UNIVERSITY OF CAPE OF COAST

COMPETENCIES OF AGRICULTURAL EXTENSION AGENTS IN THE USE OF INTERNET FOR EXTENSION DELIVERY IN THE EASTERN REGION, GHANA

BETHEL WORLAH AKPOTOSU

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BY

BETHEL WORLAH AKPOTOSU

Thesis submitted to the Department of Agricultural Economics and Extension of the College of Agriculture and Physical Sciences, University of Cape Coast in partial fulfilment of the requirements for award of Master of Philosophy Degree in Agricultural Extension

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature: …….Date……..

Name: Bethel Worlah Akpotosu

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature…….Date…… …

Name: Prof. Fetus Annor-Frempong

Co-supervisor's Signature……Date…….

Name: Mr. Martin Bosompem

ABSTRACT

Internet has been introduced by Ministry of Food and Agriculture to improve extension delivery in Ghana. However the extent to which extension agents have acquired the knowledge and skills to use it was not known in Eastern Region. The study assessed competencies of agricultural extension agents to use Internet in the Eastern Region of Ghana. The study used descriptive survey design, stratified proportional sampling technique and validated questionnaire to collect data from 217 AEAs in ten districts of Eastern Region. Statistical tools such as frequencies, percentages, means, standard deviation, appropriate correlation coefficients were generated to describe or identify relationships among variables of the study. The study revealed that age, educational level, marital status, rank, location, years of experience, monthly salary, duration of use, years of using Internet, and training of AEAs relate significantly to Internet competencies of AEAs. The AEAs used the Internet for extension delivery by sending and receiving e-mails, accessing pay slips, searching for information on agriculture reading agricultural news and chatting with colleagues. The overall Internet competency of AEAs was moderate. The best predictors of Internet competencies of AEAs were training, location, duration of use, age and educational level. The study recommends among others the need for MoFA to organize in-service training on Internet since AEAs have positive attitude to use Internet but low to moderate knowledge and skills. Furthermore, specialized mobile phones and tablets that can access Internet easily should be procured for AEAs.

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DEDICATION

Dedicated to my adorable wife, Joanna Amoah and children; Michael, Adrian and Gabriella Nartey.

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LIST OF ACRONYMS

AEAs:	Agricultural Extension Agent
DADU:	District Agricultural Development Unit
DAES:	Directorate of Agricultural Extension Services
DDO:	District Development Officer
GDP:	Gross Domestic Product
MADU:	Municipal Agricultural Development Unit
MDO:	Municipal Development Officer
MIS:	Management Information System
MoFA:	Ministry of Food and Agriculture
NGO:	Non-Governmental Organizations
RADU:	Regional Agricultural Development Unit
RELC:	Research Extension Linkage Committee
WIAD:	Women in Agricultural Development

CHAPTER ONE

INTRODUCTION

Background to the Study

Agriculture continues to be a major determinant of economic and social development in many developing countries. In Ghana, the agricultural sector employs more than 56% of the labour force and provides 30% of the gross domestic product as well as 41.1% of the foreign exchange earnings (Feed the Future, 2013).

Agricultural extension, described as a non-formal educational system, plays a major role in the agricultural sector, and these include dissemination of agricultural information, building capacities of farmers and empowering the members of farm household (Sinkaye, 2005). Also, the extension system in Ghana helps farmers and other clientele to use scientific information, new technologies and improved practices on agricultural production and processing (Abankwa, 2004).

Agricultural extension thrives on timely and relevant agricultural information, a critical resource required in the operation and management of agriculture enterprises. The timely availability of relevant information is vital for effective performance of managerial functions such as planning, organizing,

leading, and controlling of agricultural enterprise by extension agent (Asiedu-Darko, 2013).

Asiedu-Darko (2013, p.37) argued that: "the development and dissemination of the right information at the appropriate time among farmers is key to providing change in agriculture and this is the function extension education purports to provide". Asiedu-Darko further stated that "apart from this central role of disseminating useful and practical information in agriculture to farmers, extension education fulfills two other educational purposes in making farmers accept and adopt relevant change". According to Fawole (2008), information dissemination to farmers in the rural areas is an important part of the adoption of innovations and agricultural development. Therefore, the effectiveness of sources and frequency of agricultural information availability is critical if any meaningful development is to be achieved.

According to Ngomane (as cited in Asiedu-Darko, 2013), effective agricultural extension was previously faced with a range of problems such as dilution of efforts by assigning too many jobs to extension workers, excessively large areas of operation without providing enough logistic support, irregular training for updating knowledge of extension workers, inadequate research findings appropriate to condition of farmers field, low status and morale of extension staff, the duplications of services by various development organisations and disproportionate extension agent to farmer ratio.

Agricultural extension is still facing some constraints and challenges such as high cost of reaching farmers in the rural areas and loss of information associated with conventional extension. According to Annor-Frempong, Kwarteng, Agunga and Zinnah (2006), these constraints can be addressed by using appropriate ICTs such as the Internet to provide cost effective information flow and facilitate practical information delivery and sharing of knowledge among Agricultural Extension Agents (AEAs) and other stakeholders in agricultural sector to help bridge the information gap.

The Internet offers new opportunities for rapid communication and access to information worldwide. Indeed, the Secretary General of International Telecom Union (ITU), Dr. Hamadoun Toure has stated that the Internet will become a vital tool for social and economic development just as water, transport and power (Lance, 2013). Internet is increasingly being used by all sectors of the society, to make resources more accessible to all people over the world. Also, the Internet provides a useful platform for agricultural extension agents to obtain better access to agricultural information and research by agricultural research scientists (Oladele, 2010; Ojedokun & Owolabi, 2003; Oketunji, 2001). Further, the Internet is being used as a major source for agricultural information and knowledge dissemination to supplement information from Agricultural Information Centres (AIC) and library resources.

The Government of Ghana has embraced the development and promotion of ICT, especially the use of Internet, in all sectors of the economy. Internet

training and high speed Internet connectivity are being made available in every district and municipality in Ghana (National Development Planning Commission, 2010). The Directorate of Agricultural Extension Service (DAES) of Ministry of Food and Agriculture (MoFA) in its effort to adhere to the internet drive, has launched the e-extension under the West Africa Agricultural Productivity Programme (WAAPP) to ensure qualitative extension delivery to farmers and other stakeholders. The e-extension involving the use of Internet and mobile telephones to disseminate information on proven technologies to farmers in remote areas of Ghana, is being promoted as an alternative extension delivery methodology (MoFA, 2013).

The e-extension system is to offer opportunity to extension agents to use the Internet and mobile telephones to provide quality advisory services to farmers in every part of the country so as to improve agricultural productivity. The Ministry of Food and Agriculture has positioned herself to incorporate Internet into traditional extension methods due to the inadequate extension officers to educate many farmers in Ghana (MoFA, 2013). Currently, Ghana has 2,600 agricultural extension staff working with the over 4 million farmers. This translates to a ratio of 1 extension agent to 1,700 farmers and as a result, falls short of the Food and Agricultural Organization standard of 1:1000 (Osei-Boateng, 2012). This challenging situation makes agricultural information dissemination ineffective; resulting in poor coverage.

Statement of the Problem

The agricultural extension service delivery in Eastern Region of Ghana continues to support agricultural development in Ghana through the linkages and support to agricultural research and technology transfer to farmers in rural communities. However, information flow among agricultural extension agents and farmers has not been adequate due to the inadequate extension staff to farmer ratio.

However, the effective application of Internet in agricultural extension depends on the level of knowledge and skill to use it for extension delivery. The Government of Ghana and more specifically the Ministry of Food and Agriculture has identified the use of Internet as a tool that could improve extension delivery. Moreover, with proliferation of ICT and internet, many extension agents on their own have acquired knowledge and skills to apply in their work. In Ghana, little empirical data is available about AEAs' Internet competency level in extension delivery. More so, since MoFA launched the e-Agriculture and introduced Internet in some parts of Ghana, no study has assessed the AEAs' Internet competencies to establish whether and how Internet is applied to extension delivery. The proliferation and use of Internet in agricultural practices in Ghana leaves many questions unanswered and among these are salient questions such as; are agricultural extension agents adequately competent to use Internet? Do they have access to Internet? Are agricultural extension agents using the Internet for

extension delivery? The study therefore seeks to provide answers to these questions.

Objective of the Study

The general objective of the study is to assess the level of competencies of agricultural extension agents in the use of Internet for extension delivery in the Eastern Region of Ghana and the specific objectives are to:

1. Describe the demographic, work and Internet use backgrounds of agricultural extension agents.
2. Determine the extent of Internet use in extension delivery.
3. Determine the Internet competencies level of AEAs.
4. Examine the relationships between Internet competency level and demographics, work and Internet backgrounds of AEAs.
5. Assess the best predictors of Internet competencies from demographics, work and Internet backgrounds of AEAs.

Research Questions

This study will be guided by the following research questions;

i. What are the demographic, work and Internet use backgrounds of agricultural extension agents

ii. What extent do agricultural extension agents use Internet in extension delivery?

iii. What are Internet competencies levels of agricultural extension agents?

iv. What are the relationships between Internet competency level and demographic, work and Internet backgrounds of AEAs?

v. What are the best predictors of Internet competencies from demographics, work and Internet backgrounds of AEAs.

Hypothesis

The following hypotheses were formulated for the study and were tested at 0.05 alpha level.

1. **H_0:** There is no significant relationship between age of AEAs and Internet competency level.

   H_1: There is significant relationship between age of AEAs and Internet competency level.

2. **H_0:** There is no significant relationship between sex of AEAs and Internet competency level.

   H_1: There is significant relationship between sex of AEAs and Internet competency level.

3. **H_0:** There is no significant relationship between educational level of AEAs and Internet competency level.

H_1: There is significant relationship between educational level of AEAs and Internet competency level.

4. **H_0:** There is no significant relationship between monthly salary of AEAs and Internet competency level.

   H_1: There is significant relationship between monthly salary of AEAs and Internet competency level.

5. **H_0:** There is no significant relationship between years of experience of AEAs and Internet competency level.

   H_1: There is significant relationship between years of experience of AEAs and Internet competency level.

6. **H_0:** There is no significant relationship between location of AEAs and Internet competency level.

   H_1: There is significant relationship between location of AEAs and Internet competency level.

7. **H_0:** There is no significant relationship between training of AEAs and Internet competency level.

   H_1: There is significant relationship between training of AEAs and Internet competency level.

8. **H_0:** There is no significant relationship between duration of Internet use of AEAs and Internet competency level.

H_1: There is significant relationship between duration of Internet use of AEAs and Internet competency level.

9. **H_0:** There is no significant relationship between years of Internet use of AEAs and Internet competency level.

   H_1: There is significant relationship between years of Internet use of AEAs and Internet competency level.

Justification of the Study

The study sought to determine competencies of agricultural extension agents in the use of Internet for extension delivery in the Eastern Region of Ghana. Firstly, the findings of the study have added to the body of knowledge in the use of Internet by agricultural extension agents in extension delivery. This information is anticipated to be useful for Ministry of Food and Agriculture to plan Internet competency based training programmes for the extension agents in Ghana.

The results of this study have implications for agricultural policy formulation to improve information retrieval and dissemination mechanisms in agricultural development in Ghana. The stakeholders in agricultural information sector namely research, extension, farmers and Internet service providers can use this mechanism to provide lasting solutions to problems of inadequate access to useful agricultural information to farmers in Ghana.

Finally, the findings could assist the Ministry of Food and Agriculture as well as other stakeholders to subscribe to relevant extension information packages that are appropriate for information needs of farmers in Ghana.

Delimitations of the Study

Competencies in the use of Internet are broad and may differ depending on occupation. With development in ICT, new Internet technologies are determined. The Internet competencies considered in this study are the skills and knowledge that Agricultural Extension Agents (AEAs) should possess currently. Specific skills not needed in certain job environments are not covered. Furthermore, the proposed Internet competency definition is applicable to the focus of this study which is Internet applications and not hardware. The study is delimited to the opinions of Agricultural Extension Agents and measured or observed by the researcher as AEAs performed the tasks in Eastern Region.

Limitations of the Study

Though measuring of AEAs Internet competencies requires the individual using the Internet in the presence of the researcher, it is too expensive and time consuming and this is a strong limitation for large scale data collection. Therefore, this study depended on respondents' judgment of their Internet competency level.

Assumptions of the Study

The basic assumption of the study is that the Internet can be used as a tool for extension delivery. It is also assumed that all respondents would provide sincere responses to the questions in the questionnaire. It is assumed that respondents are fair, honest and willing to provide relevant information. The questionnaire method is cheaper and more appropriate than other methods for collecting data for this study. The population is normal population. The respondents have the ability to assess the competencies possessed and required. The outcomes of the study will not be beneficial to only the researcher but other stakeholders like Ministry of Food and Agriculture, farmers, NGOs and academia.

Definition of Terms

For the purpose of this study, a number of terms were defined:

Internet**:** Internet refers to the large network of networks that spans the globe and gives users access to online resources, enabling them to share information and communicate with each other using email, instant messaging and social networking pages, specifically, when AEA is able to send and receive email, use a browser to search for information, listen to online radio and communicate in the form of chat.

Internet Competencies: a set of related knowledge, skills, and attitudes that enable an individual to effectively and efficiently use the Internet (that is to create, manipulate, retrieve, store and transfer information. So for this study,

Internet competency means the ability of AEA to explore and make use of the Internet for information for extension delivery; that is, accessing agricultural information on the Internet, communication with Internet and Internet data retrieval and manipulation.

Extension Delivery: the process of transfer or dissemination of innovations and research findings to farmers and feedback from farmers to increase production and productivity, specifically through trainings, meetings, demonstrations, home and farm visits.

Agricultural Extension Agent (AEA): Staff of Ministry of Food and Agriculture who assists farmers to use agricultural innovations in the Eastern Region of Ghana and conduct trainings, meetings, demonstrations and home and farm visits for farmers.

Organization of the Study

The study is organized into five chapters. Chapter One comprise the background to the study, statement of the problem, objective of the study and research questions. The rest are significance of the study, delimitations of the study, limitations of the study and organisation of the study. Chapter Two is a review of related literature to issues raised by the study, they include social learning theory, self-efficacy theory, concept of information literacy, competency theory, Internet use, Internet access, purpose of Internet, the role of Internet in agriculture, Internet training, constraints/challenges AEAs faced when using

Internet and background characteristics on Internet use of AEAs . Chapter Three, the methodology, has the following sub-headings: research design, population, sample and sampling procedure, instrumentation, data collection and data analysis procedure. Chapter Four is organised to present the findings and discussion based on the research questions. Lastly, Chapter Five covers the summary, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The theoretical foundations and concepts related to Internet competencies for extension delivery are reviewed in this chapter. The chapter includes theoretical frameworks (social learning theory, self-efficacy theory, concept of information literacy, competency theory), Internet use, Internet access, purpose of Internet use, definitions of Internet competencies, demographic characteristics of extension agents, Internet use and challenges in use of Internet. Finally, the conceptual framework is provided in the chapter.

