and mobile phone based services enhances the availability to knowledge and information and will further help in improving awareness, education, better adoption of technology, better health and efficiency, reduced transaction costs, better market efficiencies. Extent of mobile phone usage for disseminating agricultural information in Ethiopia is high, especially in phone calling, receiving call and listening to radio for agricultural purposes.

Mobile phones are becoming more and more important in agricultural extension services. In this regard, knowledge about information needs and seeking behavior of farmers, the extent of usage of mobile phone for accessing agricultural information, the interaction between mobile phone and radio and factors constraining the use of ICTs are crucial. These are also important for mobile phones and other ICTs to be used efficiently to facilitate agricultural extension services (Deribe.K, 2016). Effective knowledge and information management in the agricultural sector will be achieved when the right knowledge and information is delivered to the farmers and other stakeholders at the right time in a user-friendly and accessible manner("Promoting ICT based agricultural knowledge management," 2012). The major challenges inhibiting the use ICT in disseminating agricultural knowledge and information, which includes the low level of access to ICT infrastructure and services, need to be addressed.

### 3.2. Recommendation

- ➢ DAs are major source of agricultural information to farmers, so that they will have an alternative extension method like mobile phone for accessing relevant and accurate agricultural information on timely bases than the face-to-face contact of farmers.
- ➢ The ministry agriculture when designing strategies for effective and efficient use of mobile phone for disseminating agricultural information, they have to consider those identified factors of mobile phone usage.
- ➢ Government should encourage adult education, creating awareness, giving trainings for farmers enables them to use mobile phone and get more knowledge which could help them to maximize their production. It is recommended to approaching educated and elderly people to disseminate the information and trainings on mobile phone utilization. This is the time to move from discussing simple mobile distribution, affordability and accessibility to different mobile applications.

strength towards the successful completion of this review. Also like to thanks source of article, journal and book especially goggle and outers.

REFERENCES

[1] Adam, L. (2010). Ethiopia ICT Sector Performance Review 2009 / 2010, 2(policy paper 9), 138.[http://www.researchictafrica.net/publications/Policy_Paper_Series_Towards_Evid ence-based_ICT_Policy_and_Regulation_-_Volume_2/Vol 2 Paper 9 –

[2] AFAAS. 2011. Concept and learning framework for the African Forum for Agricultural Advisory Services. Kampala, Uganda.

[3] Adam, L. (2010). Ethiopia ICT Sector Performance Review 2009 / 2010, 2(policy paper 9), 1–38. Retrieved based_ICT_Policy_and_Regulation_-_Volume_2/Vol 2 Paper 9 - Ethiopia ICT Sector Performance Review 2010.pdf

[4] Adongo, M. J. (2013). The role played by mobile phone communication in diffusion of dairy goats rearing in Mutonguni division, Kitui county. Kenya., (May).

[5] Aker, J. C., Mbiti, I. M., & Mbiti, I. M. (2010). Mobile Phones and Economic Development

[6] ATA-Ethiopian Agricultural Transformation Agency, (2014). 8028 New information service revolutionizes agricultural extension in Ethiopia. Retrieved from [http://www.ata.gov.et/8028-2/] site visitd on 12/07/2014.

[7] Baumüller, H. (2015). Agricultural Innovation and Service Delivery through Mobile Phones Analyses in Kenya Agricultural Innovation and Service, 156.

[8] Bornman, E. (2012). The Mobile Phone in Africa : Has It Become a Highway to the Information Society or Not ?, 3(4), 278–292.

[9] Bolarinwa, K. K. and Oyeyinka, R. A. (2011).Use of Cell Phone by Farmers and its Implication on Farmers' Production Capacity in Oyo State Nigeria.WorldAcademy of Science, Engineering and Technology, 75: 654–659.

[10] Bwalya, S., Asenso-Okyere, K. and Tefera, W. (2012). Promoting ICT based agricultural knowledge management: to increase production and productivity of smallholder farmers in Ethiopia. Development Brief UNDP Ethiopia.pp1-39.

[11] BMGF. 2010. Accelerating Ethiopian Agriculture Development for Growth, Food Security, and Equity.

[12] Cole, S. A., Fernando, A. N., & Cole, S. A. (n.d.). " Mobile " izing Agricultural Advice : Technology Adoption , Diffusion and Sustainability "

[13] CTA, 2014.ICTs for Agriculture - Making it happen. s.l., s.n.