Theoretical Framework

Four theoretical frameworks namely social learning, self-efficacy, information literacy and competency theories are set out as the foundation for the study. It is therefore important to understand how each theory influences day-to-day practice in order to establish an Internet competency framework for Agricultural Extension agents in Eastern Region of Ghana.

Social Learning Theory

Social Learning Theory is about learning from experiences and perceptions, or insights and through observation (Leh, Waldspurger, & Albin, 2004; Payne, 2005). Learning takes place when learners make an observation and change their behaviour or attitude as a result of that observation. The concept of competence is linked to social learning theory; that is, how successfully an individual performs tasks is dependent on what they have learnt through practice (Holden, Cuzzi, Spitzer, & Rutter, 1997).

"Social learning theorists suggest that learning communities provide a foundation for sharing knowledge. It is believed that individuals can learn by creating and sharing information and knowledge within the learning community as well as observing and modelling other people" (Thomas, 2010, p. 50). So emerging social networking and Internet technology tools extend opportunities for interaction with the peers and colleagues enabling them to work anywhere; thus, facilitating and advancing the learning process. Such efforts result in new learning strategies that are consistent with the concept of social learning.

Hiralaal (2012) suggests that social learning theory is a viable option to use in studies assessing attitudes toward technology use. As Shklovski, Kraut and Rainie (2006) point out, social learning theory is versatile and can be applied to competency in the use of computer and ICTs, including Internet.

Agricultural extension work requires the ability to continue to integrate new knowledge and seek continuous improvement. Social learning theory is valuable

as a practice theory as well as explaining how practice is developed. It is an important theory when analysing how agricultural extension agents learn to solve problem and learn from their practice experiences; how agricultural extension agents develop practice wisdom (Toki & Pange, 2010). Incidental learning (informal learning), the dominant means of adult learning, enables agricultural extension agents to role model skills and techniques in problem solving and empowerment. Toki and Pange (2010) identify four ways in which informal learning occurs. The first way is "vicarious experience" in which other similar people are seen to perform a behaviour successfully through observing others. The second way is "enactive mastery" in which self-efficacy for a behaviour is increased by successfully performing the behaviour. The third is “verbal persuasion”, which is attained by receiving encouragement and support from colleagues. Finally, self-efficacy can be achieved through by trial and error.

Self-Efficacy Theory

Bandura’s theory of self-efficacy originated from Bandura’s Social Cognitive Theory. Bandura defined self-efficacy as the “beliefs in one’s capabilities to organize and execute the course of action required to produce given attainments” (Bandura, 1997, p. 3). Self-efficacy influences a person’s choices, actions, the amount of effort they give, their perseverance when faced with obstacles, their resilience, their thought patterns and related emotional reactions, and the final level of achievement (Bandura, 1986).

According to Holden, Cuzzi, Spitzer, and Rutter, (1997), the concept of competence is central to theories of learning. Competence is related to self-efficacy and constructs how confident a person is to successfully perform required tasks. The way individuals gain competency over time influences the perception of their mastery of skills. If individuals continue to improve skillfully despite occasional setbacks, they are likely to be confident about their level of competency (Petrovich, 2004). Petrovich (2004) further stressed that, when competency levels decline over a period of time, it is most likely due to individuals not having an adequate learning environment or not making an ongoing effort to maintain competency.

Saucier (2010) found that some disparities in self-efficacy may be related to the ability level of the subject matter, but variations in personality, motivation, and the task itself might influence efficacy perceptions of the extension worker. Saucier (2010, p. 10) states that "self-efficacy is a belief about what one is capable of doing; however, it is not the same concept as knowing what to do".

Based on the theory of self-efficacy introduced by Bandura (1997), Wangpipatwong, Chutimaskul, & Papasratorn (2008, p.57) defined computer/ Internet self-efficacy as "an individual's perceptions of his or her ability to use computers and Internet in the accomplishment of a task". It is concerned not only with the skills one has but with judgments of what one can do with one skills set one possesses. Wangpipatwong *et al.,* (2008) argued three distinctive but interrelated dimensions of self-efficacy; they are magnitude, strength, and

generalizability. For example, persons with high computer/Internet self-efficacy generalizability would expect to be able to competently use different software packages and different computer systems, while those with low computer/Internet self-efficacy generalizability would perceive their capabilities as limited to particular software packages or computer systems. Also, people with low computer/Internet self-efficacy strength will be frustrated more easily by obstacles. Studies of computer/Internet self-efficacy suggest that computer/Internet self-efficacy is a significant determinant of an individual's decision to use computers or Internet. Byun, Ruffini, Mills, Douglas, & Niang, (2009) posited that computer self-efficacy influences an individual's expectation of the outcomes of using computers and ultimately affects his/her decision to use computers. Lane and Manner (2011) also argued that computer self-efficacy plays an important role in shaping an individual's feeling and behaviour. Individuals with high computer/Internet self-efficacy used computers and Internet more frequently and derived more satisfaction from their use. Significantly, in the context of e-Government, Wangpipatwong *et al*., (2005) empirically confirmed that the adoption of e-Government websites depends on the computer/Internet self-efficacy of citizens.

Concept of Information Literacy

The term "information literacy" was first used by Zurkowski (1974) as "people trained in the application of information resources to their work" (p.6). Zurkowski's definition was reviewed by other scholars such as Behrens (1994),

Doyle (1994), Rader (1991), Ridgeway (1990) and Kuhlthan (1987) in relation to educational reforms in the U.S.

However, Johnston and Webber (2003) went a step further to describe information literate as a "person" than a "student". This means that the definition relates to students, teachers, and also persons in non-academic settings. The American Library Association (1989) defined information literacy as "having the ability to recognize when information is needed, then to be able to locate and evaluate the appropriate information and use it effectively" (p.1).

Information literacy has also been defined to include: the knowledge of information sources in one's subject area, the ability to construct effective search strategies, the ability to critically appraise information sources and the ability to use these sources appropriately (Machin-Mastromatteo, 2012).

The Society for College, National and University Libraries (SCONUL) in the UK identified "seven pillars of information literacy". These are ability to:

i. recognize a need for information;
ii. distinguish ways in which the information "gap" may be addressed;
iii. construct strategies for locating information;
iv. locate and access information;
v. compare and evaluate information obtained from different sources;
vi. organize, apply and communicate information to others in ways appropriate to the situation; and
vii. synthesize and build upon existing information, thus contributing to the creation of new knowledge. (Johnston &, Webber 2003)

The concept of competence is linked to the concept of information literacy; that is how successful an individual is able to go through the seven pillars of information literacy. Agricultural extension delivery thrives on timely and relevant information which is required in the operation and management of agriculture enterprises. Extension agents have to be information literate in order to access relevant agricultural information on time.

Competency Theory

Durand's theory of competency originated from research on education's three key dimensions of individual learning; and these are knowledge, skill and attitude. The theory states that knowledge, skill and attitude are interdependent, reinforcing each other as learning takes place simultaneously in all directions (Durand, 1988). For instance, "Without knowledge one is not in a position to adapt to change. Skill without knowledge is thus vulnerable. Similarly, attitudes without skill may prove useless, as much as attitudes may be meaningless without knowledge and thus understanding of stakes and challenges at hand. Pure knowledge without relevant skill is sterile and knowledge without attitude may even prove counter-productive" (Durand, 1988, p.33).

Since competency depends on knowledge, skill and attitude, these attributes or qualities are briefly discussed to demonstrate how they are related to Internet competency.

Knowledge of Internet

> "Knowledge corresponds to the structured sets of assimilated information which make it possible to understand the world, obviously with partial and somewhat contradictory interpretations. Knowledge thus encompasses the access to data, the ability to enact them into acceptable information and to integrate them into pre-existing schemes which obviously evolve along the way". (Durand, 1988, p.21)

Annor-Frempong and Edumadze (2008) asserted that "effective search for information on the Internet starts with good knowledge on aspects of the Internet" (p.382). Specifically, 87.5% had knowledge about home page, 29.5% about search engines/browsers and 27.5% had knowledge about email (Annor-Frempong & Edumadze, 2008). Isiaka, Lawal-Adebowale and Oyekunle (2009) reported that extension workers were moderately knowledgeable or aware of the existence ICTs potential in extension services delivery in Southwest States, Nigeria. Although their findings slightly differ from Adebayo and Adesope (2007) who reported high (88.5%) level of awareness among female extensionists in South eastern Nigeria. Adekunle, Omoba and Tella (2007) concluded that those with more knowledge have more positive attitude towards using the Internet.

Attitude towards the use of Internet

Also, Internet usage is greatly affected by the attitude and behaviours of users (Sam, Othman, & Nordin, 2005; Zhang, 2004). Taiwo (as cited in Adekunle

et al., 2007) defined attitudes as "inclinations and feelings, prejudices or bias, preconceived notions, ideas, fears and convictions about any specific topic". Ganesh-Kumar and Ratnakar (2011) also defined attitude as an individual's positive or negative feeling (evaluative effect) about performing the target behaviour. According to Durand (1988), attitudes are too often neglected in the resource based view as well as in the competence based theory of the firm. This may be due to the traditional lack of interest of economists in behavioural and social aspects. Durand (1988) further believes that behaviour and will (determination) are essential part of the capability of an individual or an organization to achieve results. A committed individual or organization eager to succeed is more competent than a demoralized, passive one with exactly the same knowledge and skill.

According to Ndubisi (2004), attitude is related to behavioural intention because people perform behaviours toward which they have positive feeling. Attitude towards e-learning model will be positively influenced by its perceived system's usefulness and ease of use. Learner attitudes and responses are interconnected and a positive correlation exists between the two (Paris, 2004). However, the study of Omidi, Farajollah, Mirdamadi and Moghadasi (2008) found that negative attitude of organizations towards virtual education is a barrier to the development of e-learning programmes. Therefore, learners' positive attitude towards e-learning is very important if e-learning is to be developed in agricultural extension. Similarly, Ahmadpour and Mirdamadi (2010) showed that negative

attitude of user towards e-learning is a barrier to developing e-learning in agricultural extension.

"Mere exposure effect" Zajonc (2001) proposes that continuous exposure tends to increase people's liking for given stimuli. That is to say, as individuals' exposure to a particular stimulus increases, a positive attitude towards the stimulus is established (Cha, 2010; Zajonc, 2001). Also, the more people use and become conversant with given technologies, the more relaxed and ease they become using these technologies. Earlier studies demonstrate that this theory holds true on the Internet (Cha, 2010). In a study about attitude towards Internet use for learning at University of Malaysia, Hong, Ridzuan and Kuek (2003) found out that, in general, students had positive towards learning through the Internet.

Internet Skills

According to Durand (1988), "skill relates to the ability to act in a concrete way according to predefined objectives or processes. Know-how does not exclude knowledge but does not necessitate a full understanding of why the skills and capabilities, when put to operations, actually work. Know-how thus, in part, relates to empirism and tacitness" (p.21).

Internet skills research has become an important area of inquiry primarily because such skills are learned abilities that can be enhanced through education and training. Furthermore, as the internet increasingly plays an important role in contemporary society, these skills have become 'critical to social inclusion' and vital to many professions (Warschauer, 2003). As a result many scholars from

many fields have aimed to conceptualize what comprises internet skills for everyday internet users. Researchers develop skills, construct and link them to demographic factors like age and gender, as well as various social, educational, and economic benefits (DiMaggio & Bonikowski, 2008).

"A competency based study is somewhat of a new idea, yet a means of promoting innovation and continuous learning for the extension educator. A competency can be used to increase effectiveness, productivity and lead to an enhanced level of performance" (Burke, 2002, p.12).

Marrelli, Tondora and Hoge (2005) define competency as an ability to do something measured against a standard. The most common definition of competency includes knowledge, skills, and attitude (Durand, 1998). However, competency is also observable and measurable. It is for this reason that competency testing is possible. Without the empirical aspect, assessing competencies loses its objectivity and then defeats its purpose. Another characteristic of a competency is that it is based on actual performance. Given these definitions, competencies are observable knowledge, skills, and attitude that can be quantified and qualified, and are based on actual performance.

Definition of Internet Competencies

The internet is a global, computer-mediated information resource and communication infrastructure (Cox & Koelzer, 2003; December, 1996). It is a network of connected computer networks using an open, media independent, standard technical protocol known as TCP/IP (transmission control protocol/internet protocol) (Comer, 2000; December, 1996), offering a variety of

different communication services such as file transfer protocol (ftp), electronic mail (e-mail), newsgroups, internet relay chat (irc), videoconferencing, and the world wide web (www).

According to Brock and Zhou (2005), Internet can be compared with a library. Like a library, the Internet is also a source of enjoyable, important and varied information that can be obtained and used by millions of people across the world. The Internet also, like our library, contains different forms, like text sound and graphics. In a similar way, only authorized users of the Internet can access it to obtain information. Internet is a worldwide collection of computer networks. Internet is a cooperative effort of many people and organizations. The computers on the Internet can communicate because they are physically linked and because they share a common language called TCP-IP (Cox & Koelzer, 2003).

Van Deursen (2010) proposed four kinds of Internet competencies. These are:

i. Operational competencies which include the knowledge and skills to operate digital media (eg. Computer, mobile phone, ipad);

ii. Formal competencies involving the skills to handle the special structures of digital media such as menus and hyperlinks;

iii. Information competencies such as knowledge and skills to search, select and evaluate information in digital media (Internet) and

iv. Strategic competencies which include the knowledge and skills to use the information contained in digital media as a means to attain a specific or professional goal.

i. Operational Internet competencies

van Dijk (2005) described operational Internet competencies as understanding concepts and terms associated with the Internet, appreciating security considerations, accomplishing common web search tasks using a web browsing application and available search engine tools, bookmarking web sites and printing web pages and search outputs, navigating within and completing web-based forms and understanding concepts associated with electronic mail. Bunz (2004) added that in assessing peoples' fluency with computer and Internet, knowledge and skills relating to using a web browser, opening web addresses, identifying host servers from web addresses, using "back" and "forward" buttons to move between web pages and using search engines should be considered.