[14] Communities in Thailand . Edith Cowan University. (2011).

[15] Davis, K., B. Swanson, D. Amudavi, D.A. Mekonnen, A. Flohrs, B. Walkinshaw, J. Riese, C.

[16] Lamb. E. Zerfu. 2010. In-depth assessment of the public extension system of Ethiopia and recommendation for improvement. IFPRI Discussion paper 01041. Washington, D.C.: International Food Policy Research Institute

[17] Deribe.k, 2016 and Lemma, T. T., Sehai, E. and Hoekstra, D. (2011). Knowledge Centers in the Pilot Learning Woradas of Improving Productivity and Market Success Project: Utilization, Relevance and Effectiveness. IPMS-ILRI.pp1–24.

[18] Deribe, K. (2011). Agricultural Information Networks of Farm woman In Southern

[19] Ethiopia: The Role of Agricultural Extension. GmbH and Co. KG Saarbrucken, Germany: LAP Lambert Academic Publishing.160pp.

[20] DFID (2014).Agriculture And Poverty: Agriculture And Growth Evidence Paper Series. Department for International Development, London UK. 35pp.

[21] Donovan, K. (2011). Anytime, anywhere: Mobile devices and services and their impact on agriculture and development. Module 3 in ICT in Agriculture: Connecting Smallholders to Knowledge, Networks, and Institution: The World Bank Report No. 64605.

[22] Dutta, S., & Lanvin, B. (2013). The Global Information Technology Report 2013 Growth and Jobs in a Hyperconnected World.

[23] EBA, E. B. A. (2012). Ethiopian Broadcasting Authority.News Letter,1(13).

[24] Ensafi.R, (200) ICT challenges in education. Reflections from a developing country: Iran, with reference to the statistics from computer science students The 2 nd International Conference on Virtual Learning.

[25] Ethiopia ICT Sector Performance Review 2010.pdf.]sitevisitd on 09/07/2014.

[26] Falola A. and Adewumi, M. O. (2011).Constraints to use mobile telephony for agricultural production in Ondo State, Nigeria.Journal of Research in Forestry,Wildlife and Environment, 4(2): 52–63.

[27] FDRE (2009). The Federal Democratic Republicof Ethiopia: The National information and communication Technology Policy and strategy. Retrieved from [http://www.mcit.gov.et/sites/default/files/ICT Policy_final.pdf] site visitd on 10/05/2014.

[28] Furuholt, B. &Matotay, E., 2011. The Developmental Contribution from Mobile Phones Across the Agricultural Value Chain in Rural Africa. The Electronic Journal on Information Systems in Developing Countries, 48(7): 1–16.

[29] Hasan, M. (2015). Mobile Phone : An Instrument Of Disseminating Requisite Agricultural Information For The Agricultural Development Of Bangladesh : A Case Study, (October 2008), 523–534.

[30] Henze, J. and Ulrichs, C. Humboldt-Universität zu Berlin. (2010), The Potential and Limitations of Mobile-learning and other services in the Agriculture Sector of Kenya Using Phone Applications, 1–11.

[31] Islam, F. 2010. Institutionalization of agricultural knowledge Management System for Digital

[32] Marginalized Rural Farming Community, ISDA. Montpellier, France.

[33] IFRAH, 2014, to Get Access to Agricultural and Market Information Bayissa Urgesa Gurmu A Thesis Submitted to The Graduate School of Journalism and Communication Presented in Par. (December).

[34] ITU (2011).Measuring the Information Society.Retrieved from [http://www.itu.int/ITUD/ict/publications/idi/2011/index.html] site visitd on 11/07/2014.

[35] Jain, R., 2014, Business Model Innovations for Information and Communications

[36] Technology-Based Services for LowIncome Segments in Emerging Economies, s.l.: s.n.

[37] Jehan, N., Aujla, K. M., & Shahzad, M. (2014). Use Of Mobile Phones By Farming Community And Its Impact On Vegetable Productivity, 27(1).

[38] Kifiya, F. T. (2014). Kifiya Financial Technology Platforms.[http://kifiya.com/technology-platforms] site visitd on 16/07/2014.

[39] King, K. and Palmer, R. 2010. Planning for technical and vocational skills development, UNESCO IIEP Fundamentals of Educational Planning 94. Paris, IIEP.