Larsson's (2002), digital literacy checklist based on the definition of digital literacy to include suggested knowledge on what a web browser is and how to use it to move between web sites or pages, knowledge on how to use browser's bookmark file to organize web sites, knowledge on how to change the preferences on browser (e.g., changing my opening page and the font type and size); knowledge on emptying the disk and memory cache on browser to free up space on hard drive; knowledge to read various file formats on the web (e.g., GIF, JPG, PDF, Word); knowledge on use of Telnet (an Internet program) to log on to another computer and use it, knowledge on downloading audio files,

understanding that HTML is used to tag ASCII text for display by web browsers, knowledge on data on the web location, knowledge on identification of the format and knowledge on how to move data to desktop for further analysis, knowledge on downloading files using my web browser, knowledge on downloading files from public FTP sites, and knowledge on setting up a personal newsfeed so that only required information is obtained.

Revere (2005) also developed a digital literacy assessment based on Larsson's checklist using the following questions: Have you ever used a browser? Have you ever saved a Web page or printed a web page? Have you ever customized a Web browser (security settings, tool bars)? Do you know the difference between a search engine, subject directory, and meta-search tool and know when it is most advantageous to use one? If you found a site on the Web that you particularly liked, would you know how to easily bookmark that site so you could go back to it later without having to re-enter the entire address? Do you know how to view, download, decompress, and open documents and programs from Internet sites (e.g., graphics, PDF files)? Once you have located data on the Web, do you know how to move it onto the desktop or save it to a folder? Have you emptied the disk and memory cache on your browser to free up space on the hard drive?

van Deursen (2010) operationalized Internet skills, using the following aspects of an Internet browser (typing URL in the address bar): use of a search engine (input field and search operation); using (back and forward) browser buttons; bookmarking web sites; downloading or saving files from the Internet;

saving web pages and web sites; use of online forms (different buttons and sending forms); and using various file formats (e.g., pdf).

Again according to van Deursen (2010), "operational Internet skills are the basic skills needed to use the Internet and for which it is easiest to predict skill level because most of the skills research based on surveys focus on them.

ii. Formal Competencies

The second type of Internet competencies is Formal Competency. "When using the Internet, skills for using traditional media need to be complemented by form of digital skills. The skills, defined as formal competencies, allow users to make use of hypermedia (of which the Internet is the classical example)" (van Deursen, 2010, p. 38). It relates to the structure on which a medium is built, that is, skills necessary to use different web sites whilst maintaining one's focus when browsing. These skills are required by users to be able to use the countless and different websites and menus on the web. Web sites vary in features, characteristics and content. Therefore, the users need navigational skills.

van Deursen (2010) considered the following indicators for measuring formal competencies; navigating on the Internet by recognizing and using hyperlinks (e.g., menu links, textual links, image links) in different menu and website lay-outs; maintaining a sense of location while navigating on the Internet, meaning not getting disoriented or confused when surfing within a website, not getting disoriented when surfing between websites and not getting disoriented when browsing through, and opening search results.

iii. Informational competencies

According to the American Library Association, as cited in (van Deursen 2010, p.39), information literate is a person who is "able to recognize when information is needed and has the ability to locate, evaluate and use the needed information effectively."

"Most literature focuses on the search for online information, which is mostly seen as an action through which users try to fulfill their information needs. In the related literature, there exists general agreement that the process entails more than merely gathering information, it encompasses posing or identifying a question or problem, exploring available information, refining the question, gathering and evaluating information, and synthesizing and using information" (van Deursen 2010, p.40).

The following indicators were considered by van Deursen (2010) for measuring information competencies. Locating required information, by choosing a search system or appropriate website to seek information, defining search queries, selecting information (on websites or search results), evaluating information sources.

iv. Strategic Competencies

As one of the competencies, van Dijk (2005) defines strategic competencies as the capacity to use computer and Internet as the means for specific goals and for general goal of improving one's work or profession. However, the three types of competencies enumerated and discussed above relate to an effective Internet use, while strategic competencies are related to the purpose

of use. Therefore, they serve as a means to achieve a particular goal by user's own ideas.

According to van Deursen (2010), in order to acquire strategic competencies, users must be critical, analytical and must have a high degree of information competencies (skills), and it has never been measured differently. van Deursen (2010) concluded by proposing a process that entails four steps in making effective use and taking advantage of the Internet.

The first step is goal orientation towards a particular goal, which implies awareness of the prospects available on the web and one or more ways to achieve a goal. The second step is taking the right action on the Internet to reach this goal, by combining the different sources to make decision to attain required goal. Also, the third step decision making by accessing the right information sources that are relevant to the work or study. Finally, when the right decisions are made, they result in benefits for the profession or education, attainment of objective or goal. In summary, taking advantage of the Internet means, an orientation towards a particular goal, taking the right action to reach this goal, making the right decision to reach this goal, and eventually gaining benefits belonging to this goal.

Measuring Competence

van Deursen (2010) identified some requirements for measuring operational and instrumental competency and these comprise an understanding of concepts and terms associated with using the Internet, appreciating security considerations, accomplishing common Web search tasks using a Web browsing application and available search engine tools, bookmarking Web sites and printing

Web pages and search outputs, navigating within and completing Web-based forms and understanding concepts associated with electronic mail.

Hobbs (2002) used four items for testing Internet skills: create a bookmark or save a favorite Web page; save/download a Web site with graphics, video, or audio, follow a link from one Web page to another Web page, move forward and backward through Web pages.

Bunz (2009) developed an instrument to assess people's fluency with the computer, e-mail, and the Internet to fill the existing gap between previously developed computer literacy or experience scales and the ever-accelerating development of Internet technology. To measure Web fluency, Bunz used items related to using a Web browser: opening Web addresses, identifying host servers from Web addresses, using "back" and "forward" buttons to move between Web pages, using search engines.

When measuring operational Internet skills, the following aspects should be considered; operational use of an Internet browser (typing URL in the address bar), operational use of a search engine (input field and search operation), using (back and forward) browser buttons, bookmarking Web sites, downloading or saving files from the Internet, saving Web pages and Web sites, operational use of online forms (different buttons and sending forms), using various file formats (e.g., pdf).

Operational Internet skills are the basic skills needed to use the Internet and for which it is easiest to predict skill level because most of the skills research based on surveys focus on them. It is also relatively easy to observe them in

performance tests. Research shows that individuals in Western countries also show relevant differences with regard to these skills (e.g., De Haan, 2003; Hargittai, 2002; Park, 2002). Also, young users often have the operational skills that support Internet access (Clark, 2001). According to De Haan and Huysmans (2002), operational skills are mastered relatively poorly by the elderly, unemployed, and disabled, as well as by homemakers. Many senior citizens reportedly lack basic knowledge of Internet operation (Lundt & Vanderpan, 2000).

Based on above literature reviewed, I propose the following competency for the study; accessing Internet competencies, Communication with Internet competencies and Data retrieval and manipulation using Internet competencies.

Accessing Internet competencies include basic competencies needed to browse the Internet by using the URL to locate websites, navigating web pages, using search engines to locate information, listing favourites sites (bookmarking) for quick viewing, and finding pages you recently viewed.

Communication with Internet competencies are competencies needed for creating email account, creating e-mail accounts, accessing e-mail (sending and receiving emails), sending and receiving files and joining discussion newsgroup.

Data retrieval and manipulation using Internet competencies are competencies necessary for accessing database, using online library catalog, accessing files, download files and accessing e-journals.

Competency scale

Competency scale is concerned with judgment of competency level and provides guideline development of competency level (Revere, 2005). Competency

judgment is a difficult task. Its evaluation cannot be relied upon one's judgment. The basis of evaluation, is formed by particular learning and evaluation situation. In a more comprehensive study, competency is judged by taking the whole observations into account. In order to prepare a competency report for performance evaluation competency scaling is necessary (Sanchez & Levine 2009).

The Likert scale has been used as a model of competency level to scale all the competencies at a same format (Bunz, 2004; Deursen, 2010; Larsson, 2002; Revere, 2005; van Deursen, 2010). Competency scale captures a wide range of ability levels and organizes them into steps; from "fundamental awareness" or "low" to "expert" or "high". This scale serves as the guide to understanding the expected levels of competency of top performers at each grade level. To measure the Internet competencies (knowledge, skill and attitude) for this study, the scale of very low to very high will be used.

Internet Use

Zizi and Rubin (2010) reported that pattern of exposure or use (that is amount of use, duration of use, type of use) and attitudes are relative to the study of the Internet. Internet use is operationalized to include duration of use, frequency of use, years of Internet use and purpose of Internet use. Duration of use implies the number of hours one uses Internet. The number of hours spent on the Internet in a day, according to Rohde and Shapiro (2000), has a direct effect on one's Internet competency level. The longer one stays on the Internet, the higher the

competency level. The frequency of use shows how often one uses the Internet and purpose of Internet use also indicates what the Internet is used for. Hefny (2013) established that majority of agricultural extension agents use the Internet for one (1) to five (5) hours a day and consequently concluded that PC and Internet usage have become part of many extension agents' extension delivery tools in Egypt.

According to the Internet and Society Report by the Stanford Institute for the Quantitative Study of Society (2000), Internet experience has a positive correlation with the amount of Internet use. The longer people use the Internet, the more hours they spend and the more activities they engage in on the web (Ahmadpour & Soltani, 2012: Yaghoubi, 2009).

Internet Access

The Internet can be accessed from more than one place and more so it can be accessed from the home, school, workplace, library or the Internet café. According to Rohde and Shapiro (2000), 22% of Americans access internet from home and 56% access Internet at the workplace which is the most common place apart from home. According to van Dijk (2006), many researchers have argued that more attention should be paid to social, psychological, and cultural backgrounds, resulting in several conceptualizations of the digital divide. Kling (2000) proposed a distinction between technical access (material availability) and social access (the professional knowledge as well as technical skills necessary to

benefit from information technologies). Similar distinctions have been suggested by Hargittai (2002) and Attewell (2001).

DiMaggio, Hargittai, Russell and Robinson (2001) proposed five dimensions along which divides may exist. These are, technical means (software, hardware, and connectivity quality), the independence of use (location of access and freedom to use the medium for one's preferred activities), use patterns (types of uses of the Internet), social support networks (availability of others one can turn to for assistance with use and the size of networks to encourage use), and skills of users (one's ability to use the medium effectively).

van Dijk (2005) suggested a causal model with four types of access to ICTs. Motivational access include the lack of the elementary digital experience by people who have no interest or feel hostile towards ICTs, physical access that is the availability of ICTs, digital skills meaning the ability to use ICTs, and usage access which includes the opportunity and practice of using ICTs.

Wilson (2006) also considered eight dimensions of the digital divide to include physical access (access to ICT devices), financial access (cost of ICT services relative to annual income), cognitive access (ICT skills), design access (usability), content access (availability of relevant applications and information online), production access (capacity to produce one's own content), institutional access (availability of institutions that enable access), and political access (access to the institutions where the rules of the game are written).

Indicated gaps in van Dijk (2005) and Wilson (2006) further stress the cultural, educational, political, and socio-economic aspects of the digital divide.

They conceded that while gaps in physical access are being addressed, other gaps seemed to be widening. Therefore, attention in the digital divide discourse should be shifted to other types of inequalities (e.g., inequalities in skills).

Omotesho, Ogunlade, and Muhammad (2012) reported that Internet can promote access to and sharing of information in agriculture and other sectors. The inherent benefits in the pluralistic nature of information flow through Internet, if properly harnessed, will have a positive effect on the productivity of extension workers. Salau and Saingbe (2008) reported that extension workers in Nasarawa State had high access to Internet on phones but fewer access Internet on computers. This is similar to findings of Sife (2010). It is expected that with majority of extension workers connected to Internet on mobile phone they should be able to use Internet for extension delivery and this will depend on their Internet competency. However, Mtega and Msungu (2013) found contrarily that those who used Internet services had multiple Internet access points. These include accessing through laptops installed with modems (68.2%) and offices (59.8%) and mobile phone (29.9%).

Purpose of Internet Use

Some studies have attempted to explain the use of the Internet and Internet related communications (Cha, 2010; Ferguson & Perse, 2000; Leung, 2001; Papacharissi & Rubin, 2000). For instance, Papacharissi & Rubin (2000) identified interpersonal utility, passing time, information seeking, convenience, and entertainment as five motives for using the Internet. Similarly, Yang and Kang (2006) suggested that entertainment, habit, social interaction, information, and

escapism were five motivations for Internet use. While information seeking and entertainment are critical gratifications sought from the Internet in general (Papacharissi & Rubin, 2000), individual Internet services show differences in the relevance of gratifications sought. Cha (2010), focusing specifically on Internet chat rooms, found that social inclusion, maintaining relationships, meeting new people, social compensation, and entertainment are the gratifications for using these chat rooms. It is apparent in Cha's (2010) research that most of the motives are associated with social interaction or interpersonal utility.

In comparing general Internet use and Internet chat rooms, it has been found that people are more likely to use Internet chat rooms for socialization than information seeking. In addition, Ko, Chang-Hoan & Roberts (2005) discovered that the social interaction motivation for using the Internet has a positive effect on the use of human-human interaction features on the Internet that have characteristics of connectedness and reciprocal communication.

Although the type of information sought by extension officers in Egypt on the Internet focused only on the extension duty and the amount of time associated with it. Weather information was cited most by extension officers. Extension officers search for information pertaining to agricultural products and farm news using Internet, while fewer search for information on political news (Hefny, 2013). Study on the purpose of the Internet use and learning through Internet Ruzgar's (2005) revealed that Internet usage among extension workers was approaching 100% in Turkey. It also revealed that sending and receiving emails

topped the list, followed by reading news and chat. However, according to a study by Badu and Markwei (2005), apart from email, the frequency of using Internet resources was very low among postgraduate students in University of Ghana. The purpose of using the Internet therefore greatly depends on what motivates the person (attitude) and who pays for the Internet.

Duration of Using Internet

There is a limited amount of studies that examined at the relationship between duration of using Internet and Internet competency level. The number of hours or years one is exposed to the Internet tends to increase ones Internet competency level. The longer the hours or years one uses Internet, the higher the Internet competency level (Oghenevwogaga & Oghenevwogaga, 2006). Also, Joiner, Brosnan, Duffield, Gavin, and Maras, P. (2005) found out that Internet use was positively and significantly related to hours per week spent using the Internet. However, according to van Deursen, van Dijk, and Peters, (2011), the level of Internet skills or competency has a weak relation with years of Internet experience and with the number of hours spent online weekly. Internet experience only contributes to medium-related skills. This according to van Deursen, van Dijk, and Peters, (2011) might be explained by the fact that people often keep repeating similar mistakes when using computers and Internet. According to them, content-related skills do not grow at all with years of Internet experience and number of hours spent online weekly. These skills strongly relate to the possession of general intellectual skills that are not gain from long or heavy Internet use.

Role of Internet in Agriculture

Smithers, Lamarche and Alun (2008) underlined the role of Internet in the context of marketing in farming business. The increasing use of Internet for agricultural purpose was also revealed. Moreover, it was emphasized to get benefit from this useful tool with the perspective of extension. Andreopoulou, Tsekouropoulos, Koutroumanidis, Vlachopoulou, and Manos (2008) critically analyzed the use of Internet and particularly taking into account the crucial aspect of cost effectiveness. Andreopoulou, *et al.,* were of the view that the efficacy of various electronic media varies for less developed countries as compared to the developed ones. More advancements in telephonic technologies have also contributed in enhancing the income and bettering the business, while the accessibility to Internet is still a dilemma in terms of networking (infrastructure), language problem, illiteracy and cost effectiveness. Still, Internet has a place for quick information exchange. It may be used as supplementary with the media like radio and telephone for the poor.

Hassan and Shaffril (2009) opinioned that poverty also means lack of knowledge in addition to low income. The gap of "digital divide" among people having access to Internet technology and those who are deprived of this facility appears on the scene. However, telecenters are providing the opportunity for the poor to get benefits out of it by shared access. One aspect is there for using these telecenters as earning point. On the other hand, it was pointed out that poor people should be provided as free service.

Kallioranta, Vlosky and Leavengood (2006) underlined the importance of web based connectivity among stakeholders. Further, they also pointed out the interconnectivity through Internet which has facilitated the spreading of information and thus, shape an Internet based community. In this way, the barriers of distance can be overcome through this facility and the business can be uplifted. Advanced forms of communication like fax and e-mail have expedited communication speed and as a result, extension work can be done with greater efficacy in addressing the clients' needs in time. Also, Brown (2011) discussed that among the various forms of communication, currently "computer mediated human communication" has made its place. Moreover, e-mail facility and website have increased the scope of media to get access in a broader sense.

Michailidis (2007) conducted a study in Greece and indicated that progress in "communication infrastructure" has improved computer and Internet use by the farmers and agricultural extension agents. Neufeld *et al.,* (2007) stated that websites related to Integrated Pest Management (IPM) information successfully uplifted the awareness as well as adoption of appropriate use of pesticides. By using Internet, agricultural information can be accessed more easily and coverage also expands (Woods, Raab, & Abdon, 2002). There are experiences gained from all over the world such as the International Rice Research Institute (IRRI), Asia Pacific Regional Technology Centre (APRTC) and Sustainable Development e -Learning Network (SDLEARN that application of ICT on e -learning in particular is an effective alternative in addressing the continuing educational needs of

agricultural knowledge, especially in the areas of sustainable agriculture and natural resource management (Abdon, Raab & Ninomiya, 2008).

The benefits of utilizing Internet as an e-learning tool for agricultural extension and training purposes are well documented (Asenso-Okyere & Mekonnen, 2012; Richardson, 2005). Shea-Shultz and Fogarty (2002), for instance, pointed out that one of the significant reason for the increase in e-learning is related to cost of training, citing that Price Waterhouse Coopers reduced the cost of training per person by approximately 87% through its e-learning initiative. The same authors state that e-learning is saving 33 to 50 percent from the cost of training while cutting 50 percent off the time invested and allowing better results.

In addition to cost benefits, organizations prefer e-learning for its potentials to increase employee retention, development as well as opportunities to deploy and update content and provide effective training anywhere and anytime (Minton, 2002). Bork (2002) states that e-learning boosts worker productivity, broadens training opportunities, stays competitive, improves motivation and morale and facilitates the implementation of strategic initiatives. Chamala and Shingi (2010) confirm that Internet use for extension activities will ultimately transform extension workers into catalysts who will play roles of empowering community organizations, human resource development, problem solving and educating farmers. Further, Richardson (2005) emphasized that extension organizations have a key role in being a link between communication

technologies, providing technologies and service to the farmers they serve. More significantly, extension workers are to bridge the technological gap between existing as well as evolving scientific knowledge and farmer's knowledge. It is therefore appropriate to state that the most critical target learners of Internet initiatives are knowledgeable, skilled and committed extension workers.

Internet Training

Generally, most studies concluded that there is positive relationship between training and Internet competency, as training increases Internet competency increases (Potosky, 2002; Yakubu, Abubakar, Atala, Muhammed & Abdullahi, 2013). Adoption of ICTs is likely to be favoured by training received on ICT use. Categorized training into absence of training and received training, Yakubu *et al.,* (2013) concluded adoption of ICTs by extension workers was influenced by training they received contrary to Ogunjobi and Fagbami (2012) view that most AEAs acquired Internet knowledge through self-development in Ibadan, Nigeria. This could be as a result of the increase in the number of AEAs that owned mobile telephones which are connected to Internet, which gave them the opportunity to learn on their own (time and space). Self-rated knowledge and performance during a training positively influenced post training technological efficacy (Potosky, 2002). However, training had no influence on people with negative attitude towards Internet use.

In a study by Annor-Frempong and Edumadze (2008) on the use of Internet among Agricultural students, they found out that 36.5% had received Internet training before entering university and 34% claimed they studied Internet

on their own. While 6% studied in University, 13.5% had their training outside (Internet cafes) the university. However, Anandarajan *et al.,* (2000) are of the view that neither Internet skills nor formal training are important variables for Internet competencies.

Constraints/ Challenges AEAs Face When Using Internet

A number of challenges are known to hinder the use of Internet by AEAs in developing countries. The overall situation in developing countries is similar to the situation in Ghana compared to developed countries. Ahmadpour, Mirdamadi, Hosseni and Chizari (2010) affirmed that in Iran the financial factor plays a crucial role, because setting up e-learning system such as purchasing computers, internet access, and maintenance of ICT equipment/resources requires financial investment. Findings of Kushner and Chong (2004) and Stribhadung (2006) also showed that high cost of buying and maintaining a system adversely affected the development of ICTs.

However, Akpabio, Okon and Inyang (2007) point out that the major constraint perceived by extension workers in Nigeria was attributed to poor infrastructure development. While findings by Mabe (2012) revealed that lack of competence in handling ICT facilities, lack of internet access to the rural areas, poor finance and poor communication network were considered as major challenges to the use of ICTs by extension workers, Ogunjobi and Fagbami (2012) enumerated various constraints faced by extension workers while using Internet. Among these constraints are inadequate information retrieval skills, there is no or

little connectivity in the rural areas where most of the extension workers work, the slowness in accessing Internet/poor Internet speed as another major constraint extension workers faced while using the Internet and the issue of cost restricts their use of Internet (cost of buying Internet bundle and PC).

Background Characteristics on Internet Use and knowledge of AEAs

Studies on demographics of AEAs have shown that there is a close relationship between AEAs' demographic characteristics and the use of Internet (Agwu, Uche-Mba & Akinnagbe, 2008; Hefny, 2013). The main demographic characteristics that this study focused on are age, sex, educational level, household size, marital status, and income.

Age of AEAs

A good deal of literature shows that Internet competency is related to age. Age has inverse relationship with Internet use, implying older people have lower competency (Marquire, Jourdan-Boddaert and Huet, 2002). Hefny (2013) explained that age of individuals including extension agents affects their personal computer and Internet use because both computer and Internet require new learning skills and changing behavioural practices. Older individuals perceive technology as intimidating and perhaps mysterious and as a result, younger extension agents tend to use Internet more than their older colleagues.

In a study on the role of online skilled and Internet self-efficacy, Livingstone and Helsper (2010) found that older workers were more likely to

experience "technostress" compared to young workers. Similarly, Agwu *et al*., (2008) examined individual differences on skill in end-user computing and found that age is negatively correlated with skill level. In the context of the Internet, studies have shown that users tend to be young adult (Khan, Khan & Bhatti, 2011).

Cha (2010) discovered in his work that age has an inverse relationship with Internet use. Pew Internet and American Life Project (2009) confirmed the findings of Cha (2010). Similar findings can be found in the adoptions of specific Internet–related technologies such as online chat rooms and webcasting (Peters, Amato & Hollenbeck, 2007; Lin, 2004).

De Haan and Huysmans (2002) reported that people get to know the Internet at an early age and thus are considered more skillful than the elderly. It is often believed that the so-called digital generation possesses the highest level of Internet skills. De Haan and Huysmans (2002) further reported that the elderly have never had the opportunity to accustom themselves with the Internet at school and lag behind in the use of the Internet as well as their digital skills. According to Agwu *et al.,* (2008) and Agwu and Chan (2007), the elderly are less interested in using high technology and prefer oral to printed information channels which are less efficient, and this trend may have significant implication for Internet usage.

According to Castells (2004), difficulties in learning new skills and resistance to change have also been suggested as barriers to Internet use by the elderly. Boyd and Bee (2009) further reported that older people have more trouble

learning new digital skills due to decreased working memory and reaction times. Those over forty years have also missed this opportunity at school, however, many of them at least have learned to use computers and the Internet at work. In agreement with these statements, Hargittai (2002, 2010) concludes that age is negatively associated with one's level of Internet skills.

Cho, Gil de Zúñiga, Rojas and Shah (2003) reported that both young and old users were more effective in obtaining what they sought online. Others took indirect or multiple routes to achieve the same end. On the contrary, some literature show that there are some older people who are comfortable with Internet technology (Fox, 2004). There is also evidence that certain Internet skills are lacking among students (Davis, 2003; Metzger, Flanagin & Zwarun, 2003; Volman, Van Eck, Heemskerk & Kuiper, 2005).

Again, Anandarajan, Simmers and Igbaria (2000) concluded that age and sex do not have any significant associations with Internet related factors, except that women are less likely to access work webpages. Also, a joint study of the Center of e-Government of the Donau-Universitat Krems, the Demokratiezentrum Vienna and the ICT&S-Center showed significant shortfalls of young people in serious usage of the Internet. The project involving 400 pupils in Vienna, Lower Austria and Salzburg looked at Internet competencies, types of activities, thematic interests, and search habits of the Austrian pupils aged 14 years (Diendorfer *et al.,* 2010).

Sex of AEAs

Studies that examined gender issues on Internet usage show results that are not consistent. For example, Schumacher and Morahan-Martin (2001) reported that males have greater Internet skills than females do. Goulding and Spacey (2002), also assert that males have more knowledge about the Internet and how to use it than females since the latter have been slower to start using the Internet than their counterparts male. Studies by van Dyke (2002) on Internet use that have made a distinction by sex have also concluded that on the whole, men who have higher computer and Internet self-efficacy rated themselves higher on perceived self-efficacy, express more positive attitude towards computers and the Internet as compared to women. Wasserman and Richmond-Abbott (2005) discovered that the level of Internet use was related to Web knowledge, and that this was higher among males than females. Moreover, males tend to use the Internet more frequently and for longer periods than females (Ono & Zavodny, 2003; Wasserman & Richmond-Abbott, 2005). Agwu *et al.,* (2008) noted in their study on extension workers in Nigeria that majority of extension workers were males which is due to the gender difference found in public services in Nigeria.

On the other hand, in studying differences in gender, Bimber (2000) controlled socio-economic and demographic characteristics, and although female were less likely than male to use the Internet frequently, he concluded that this was the product of socio-economic and other factors, not gender itself. Durndell and Haag's (2002) findings show that this gender difference in Internet usage is disappearing. Also, findings by Ono and Zavodny (2003) showed slight variation

by gender in access to the Internet in the developed Western countries. Similarly, findings of Zhang (2004) showed that female employees view Internet to be equally useful as male employees do. Similarly, Hargittai and Shafer (2006) establish that males and females do not vary significantly in their online competences, but that women's self-assessed skill is significantly lower than that of male.

Educational Level of AEAs

The use of Internet in obtaining information requires intellectual ability, and therefore education plays a major role in determining ones Internet competency. There is a limited amount of research that looked at the relationship between educational level and Internet use. In most of the studies, educational level is not included or considered as a main construct but measured as part of demographic characteristics (Teo, 2001). Another study by Awgu *et al.,* (2008) showed that educational level has a significant positive influence on perceived usefulness of Internet and computers. All together, these findings imply that higher educational level is likely to have positive relationship with usage. Additionally, higher educational level may result in better knowledge about Internet use and computers; thus, facilitating Internet usage. Zhang (2004) concluded that, the more educated people are, the more useful they felt Internet to be.

Hefny (2013) asserts that education of extension agents plays a supporting role in determining computer and Internet adoption. Internet competency and

educational level are highly correlated according to Rohde and Shapiro (2000). The most consistent universal predictor of the use of ICTs is education. The higher educated more often own computers, have Internet access at home, and connect through broadband and spend more time online (Buente & Robbin, 2008; Robinson, DiMaggio & Hargittai, 2003). Strongly related to educational achievement are cognitive resources that are largely responsible for differences in Internet use and in the digital skills of different educational groups (De Haan, Huysmans & Steyeart, 2002). Goldin and Katz (2008) argue that the more highly educated are able to keep up with technological advancements and therefore increase the lead over people who are not able to keep up. However, Goldin and Katz (2008) concluded that education in digital skills cannot keep up with technological developments, which has resulted in wage inequality in the US.

Many private, labour organizations and educational institutions offer Internet courses. Those that take part in these courses and learn to use the Internet are more likely to possess sufficient Internet skills than those who do not (Goldin and Katz, 2008). Bunz (2004) contended that users who lack formal instruction are likely to have trouble using the Internet. Alluding to findings by Agwu *et al.,* (2008) showed that majority of extension workers in Abia and Enugu States of Nigeria had HND certificates while 32.5% had BSc. Whilst with Ahmadpour and Soltani (2012), 77.6% of extension staff in Iran were BSc and higher degree holders, meaning that respondents in that study appreciated Internet use more.

Household size of AEAs

Household size may be referred to as the number of people who depend on AEA for their livelihood. Literature indicates that maany consultations take place among family members on adoption or the use of new technology or household activity. An FAO (2012) publication, a Ghana living standards survey (GLSS 5) in Ghana, revealed the average household number for non- poor rural households is approximately 5 members and poorer rural households members also averaged 8. According to Feder, Just and Zilberman (1985), the household members available may affect their ability and willingness to adopt and use a new technology. Knepper (2002) also observed larger households tend to have more negative implications on new technology adoption and use than smaller ones.