[40] Lee Rainieand Janna Anderson, (2008), The Evolution of Mobile Internet Communications

[41] Lwoga, E. T., Ngulube, P., & Stilwell, C. (2011). Challenges of Managing Indigenous Knowledge with other Knowledge Systems for Agricultural Growth in sub-Saharan Africa, 61(September), 226–238. https://doi.org/10.1515/libr.2011.019

[42]  Mammo, Y. (2015). Yared Mammo.

[43]  Masuki, K. F., Tukahirwa, J., & Kamugisha, R. (2007). Mobile phones in agricultural information delivery for rural development in Eastern Africa : Lessons from Western Uganda, 1–11.

[44]  Matous, P. (2014). Emergence of multiplex mobile phone communication networks across rural areas': An Ethiopian experiment, 2(May 2017), 162–188.https://doi.org/10.1017/nws.2014.12

[45]  MITTAL, S., S. GANDHI and G. TRIPATHI (2010): Socio-economic Impact of Mobile Phone on Indian Agriculture. ICRIER Working Paper no. 246. International Council for Research on International Economic Relations, New Delhi.

[46]  Mittal, S., & Mehar, M. (2012). How Mobile Phones Contribute to Growth of Small Farmers ? Evidence from India, 51(3), 227–244.

[47]  Mobile For Development mobile operators & start-ups. (2016), (December).

[48]  Mwangi, J. W. (2012). The Potential of Mobile Phone Usage in Dissemination of Agricultural Information: a Case of Kikuyu District, Kenya..

[49]  Ogboma, M. U. (2010). Access to Agricultural Information by Fish Farmers in Niger Delta Region of Nigeria.

[50]  OXFAM, 2013.Incorporating the use of ICTs into Oxfam's markets-based livelihoods programmes: A guidance paper1, s.l.: s.n.

[51]  Owiny, S. A., & Maretzki, A. N. (2014). The Use of Social Media Technologies and Disseminate Indigenous Knowledge and Skills to Communities in East Africa, 8, 234–247.

[52]  Promoting ICT based agricultural knowledge management. (2012).Parikh, T.S. (2009).Engineering rural development.Communications of the ACM, 52(1), 54 – 63.

[53]  Sustainability, D., Program, F., Papo, A., Jessee, U., & Moorthy, A. (n.d.). Leveraging Mobile Technology to Drive Sustainability in Agriculture in Emerging Markets.

[54]  Swanson, B.E. and Rajalahti, R. 2010. Strengthening Agricultural Extension and Advisory Systems: Procedures for Assessing, Transforming, and Evaluating Extension Systems. Agriculture and Rural Development Discussion Paper 45. Washington, D.C: World Bank.

[55]  Telecom, E., & Wondirad, A. (2015). Ethiopian Agricultural Hotline Surpasses 1 Million Caller Mark, (June).

[56]  Tessema, Y. M., Asafu-adjaye, J., Kassie, M., Maize, I., Centre, W. I., & Mallawaarachchi, T. (n.d.). Do neighbours matter in technology adoption ? The case of conservation tillage in northwest Ethiopia, 11(3), 211–225.

[57]  Traore, A. (n.d.). Mobile Phone in Sub-Saharan Africa : Impact on Technological Innovation and Economic Development, 33(0).

[58]  UNESCO (2014a), Education development as the top priority of the Organization – because education is a basic human right and the foundation for more sustainable, inclusive and just development.

[59]  Woodill, G. and Udell, C. 2012. mAgriculture: The application of mobile computing to the

[60]  business of farming. Float Mobile Learning.

[61]  World Bank. 2011. Sparks of a Revolution in the Trade in African Farm Products now Visible in Ethiopia.

[62]  World Bank, 2011.ICT in Agriculture: Connecting Smallholders to Knowledge, Networks, and Institutions, Washington D.C.: World Bank.

[63]  Yakubu, D. H., Abubakar, B. Z., Atala, T. K., Muhammed, A. and Abduhlahi, M. K. (2013).Assessing the Effects of Socio-Economic Factors on Icts Adoption AmongExtension Workers in the North-west zone of Nigeria, 1(November),1: 255–269.

[64]  Zewge, A., Dittrich, Y., & Bekele, R. (n.d.). Providing Market Information for Ethiopian Farmers : Extending Participatory Design.

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