The family size is an important socio-demographic characteristic because it often determines how much family income can be invested in ICTs and also determines the extent to which a household is able to respond to innovative change. The variable is expected to influence technology adoption negatively. Married couples and family household without children tend to use Internet more than those with children according to Mabe and Oladele (2012). The larger the household size, the larger the negative financial impact on the respondents with implications for Internet access, supported by Mabe and Oladele (2012) findings on extension officers in the north-West Province of South Africa. Also, Rohde and Shapiro (2000) determined that large household size have negative effect on the use of Internet because of cost implications. Families with small household size

tend to use Internet more. In 2013, 41% of the world's households were connected to the Internet and half of them are in the developing world, Sanou (2013) argued.

Marital Status of AEAs

Mabe and Oladele (2012) reported in their study that 70.1 percent of extension officers in the North-West province of South Africa were married. This is because the length of time on the job could connote negative influence on the attitude since Internet is a new innovation. The above research findings are similar to that of Adesope, Asiabaka and Agumagu (2007) about characteristics of extension managers and supervisors on information technology needs in the Niger Delta area of Nigeria. Adesope *et al* established that majority of the respondents had working experience ranging from 5 to 15 years with mean working experience of 15.52 years and most were married. Taylor, Zhu, Dekkers and Marshall, (2012) assess the use of Internet in extension delivery and agriculture in Australia. The study interviews extension workers between 25 and 50 years old and discovers a difference in attitude towards Internet use and agriculture among single extension workers and extension workers who are married and have children. The study indicated that single extension workers originally perceived Internet use as a gateway to better jobs and employment outside extension and agriculture, and why young extension workers with families focus on using Internet to improve their lot.

Income of AEAs

Regarding income, differences in computer ownership and Internet access are narrowing, however, differences can be seen in the way they are used (Hargittai, 2008). People with a higher income are more likely to seek news and product information, make online travel arrangements, and perform work-related activities online than those with lower income (van Deursen, 2010). People forced to use the Internet at school or in libraries have less time to practice, and that might result in a restriction of their Internet skills. Internet use is directly related to person's income level. Mukoko (2012) concluded that income is one of the main drivers of Internet adoption and use in Cameroon.

Work Experience

Research has found that most studies used time on the job or tenure to measure work experience. This is further supported by some researchers suggesting that experience leads to job relevant knowledge gained over time (Fiedler, 2007; McCall, 2004). Since individuals are products molded by every experience in life, past and present experiences continuously have an effect on the development and shape of knowledge, skills, attitudes, ambitions, beliefs and behaviours (McDonald & Siegall, 2008). Judge, Jackson, Shaw, Scott and Rich (2007) found the relationship between work experience and job performance to be influenced by two variables: length of experience and job complexity. Work experience is therefore tends to have an influence on performance and behaviour.

Location of AEAs

According to Al-Hammadany and Heshmati (2011) the location of the Internet user played a significant role on Internet use in developing countries. In Iraq it is more important since at some point in time, access to all forms of Internet was extremely restricted. However, after the liberalization of the market, this sector has witnessed some positive growth, concentrated in the middle areas and in the cities more than the rural areas. Living in the provinces of southern Iraq (that is the rural areas) shows a negative impact on the use Internet compared with the cities and urban areas. Hence, one could expect a positive relationship between urbanization and Internet access and use.

In general, cities are better networked than rural areas (Wunnava & Leiter 2009). This is mostly due to practical and economic reasons. Therefore, it is plausible to assume that countries in which people tend to live in cities or urban areas benefit from higher Internet usage and penetration rates. Studies such as Kay and Xiaoming (2004) and Crenshaw and Robison (2006) have found urban population to have a significant impact on Internet diffusion.

Extension Delivery in Ghana

Maunder (1978) described extension as a system of service which helps farmers through educational procedures, in improving farming methods and techniques, increasing production efficiency and income, bettering their standard of living, and lifting the social and educational standard of rural life. Birner, *et al.,* (2009) defined Agricultural extension as the entire system that support and

facilitate people engaged in agricultural production to solve problems and to obtain information, skills, and technologies to improve their livelihoods and well-being. Christoplos (2010) also defined extension as systems that facilitate farmers access, their organizations and other market actors to knowledge, information and technologies, also facilitate their interaction with partners in research, education, agribusiness, and other relevant institutions, and assist them to develop their own technical, organizational and management skills and practices.

According to Fu and Akter (2012), "Agricultural extension services provide critical access to knowledge, information and technology that farmers require to improve productivity and thus the quality of their lives and livelihoods" (p.3). Fu and Akter (2012) further explained that Agricultural extension services include transferring knowledge to farmers, advising and educating farmers in their decision making, allowing them to clarify their own goals and possibilities, and inspiring desirable agricultural developments.

Agricultural extension service delivery in developing countries started a long time ago (historically) with production-oriented limited extension services for export crops. The focus was later redirected to food production and improved farming techniques (Anandajayasekeram, Puskur, Sindu & Hoekstra, 2008). The rise in the demand for agricultural services subsequently gave rise to many forms of methods, approaches and models to connect researchers, extension agents, producers and consumers (Anderson & Feder 2004). The World Bank sponsored Training and Visit (T&V) extension model, Farmers Field Schools (FFS) and fee-

for-services are the most common approaches. Others are the Commodity approach, Unified extension system and Decentralized extension.

Further, donors (World Bank) subscribe that services must be provided in a different way from the past, stressing on a framework for agricultural service provision that might be effective under current circumstances in developing countries. Agricultural extension is therefore put into a much broader context of a demand-led service market by this framework. Therefore, the term "advisory services" is used, instead of "extension", to include the many non-traditional tasks such as market information, health issues (AIDS), micro-finance, and farmers' self-organization.

Because extension plays a major role in Ghana's agriculture, Kwadwo Baah Wiredu, the then Minister for Finance and Economic Planning, in the presenting the 2006 budget, conceded the inadequacy of funds allocated to extension services in Ghana and therefore recommended the allocation of adequate resources to the sector in order to overcome many challenges facing the agriculture sector. Also, Kwabena Duffour, Minister for Finance and Economic Planning, in presenting the government's 2009 budget statement, supported Baah Wiredu's position by stating that government considered agriculture as Ghana's greatest strength and critical for the country's industrial growth. He consequently announced government's plans to ensure food security, improve incomes, sustain land and environmental management, and improve extension service delivery and irrigation as well as other sub-sectors (Duffour, 2009).

Agricultural Extension Agents in Ghana

The Ghanaian agriculture extension agents are a part of the Ministry of Food and Agriculture. The Directorate of Agriculture Extension Services "oversees agricultural technology diffusion through the management of extension delivery service", and foresees "establishing an efficient and demand-driven extension service in a decentralized system, through partnership between the government and the private sector for the provision of quality service to our clients" (Birner & Anderson, 2007). The DAES is expected to generate extension policy, provide services and information to FBOs and farmers, collaborate with private agencies and NGOs to promote research-extension-farmer linkages, as well as monitoring and evaluating all extension activities organized by MoFA.

The AEAs and DDOs are at the district level, operating in the Municipal and District Agriculture Development Units. These Units report to the Regional Agriculture Development Units, which serve as supervisory agencies for all M/DADUs located within their respective region. The Central Ministry then guides and monitors the activities of the RADUs (MoFA, 2005). District Agriculture Development Officers (DDOs) report to the Deputy District Director, and supervise the AEAs. Their objectives include guaranteeing "effective and efficient delivery of agriculture services to clients, and ensuring that zonal programmes are demand driven and oriented towards promoting agriculture productivity of the district" (MoFA, 2005. p.49). As their principal responsibility is supervising the AEAs, their duties also include providing monthly trainings for

AEAs, monitoring agent work, ensuring participation of AEAs in RELC planning sessions, reviewing reports, mapping routes and guides for AEA activities, and analyzing agriculture failures and successes in the district (MoFA, 2005).

AEAs function at operational areas and are the agriculture public service provider closest to farmers. Their objective is "to advise farmers and other stakeholders in the application and adoption of appropriate technical know-how", and their duties include creating agriculture profiles, contacting farmers and FBOs, assisting farmers in diagnosis of problems, establishing mini-demonstrations, promoting HIV/AIDS and gender awareness, developing viable farmer groups, providing information on credit support and marketing, submitting reports to the DDO, and conducting on farm adaptive trials.

Summary of Literature Review

Since the Internet touches upon many aspects of life, researchers from several disciplines have studied the area including media and communication, sociology, education, and information and library science. Such variety has led to different terminology including 'skill' (Litt, 2013; Hargittai, 2010; van Deursen & van Dijk, 2010; Zimic, 2009), 'competency' (Bubas, Radosevic & Hutinski, 2003), 'literacy' (Potosky, 2002), and 'fluency' (Bunz, 2004). The diversity of perspectives has also led to diversity in assessment styles of people trying to capture an everyday adult/young adult user's basic internet skills. Instruments range from one to dozens of items and utilize multifaceted methods from surveys, interviews, observations to a combination of methodological styles. Some

researchers argue that Internet competencies are "whole" and any attempt to separate them into individual elements runs the risk of distorting the seamlessness and intricacy of literacy practices (Knobel & Lankshear, 2008), leading them to use a global Internet skill survey item.

Conceptual Framework

This study adapted Durand's (1988) conceptual framework which shows the dynamics of competence building. The conceptual framework illustrates how Internet competencies of AEAs is influenced by the three aspects (knowledge, skill and attitude) of Internet competency.

AEAs acquire knowledge about Internet through training, existing knowledge and learning by learning. Skill is the ability to use the Internet to retrieve, process, manipulate and store information which are achieved through practice the use of the Internet, while attitudes or behaviors are AEAs interest or willingness to use the Internet through learning by sharing, conformity and commitments.

The three (3) aspects of competence are interdependent. Learning actually takes place at the same time during the 3 aspects of the framework. For example, Internet competency depends on the knowledge of Internet (how to use it). However, knowledge of how Internet works would mean nothing without the ability or skill to use the Internet, without which AEAs would be left with dead and useless knowledge, while skill without knowledge is very vulnerable. This is because, AEAs will be highly vulnerable to technological change as they build

their competency around only practical skills with little or no knowledge. Without knowledge, they are not in the position to adapt to the change.

Internet competency goes further by highlighting attitude. Attitude has everything to do with willingness to apply ones knowledge and skills. Thus if willingness is lacking knowledge and skill may not be effective. Additionally skills may be built up by continuous practice. Therefore the absence of willingness to practice may jeopardize the acquisition of skills which will also render any knowledge acquired ineffective. Internet competencies of AEAs therefore embodies knowledge, skills and attitudes which in effect affects how AEAs use the Internet.

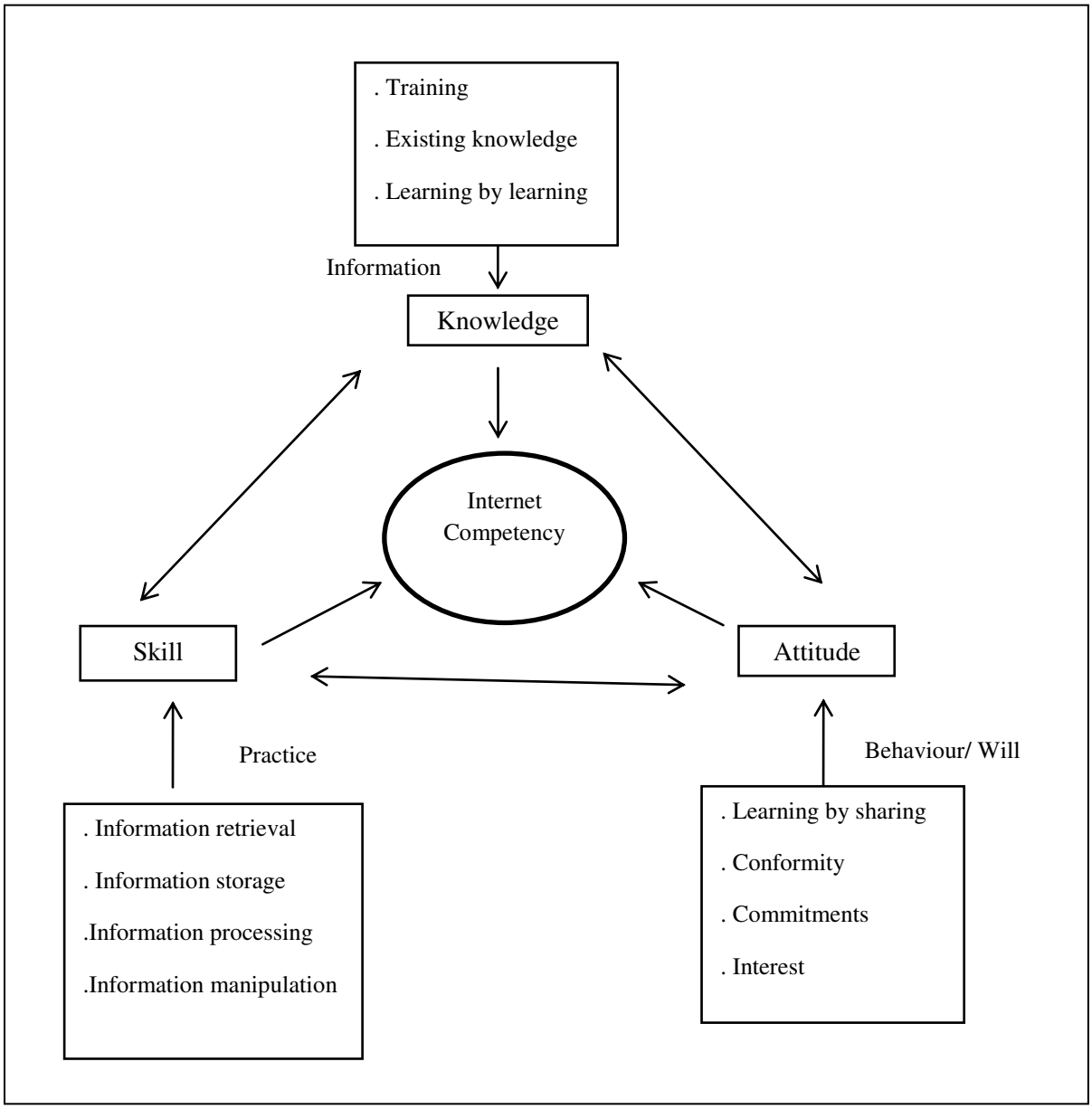

Figure 1: Conceptual Framework for Determining Internet Competency (Adapted from Durand, T. (1998). The alchemy of competence. *Strategic Flexibility*, 303-330).

CHAPTER THREE

METHODOLOGY

Introduction

This chapter describes the procedures and techniques employed to collect and analyse data for the study. As a result, the chapter includes the research design, the study area, the study population, the sampling procedure and sample size and the instrumentation that that were used, data collection and processing and analysis that were carried out as well as the rational for the use of various procedures and techniques.

Research Design

Research design is a blue print for research which indicates which questions to answer, relevant data to collect and how to analyze the data to provide results (Babbie & Rubin, 2010). Moreover, the research design describes the procedure for conducting the study, such as when, from whom and under what conditions data will be obtained. Research design is also meant to provide valid and accurate answers as possible to research questions (McMillan & Schumacher, 2001).

The study design was a descriptive survey and this design was deemed appropriate because survey usually examines a sample for the purpose of making conclusion about the population from which the sample was drawn (Vanderstoep & Johnston, 2009). Surveys are very robust and used to collect large amount of data from many diverse people in a short amount of time. Muijs (2004) had argued that survey research is appropriate for descriptive studies where researchers are interested in examining relationships between variables occurring in particular real-life contexts. For instance, the extent relationship between two or more variables using correlation coefficient and to make predictions. Hence, the design was deemed appropriate (Stanovich, 2007).

Specifically, the design was chosen because the study sought to explore the relationship between dependent variable (Internet competency) and independent variables as well as the best predictor(s) of the dependent variable from the independent variables of the study. Again, this design was chosen because the study sought to answer the question, what are the Internet competencies of AEAs in the Eastern Region of Ghana?

Study area

The study was conducted in the Eastern Region of Ghana. Which occupies a total land area of 19,323 square kilometers, constituting 8.1 per cent of the total land area of Ghana (Ministry of Local Government/ Rural Development and Environment & Maks Publications and Media Services, 2013). The region is the sixth largest region in terms of land area in Ghana and lies between latitudes 6^{o}

and 7° North and longitudes 1°30' West and 0°30' East. The region shares common boundaries with the Greater Accra, Central, Ashanti, Brong Ahafo and Volta Regions. (Ministry of Local Government/ Rural Development and Environment & Maks Publications and Media Services, 2013).

The Ministry of Food and Agriculture (MoFA) operates in all the twenty six (26) municipalities and districts in the region. Each municipality or district is demarcated into four zones, with each zone further demarcated into eight operational areas. The agricultural development unit in each municipality or district is headed by a director. The municipal and district agricultural officers serve as zonal heads or supervisors and divisional heads. The divisions include Crops, Animal production, Women in Agricultural Development (WIAD), Extension, Veterinary services and M.I.S. office. The AEAs are in charge of operational areas within the zones in the districts.

Eastern Region is one of the two pilot regions where e-Agriculture was launched. Eastern Region is also strategically located such that almost every municipal and district capital has access to telecom operators who provide Internet services to users.

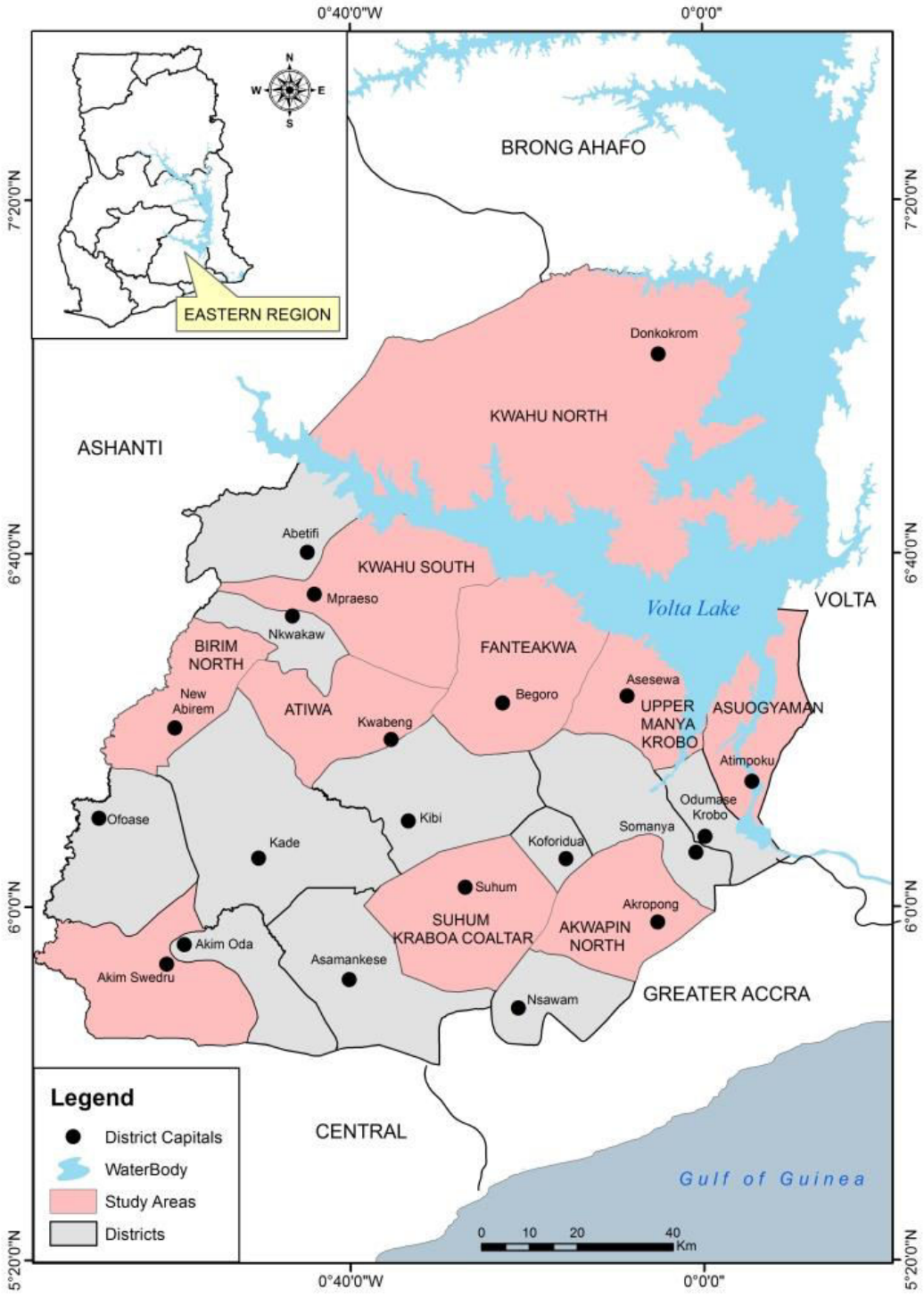

Figure 2: The map of Study Area, Eastern Region of Ghana

Source: Ghana Statistical Service, 2012

Population

The study population comprises all agricultural extension agents in the Eastern Region of Ghana. They number five hundred and fifteen (515) according to the staff lists collated from the regional office of MoFA at Koforidua.

Sample and Sampling Procedure

The sample size is a subset or a portion of the total population while sampling procedure is the manner in which a researcher selects representative sample (Muijs, 2004). A good selection of units of interest ensures fair generalization on the population from the sample chosen (Trochim, 2006). According to Barreiro and Albandoz (2010), the selection of sample size is influenced by the purpose of the study, population size, the risk of selecting a "bad" sample and allowable sampling error. To ensure that the sample size is representative, the table of determining sample size (Krejcie & Morgan, 1970) was used- (Appendix A). According to this table, for population of 500 which is very close to study population of 515, a sample size of 217 would be required to be representative.

The next stage was selection of sample size from each districts and municipality since location was a factor in receiving Internet competency. A stratified proportion sampling procedure was adopted at this stage. The stratified proportional random sampling technique was used to obtain the sample size. According to Sekaran (2003), a stratified random sampling is a "probability

sampling design that first divides the population into meaningful, non-overlapping subsets, and then randomly choosing the subjects from each subset" (p. 424).

The region was stratified into two (2) strata namely municipal and district. Proportional sampling was applied at this stage to obtain the number of respondents in municipals and districts - (Table 1), and then the municipals and districts were selected randomly. After getting the sample municipalities and districts, all AEAs in the sampled municipals and districts were used in the study.

Table 1: Determination of Sample size in Districts and Municipals

District Type	Proportion	Sample size
Municipality	10/26 X 217	83
Districts	16/26 X 217	134
Total		217

Source: Field Survey, 2014

Data presented in Table 2 shows the population of AEAs in each of the randomly selected districts/municipal and sample size drawn to obtain the sample size of 217 for the study.

Table 2: The Sample Size in Municipals/ Districts Used in the Study

Municipality/ Districts	Number of Respondent
Akuapem North	32
Suhum	28
West Akim	25
Asuogyaman	22
Atiwa	20
Birim North	16
Fanteakwa	19
Kwahu North	25
Kwahu South	14
Upper Manya	16
Total	217

Source: Field Survey, 2014

Instrumentation

Questionnaire (Appendix B) was used as the instrument for data collection and this was used because the population was literate. A questionnaire consists of questions or statements related to the objectives of the study, the research questions to be verified and answers to which the respondent is required to complete by writing (Muijs, 2004; Fraenkel & Wallen, 2000). Questionnaire was used because it was considered to be extremely efficient in providing large amount

of data at relatively low cost in a short time (Robson, 2002) and administered to a large number of people at the same time (Fraenkel & Wallen, 1993).

The questionnaire also ensured the privacy of the respondents by reducing or eliminating researchers' influence on respondent(s). Other reasons for the preference of the questionnaire over other methods were its fast way for collecting data with higher chances of being quite valid and reliable. In comparison to other methods of data gathering, the questionnaire has relatively low return rate (Robson 2002; Rose & Grosvenor, 2001; Best & Khan, 1998), however, in this study, the rate of return was 100% because all the AEAs were present at their meetings.

Part of the Internet competency items was adopted from instrument constructed by the Principal supervisor, however, aspects were upgraded using the review of current literature on Internet. The questionnaire was made up of four parts. Part A focused on AEAs demographic background characteristics such as age, sex, level of education, working experience, income, marital status, location. Part B sought information about Internet use and related issues such as availability of Internet, place of use of Internet, purpose and frequency of Internet use. Part C consisted of structured questions (constructs and items) on Internet competencies in terms of knowledge, attitude and skills. The knowledge level items were measured along a 5-point Likert type scale ranging from 1 (very low) to 5 (very high). The attitude was measured along a 5- point Likert type scale ranging from 1 (very low) to 5 (very high) and the skill level was on a scale 1 (very low) to 5 (very high).

Table 3: Interpretations of Likert-Type Scales- for Internet competencies (Knowledge, Attitude and Skill) of Agricultural Extension Agents

Ratings	Intervals	Knowledge	Attitude	Skill
1	1.00-1.44	Very Low	Very Low	Very Low
2	1.45-2.44	Low	Low	Low
3	2.45-3.44	Moderate	Moderate	Moderate
4	3.45-4.44	High	High	High
5	4.45-5.00	Very High	Very High	Very High

Source: Author's construct, 2014

Part D was both open-ended questions and multiple answers. The AEAs were requested to tick the main constraints/challenges that they faced and benefits gained in using the Internet. The last part was open ended for respondents to list suggestion.

Pretesting of Instruments

The questionnaire was pretested between 20th and 27th January, 2014 in two districts namely, Efutu Municipal and Awutu Senya District of Central Region. Thirty five AEAs with similar characteristics as those in the study area responded to the questionnaire. The items on the Likert-type scales were coded into the SPSS version 21 to estimate the internal consistency (reliability) of the items. The Cronbach Alpha coefficients for subscales were 0.995, 0.991 and 0.977 respectively for items on knowledge, attitude and skill subscale (Table 5).

The items on the subscales were considered very reliable based on George and Mallery's (2003) interpretation scale (Table 4). According to their scale, the closer the coefficient is to 1.0, the greater is the internal consistency of the items in the scale.

Table 4: Reliability Interpretation

Alpha Coefficient	Meaning
> 0.9	Excellent
> 0.8	Good
> 0.7	Acceptable
> 0.6	Questionable
> 0.5	Poor
< 0.5	Unacceptable

Source: SPSS for windows step by step: A simple guide and reference (George & Mallery 2003).

Table 5: Reliability Co-efficients of Subscales of the Research Instrument

Variable	Cronbach's Alpha	N of Items
Knowledge	0.99	18
Attitude	0.97	18
Skill	0.99	18

n=35, Source: Pretest Data, 2014

Data collection Procedure

The questionnaire was administered to all AEAs in the sampled districts at the same time during training sessions and monthly meetings. The main advantage was that it gave high rate of response, in this case 100%. Also, the researcher had the opportunity to explain and answer any questions that the respondents had before filling the questionnaire. The District and Municipal Directors of Agriculture were contacted for monthly meeting/training schedule dates which made it possible for the researcher to meet all AEAs. The data was collected between 20th February, and 4th April, 2014.

Data Analysis

Data collected from the field were organised, edited, coded and entered for analysis using the Statistical Package for Social Sciences (SPSS) version 21.0 software for analysis. To describe the demographic characteristics of agricultural extension agents in Eastern Region, frequencies, percentages, mean and standard deviations were computed to describe variables such as age, sex, educational level, income level and years of experience, location and marital status of extension agents. Similarly, frequencies, mean and standard deviations were generated to determine the extent of use of Internet in extension delivery.

To determine the AEAs' Internet competencies, means and standard deviations were generated. A combination of correlational coefficients (Pearson, Point Biserial, Biserial and Spearman) were used to determine the relationships

between Internet competency levels and demographics, work and Internet backgrounds of AEAs. An alpha level of 0.05 was set a priori to test each of the hypotheses. Correlations are statistical measures of association between variables. The correlation coefficients measure the strength and direction of relationship between variables. (Ahiawodzi, 2011; Vanderstoep & Johnston, 2009). Different coefficients were used because the variables were measured differently; therefore, it was not prudent to use a correlation to test for relationship between the variables.

According to Brown (2001), the point-biserial correlation coefficient (*rpbi*) is a statistic used to estimate the degree of relationship between a naturally occurring dichotomous nominal scale and an interval (or ratio) scale, while the biserial correlation coefficient (*rbi*) is appropriate when you are interested in the degree of relationship between two interval (or ratio) scales but for some logical reason, one of the two is more sensibly interpreted as an artificially created dichotomous nominal scale. Pallant (2011) noted Pearson's product-moment correlation (r) describes the strength and direction of the relationship between two variables (usually continuous) or when both scales are interval or ratio. The Spearman's rho is a correlation coefficient suitable for ordinal or ranked data.

A linear multiple regression was used to predict Internet competencies of AEAs from the demographic, work and Internet backgrounds of AEAs. The regression model is given as;

$Y = a + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_{5\ldots} + \beta_{11} X_{11} + \varepsilon$. Where;

Y= Internet competency level; a= constant; $\beta_1 - \beta_n$ = beta coefficients of predictor variables;

X_1= Rank of AEAs; X_2= Marital status of AEAs; X_3= Sex of AEAs; X_4= Location of AEAs; X_5= Years of experience of AEAs; X_6= Age of AEAs; X_7= Level of education; X_8= Monthly salary of AEAs; X_9= Duration of Use of Internet; X_{10}= Training received on Internet; X_{11}= Years of Internet use.

Table 6: The Codes, Sign and Explanatory variables used in the Regression Analysis

Explanatory variables	Codes	Sign	Explanation (Assumption)
Age	Number of years	+	Young age increases the probability of obtaining high Internet competency
Sex	1=Male 0 =Female	+	Probability that males have higher Internet competency than females
Education level	Educational level	+	Higher education increases the probability of high Internet competency acquisition
Monthly salary	Monthly salary	+	Higher salary increases the probability of high Internet competency acquisition
Duration of use of Internet	Number of hours	+	Long hours spent on Internet increases the probability of high Internet competency acquisition
Class	1 = Professional 0 = Technical	+	Higher class increases the probability of high Internet competency
Years of experience	No of Years at MoFA	-	Long years in MoFA decreases the probability of Internet competency

Table 6 continued

Marital status	1= Not married 0= Married	Positive	Probability that, not married have higher Internet competency than married respondents
Location	1 = Rural 0 = Urban	Negative	Rural decreases the probability of use of Internet
Training received	1 = Training on Internet 0 = No Training	+	Training increases the probability of higher Internet competency acquisition
Years of Internet use	Number of years	+	Higher number of years of Internet use increases the probability of acquiring high Internet competency

Source: Author's construct, 2014

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents and discusses the results in line with the objectives of the study. The chapter starts with the discussion on findings on the demographic characteristics of AEAs. Furthermore, the extent of Internet use by AEAs in extension delivery, the level of Internet competencies (knowledge, attitude and skill) of AEAs, and the factors that predict the Internet competencies of AEAs are presented and discussed.

Demographic, Work and Internet Use Background of Agricultural Extension Agents

Age and Sex of AEAs

The data on the age and sex distributions of AEAs are presented in Table 7. Close to one-fifth (19.8%) of respondents are very youthful (aged up to 30 years) while more than half (53.9%) of the AEAs were between 31 and 50 years. The mean age of the respondents of 41.7 years and a standard deviation of 10.8 years indicate that although the ages of respondents highly varied, they are found within the active age bracket of up to 53 years. Age has significant implication for Internet usage. Agwu *et al.* (2008) and Agwu and Chan (2007) found elderly

extension workers, researchers and farmers in Nigeria to be interested in using high technology. With majority of the respondents in their active age, the contrary is expected with AEAs in Eastern Region of Ghana.

Table 7: Age and Sex Distribution of AEAs

	Sex of AEA								
	Male		Female		Total				
Age (years)	Freq	Percent	Freq	Percent	Freq	Percent	Chi square value	df	*p value
21-30	34	15.7	9	4.1	43	19.8	5.05	3	0.168
31-40	51	23.5	6	2.8	57	26.3			
41-50	48	22.1	12	5.5	60	27.6			
51-60	52	24.0	5	2.3	57	26.3			
Total	185	85.3	32	14.7	217	100			

n=217 Source: Field Survey Data, 2014. Mean=41.73 years, S.D=10.78 years
* p<0.05

Table 7 further revealed that 85.3 percent of the respondents were males whilst 14.7 percent were females. This shows that majority of the AEAs were males reflecting high gender difference in staff ratio found in the Ministry of Food and Agriculture in Ghana. The national ratio is about 5 males to 1 female (Ministry of Food and Agriculture, 2010). This finding also conforms to Agwu, *et al.,* (2008) whose study on extension workers, researchers and farmers in Nigeria reveal that majority of them were males. The results also revealed that more than a quarter, 26.3 percent, would be retiring in the next 10 years which implies

employing new staff who may be more interested in using Internet in extension delivery in the Eastern Region of Ghana.

The finding in Table 7 revealed in the Chi-square corrected value of 5.05, degree of freedom of (3) with a related significance level of .168 which is larger than the alpha value of .05, so it can be concluded that the result is not significant.

Marital Status of AEAs

Results from Table 8 show that most of the AEAs (69.6%) were married, while 0.9% are widowed. This is similar to findings of Mabe and Oladele (2012) who reported that 70.1% of extension officers in the North-West province of South Africa were married. Also, Taylor *et al.* (2012) assessed the use of Internet in extension delivery and agriculture in Australia and concluded that a difference in attitude towards Internet use and agriculture among single extension workers and extension workers who are married and have children.

Table 8: Marital Status of AEAs

	Frequency	Percent
Married	151	69.6
Single	54	24.9
Divorced	10	4.6
Widow	2	0.9
Total	217	100.0

n=217 Source: Field Survey Data, 2014.

The study indicated that single extension workers originally perceived Internet use as a gateway to better jobs and employment outside extension and agriculture, and why young extension workers with families without delay focus on using Internet to improve their lot. This implies that majority of AEAs were married with family responsibilities

Years of Experience of AEAs

Table 9 shows that most (66.3%) of the AEAs had work experience ranging from 1-20 years. The mean years of work experience of 15.1 years with standard deviation of 10.6 years show that AEAs have relatively varied experiences in extension. Consistent with findings of Adesope, Asiabaka and Agumagu (2007) about characteristics of extension managers and supervisors on information technology needs in the Niger Delta area of Nigeria. They found that majority of the respondents had work experience ranging from 5 to 15 years with mean work experience of 15.52 years. This is further supported by some researchers suggesting that experience is the job-relevant knowledge gained over time, (Champoux, 2011; Driskill & Brenton, 2005). Since individuals are products molded by every experience in life, our past and present experiences continuously affect the development and shape of knowledge, skills, attitudes, beliefs and behaviours (Steers, 2011). McDaniel, Anderson, and Wildman (2007) found the relationship between work experience and job performance to be influenced by two variables: length of experience and job complexity. Work experience is therefore a central force of influence on performance and behaviour. Since most of the respondents fall within 1 to 20 years of work experience, it is indicative of the

notion that the AEAs are likely to adopt new technologies and to use Internet in extension work.

Table 9: Years of Experience of AEAs

Years	Frequency	Percent
1-10	81	37.3
11-20	63	29.0
21-30	58	26.7
31-40	15	6.9
Total	217	100.0

n=217 Source: Field Survey Data, 2014. Mean=15.10 S.D=10.57

Number of Dependents in Household and Dependents with Internet Knowledge

Generally, the majority of respondents (96.3%) have up to 4 dependents in the household with knowledge on Internet usage. Only a few (3.7%) participants have more (5-8) dependents in household with Internet knowledge. This is encouraging since even one person in the household could be a good resource person to assist the AEA to use the Internet or could be depended upon to provide information on Internet use. However, the larger the household size (6-15), the fewer the number of dependents (1-4) with Internet knowledge (20.7%). Majority (76.5%) of the respondents have few dependents (up to 5) have up to 4 of them with some form of Internet knowledge, but surprisingly few (1.4%) respondents had dependents (11-15) with Internet knowledge. The mean household size of 4

show that the respondents have few dependents in the household, although some have up to 15 dependents. This finding mirrors Mabe and Oladele (2012) study on extension officers in the North-West Province of South Africa which shows majority of the respondents had dependents up to 5. The results indicate that large household sizes have negative effect on the use of Internet and this is because increase in household size reduced access to Internet among AEAs (Mabe & Oladele, 2012). Therefore, the higher the household size, the lower the Internet access.

Table 10: Number of Dependents in Household and Dependents with Internet Knowledge

	Number of dependent with Internet Knowledge					
	1-4		5-8		Total	
Household size (Dependents)	Frequency	Percent	Frequency	Percent	Frequency	Percent
1-5	164	75.6	2	0.9	166	76.5
6-10	43	19.8	5	2.3	48	22.1
11-15	2	0.9	1	0.5	3	1.4
Total	209	96.3	8	3.7	217	100

n=217 Source: Field Survey Data, 2014.
Household size: Mean= 4.0 dependents, S.D= 3.0 dependents.
Dependents with Internet knowledge: Mean= 2.0 dependents, S.D = 1.0 person.

Residence and Working in Operational Area

The results presented in Table 11 reveal that majority (76%) of the AEAs work in rural area. However, half of the AEAs (50.2%) live in rural area. Table 11 further reveals that (69.1%) live in their area of operation. Mabe and Oladele (2012) reported similar findings in their studies in North- West Province, South Africa that majority of extension workers reside in their areas of operation. Zwane (2009) also reported similar findings in Lipopo province of South Africa that extension officers live in their job locations. An individual who uses the Internet in urban areas typically has the opportunity to use the Internet frequently and for longer periods than respondents of rural areas. This is because Internet connectivity is better in urban areas than rural areas (McDonald & Siegall, 2008).

Table 11: Residence and Working in Operational Area

	Area of Operational					
	Rural		Urban		Total	
Residence	Freq	Percent	Freq	Percent	Freq	Percent
Yes	109	50.2	41	18.9	150	69.1
No	56	25.8	11	5.1	67	30.9
Total	165	76.0	52	24.0	217	100

n=217 Source: Field Survey Data, 2014

Educational Level of AEAs

Table 12 shows that majority of the respondents (71.0%) have certificate and diploma degrees in agriculture while only a few of the participants had higher degrees (Masters degree -9.2% and 0.5% PhD degree). This could be due to the

notion that most AEAs were employed with certificate degree. This conforms with Agwu *et al.'s* (2008) that majority of extension workers in Abia and Enugu States of Nigeria had HND certificates while 32.5% had BSc. In contrast, the study by Ahmadpour and Soltani (2012) revealed that about 78% of agricultural extension workers in Iran were BSc and higher degree holders with greater appreciation of the importance of Internet. This implies that all the respondents are literates and should be able to appreciate the use of Internet in their extension duties. In Arokoyo (2005)'s study on ICTs application in Agricultural Extension service delivery in Nigeria, high level of illiteracy was identified as a serious constraint to ICT utilization by extension workers and farmers in Nigeria.

Table 12: Educational Level of AEAs

Educational Level	Frequency	Percent
Certificate	92	42.4
Diploma	62	28.6
Bachelor degree	42	19.4
Master's degree	20	9.2
PhD	1	.5
Total	217	100.0

n=217 Source: Field Survey Data, 2014

Area of Specialization of Agricultural Extension Agents

Figure 3 depicts that majority of AEAs (51.6%) specialized in general agriculture followed by general extension (18%), consistent with the findings presented in Table 12. The agricultural colleges that train AEAs award certificates

in general agriculture while at the first degree level, AEAs can specialize in any of the disciplines such as animal science, crop science, horticulture, agricultural engineering and post-harvest. AEAs with general agricultural extension are those who might have pursued at the Diplomas, BSc or Masters at University of Cape Coast and University of Ghana.

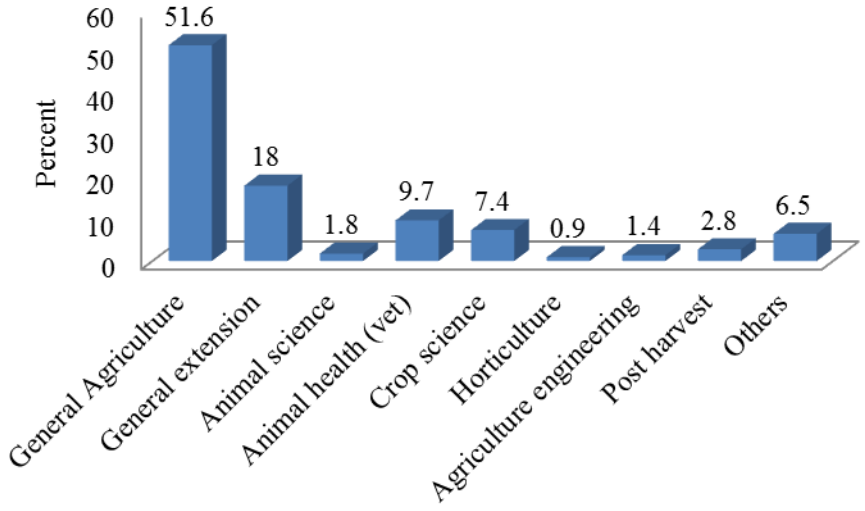

Figure 3: Area of Specialization of Agricultural Extension Agents.
Source: Field Survey Data, 2014

Class of Agricultural Extension Agents

Figure 4 shows that majority of the respondents (62.7%) are in the technical class while 24.9% and 12.4% are in the professional and sub professional class respectively. Technical class are AEAs with certificate, while sub-professional are those with diploma. Also, professionals are extension workers with first degrees and postgraduate degrees. Rank, according to Sarfo and Aseidu

(2013), also influences ones Internet competencies. Computers and Internet were mistakenly perceived as a privilege tool and status symbol for senior staff by the juniors, however junior staffs were noted to have more knowledge than their superiors although they were not allowed to use the Internet facilities in the offices.

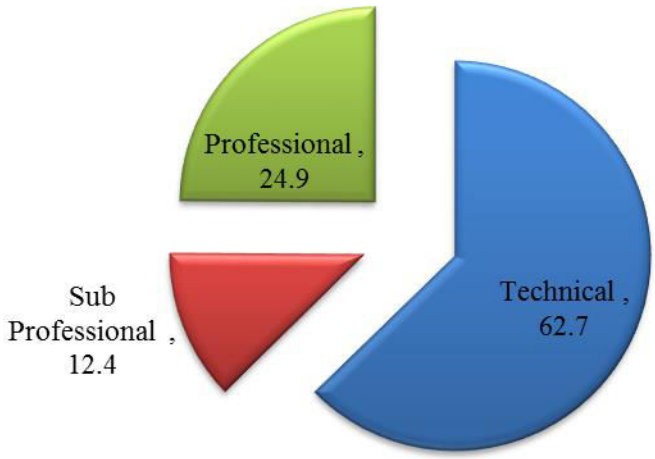

Figure 4: Class of Agricultural Extension Agents.
Source: Field Survey Data, 2014

Job Responsibility of Agricultural Extension Agents

Figure 5 indicates that majority (72.4%) of the AEAs are directly responsible for extension delivery. The rest of the participants are charged with supervision (15.2%) and report writing (5.1%). This implies that majority of AEAs are involved in extension duties. This finding is supported by studies of

Mabe and Oladele (2012) who found that in North-West Province of South Africa extension workers job designation predominantly are extension delivery.

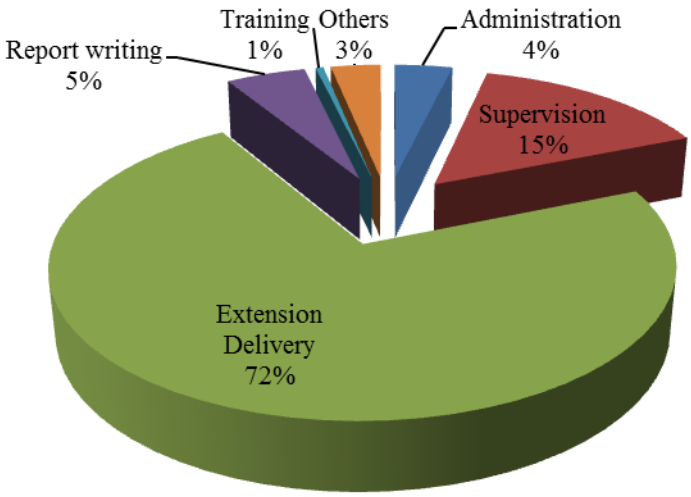

Figure 5: Job Responsibility of Agricultural Extension Agents
Source: Field Survey Data, 2014

Monthly Gross Salary of Respondents

Table 13 presents the monthly salary of respondents and depicts that majority of the respondents (86.1%) receive between GHS 500 and GHS 1,500 per month. The mean salary is GHS 1,156.30, while 14.9 percent of the respondents received salary between GHS 2,001 and 2,500. These figures imply the salary levels of AEAs are very low, and most respondents may not be able to afford personal computer, use Internet and consequently a negative effect on Internet competency. Consistent with a study by Jaaskelainen and Savolaine (2003) in Finland, people with the highest level of network competency had relatively high level of income.

Table 13: Monthly Gross Salary of Respondents

GHS	Frequency	Percent
500-1,000	78	35.9
1,001-1,500	109	50.2
1,501-2,000	19	8.8
2,001-2,500	11	5.1
Total	217	100

n=217 Mean= GHS1,156.30, S.D= GHS407.42 Source: Field Survey Data, 2014.

The Use of Internet in Extension Delivery

This section discusses the use of Internet in extension delivery by AEAs. The components discussed include; availability of Internet, place of use of Internet, frequency of use of Internet, duration of use per day, payment for Internet use and the use of Internet for extension delivery.

Availability of Internet

Table 14 shows that more than half of respondents have Internet available on their mobile phones (55.3%), 51.6% have it on their personal desktop or laptop computers while 32.7% have Internet available on their office desktop or laptop computers. This conforms with findings of Salau and Saingbe (2008) who reported that extension workers in Nasarawa State had access to Internet on their phones while few had access on their office computers. This is also similar to findings of Mtega and Msungu (2013) in Tanzania.

Table 14: Availability of Internet

Source of Internet	Frequency	Percent
On mobile phone	120	55.3
Personal desktop or laptop computer	112	51.6
Office desktop or laptop computer	71	32.7

n=217 Source: Field Survey Data, 2014.

Place of Internet Usage

More than half (56.7%) of the respondents use Internet on their mobile telephone or tablet, while 44.2% of the respondents accessed Internet from Internet café. Also, more than one-third (31.8%) use Internet on the home computer or laptop. However, few (14.7%) respondents indicated that they accessed from office computer or laptop. Results in Table 15 also connote AEAs using multiple Internet points which in itself could potentially improve the sharing of agricultural knowledge and research output between agricultural researchers. This picture shows that access to Internet at office is minimal. This is not surprising since MoFA offices in the region have few computers that are only available to MIS officers, Directors or Typists or office administrators. Therefore, any effort to improve on the use of Internet for extension delivery will need to consider investing in personal mobile phone for extension agents. The findings of this study mirrors that of Salau and Saingbe (2008) who found that Internet on the mobile phone is what most extension workers in selected institutions in Nasarawa State of Nigeria prefer and use for extension work. However, Mtega and Msungu (2013) found contrarily in Tanzania that agricultural extension staff who used

Internet services accessed them from their laptops installed with modems (68.2%) and others in their offices (59.8%) and mobile phone (29.9%). The case in Tanzania was that AEAs were provided with laptops and computers at their offices.

Table 15: Place of Use of Internet

Place of Use of Internet	Frequency	Percent*
Mobile phone / Tablet	123	56.7
Internet café or business center	96	44.2
Home desktop/ laptop computer	69	31.8
Office desktop/ laptop computer	32	14.7

n=217 Source: Field Survey Data, 2014. *multiple response

Frequency of Internet Usage

Findings presented in Table 16 reveal that majority (85.3%) of AEAs never use Internet from computers or laptops at office and 68.2% from home. The results further indicate that AEAs often (mean=3.24, s.d=1.26) use Internet from their mobile telephones and this is corroborated in Table 15 where 56.7% of AEAs indicated that they access Internet from their mobile telephone. This finding is however different from earlier studies by Ogunjobi and Fagbami (2012) who established that in Nigeria more than half agricultural extension agents in Ibadan, Oyo State used Internet every day of the week for their work.

Table 16: Frequency of Use of Internet

Source	Never (0)		Sometimes (once a week)		Often (thrice a week)		Always (every day of the week)		Mean	Sd
	Freq	%	Freq	%	Freq	%	Freq	%		
Mobile Phone internet	94	43.3	33	15.2	33	15.2	57	26.3	3.24	1.26
Computer/ Laptop at Home	148	68.2	21	9.7	22	10.1	26	12	1.66	1.07
Internet café/Business centre	120	55.3	80	36.9	11	5.1	6	2.8	1.55	0.72
Computer/ Laptop at office	185	85.3	19	8.8	6	2.6	7	3.2	1.24	0.66

n=217 Source: Field Survey Data, 2014. *Multiple response

Means were calculated from a scale of 1= Never 2= Somehow (once a week) 3= Often (thrice a week) 4= Always (every day of the week)

Duration of Daily Usage

Table 17 shows that 67.5 percent of the respondents who use Internet stated that they use the Internet between one and two hours a day. On the average, the AEAs spent 1.55 hours in a day using the Internet. The number of hours spent on the Internet a day, according to Rohde and Shapiro (2000), has a direct effect on one's Internet competency level. The longer one stays on the Internet, the higher the competency level.

Table 17: Duration of Daily Usage

Duration (Hours)	Frequency	Percent
Less than 1	23	14.1
1 – 2	110	67.5
3 – 4	18	11.0
5 – 6	10	6.2
7 – 8	2	1.2
Total	163	100

n=163 Source: Field Survey Data, 2014. Mean= 1.55 hours S.D =1.50 hours

Payment for Internet Use

According to Emmanouilides and Hammond (2000), payment for use of Internet has a relationship with activeness in the usage of Internet. They concluded that those who pay for their Internet access are most likely to be active users than those with free access and those whose access to the Internet is paid for by office or employers due to control or restrictions of use by employers (Emmanouilides & Hammond, 2000). The results in Table 18 show that majority of the respondents (89%) pay for use of Internet on their own. Only 2 indicated they have free access and 16 others receive payment from the office. By this analysis, the AEAs could be described as active users.

Table 18: Payment for Internet Use

Payment	Frequency	Percent
Office	16	9.8
Self	145	89.0
Free	2	1.2
Total	163	100

n=163 Source: Field Survey Data, 2014.

The Use of Internet for Extension Delivery

The results presented in Table 19 show that AEAs mainly use Internet to send (82.8%) and receive (83.4%) emails. Furthermore, the Internet is used to access payslips from the Controller and Accountant General Department (77.9%), search for information on agriculture (71.8%), network on social media such as Facebook, Twitter and Whatsapp (64.4%). About two thirds (59.5%) indicated that they use Internet to read news on agriculture. The results further reveal that only few AEAs used the Internet for the purpose of extension delivery, to communicate with farmers (16%); to communicate with researchers (24.5%) and listen to online news on agricultural programme (21.5%). An earlier study conducted by Ruzgar (2005) on the purpose for the Internet use and learning through Internet in Istanbul revealed that internet usage in search of information on agriculture was approaching 100%. It also revealed that sending and receiving emails topped the list, followed by reading news and chatting.

Table 19: The Use of Internet for Extension Delivery

Purpose	Freq	Percent
Receiving e-mail	136	83.4
Sending e-mail	134	82.2
Accessing payslip (e-payslip)	127	77.9
Searching for information on agriculture	117	71.8
Social networking (using Facebook, Whatsapp, Twitter) with AEAs/ farmers	105	64.4
Reading news on agriculture	97	59.5
Chatting with colleagues	91	55.8
Accessing MoFA's Website	87	53.4
Downloading media (audio and video) files on agriculture	65	39.9
Subscribing/ reading newspaper on agriculture	54	33.1
Communicating with other workers using Skype, Viber	53	32.5
Communicating with researchers	40	24.5
Listening to online radio on agricultural programme	35	21.5
Communicating with farmers	26	16
Doing online shopping (agrobased pdfs)	10	6.1

n=163 Source: Field Survey Data, 2014.

Training on the Internet Use

Close to two thirds (59%) of respondents have not received formal training on how to use Internet while (41%) said they have received one form of training or the other on Internet. This situation seemed to be the trend in the sub-region. Yakubu *et al.* (2013) discovered that extension workers in North-West Zone of

Nigeria did not receive training on Internet use, in a study on the effects of socio-economic factors on ICTs adoption among extension workers in the North-West Zone of Nigeria.

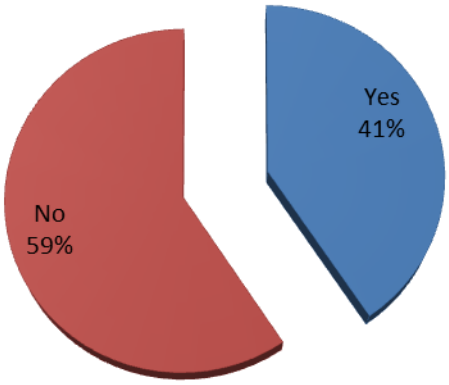

Figure 6: Training on Internet Use.
Source: Field Survey Data, 2014

Nature of Training Received on the Use of Internet

Table 20 presents data on the nature of training received on the use of Internet by respondents. The result shows that self-tutoring (50.7%) is a major means of receiving training on Internet among AEAs. This is in line with Ogunjobi and Fagbami (2012) findings that most of the agricultural extension workers and researchers in Ibadan, Oyo State acquired Internet knowledge through self-development (self-tutoring). Less than a third (29%) have formal training on Internet as part of education received at the university or colleges. Also, about a quarter (23.5%) of respondents were taught by colleagues, 11.5% had training

from business centres or Internet cafes whilst few (9.2%) had training from workshops or seminars and professional courses sponsored by MoFA. This could be due to the increase in the number of AEAs that have access to mobile phones and Internet facilities at their disposal which gave them the chance to learn on their own.

Table 20: Nature of Training Received on the Use of Internet

Nature	Frequency	Percent
Self-tutoring	110	50.7
Formal training (university/ college)	63	29.0
Colleagues	51	23.5
Internet café/ Business centre	25	11.5
Professional course/ workshop/ seminar sponsored by MoFA	20	9.2

n=217 Source: Field Survey Data, 2014.

Number of Years AEAs have used Internet

The number of years AEAs have been using Internet is presented in Table 21. Majority of AEAs (58.2%) have used Internet for up to 5 years, this was followed by 33.2 percent of them who had used Internet between 6 and 10 years. Few (6.2%) and (2.4%) had used Internet between 11- 15 years and less than a year respectively. The number of years one is exposed to the Internet tends to increase ones Internet competency level. The longer the years one uses Internet, the higher the Internet competency level. This implies that majority of AEAs should have considerably high Internet competency level in MoFA.

Table 21: Number of Years AEAs have used Internet

Years	Frequency	Percent
Less than 1	4	2.4
1 – 5	95	58.2
6 – 10	54	33.2
11 – 15	10	6.2
Total	163	100.0

n=163 Source: Field Survey Data, 2014. Mean =4.78 years S.D=3.32 years

Competencies of AEAs in the Use of the Internet

Competencies of AEAs in the use of Internet are discussed under three (3) general areas namely; accessing Internet competencies, communication with Internet competencies and data retrieval and manipulation using Internet competencies.

Competencies of AEAs in Accessing Information on the Internet

Table 22 presents data on the competencies of AEAs in accessing information on the Internet and the table demonstrates that the overall competencies of AEAs in accessing information on the Internet is moderate (composite mean=2.90, s.d= 1.36). While they have high attitude (composite mean= 3.61, SD= 1.19), they have moderate knowledge (composite mean = 2.62, SD= 1.50) and skills (composite mean= 2.49, SD= 1.40) in accessing information from the Internet. Specifically, the AEAs perceived the attitude, knowledge and

skills for competencies in using search engines, entering web address, finding pages recently used, navigating pages on web site, using URL, and favourite bookmarks to be moderate (means < 2.4). However, there were great variance in opinion of respondents in accessing information on the Internet (composite mean> 1.0).

Table 22: Competencies of AEAs in Accessing Information on the Internet

Area	Attitude		Knowledge		Skill		Competency	
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
Using a search engine (Google, Internet explorer) to locate information	3.80	1.18	2.86	1.59	2.62	1.48	3.09	1.42
Finding pages recently viewed	3.61	1.17	2.64	1.45	2.53	1.41	2.93	1.34
Navigating pages on the internet	3.58	1.18	2.53	1.48	2.48	1.40	2.86	1.35
Using URL to locate website	3.47	1.20	2.50	1.46	2.36	1.34	2.78	1.33
Using favourites (bookmarks) for quick viewing	3.53	1.22	2.42	1.42	2.33	1.34	2.76	1.33
Composite Mean	3.61	1.19	2.62	1.50	2.49	1.40	2.90	1.36

n=217 Source: Field Survey Data, 2014.

Means were calculated from a scale of 1 – 1.44 = Very Low, 1.45 – 2.44 = Low, 2.45 – 3.44 = Moderate, 3.45 – 4.44 = High, 4.45 – 5.00 = Very High.

Communication with Internet Competencies of AEAs

Table 23 shows that communication with Internet competencies of AEAs is moderate (composite mean=2.93, s.d=1.36). While they have high attitude (composite mean =3.61, s.d=1.18), they have moderate knowledge (composite

mean=2.66, s.d=1.49) and skills (composite mean= 2.52, s.d=1.40) in communication regarding Internet competencies. Specifically, the AEAs perceived the knowledge and skill for competencies in accessing e-mails, creating e-mail account, sending message to individuals, sending message to multiple recipients, and attaching files or pictures to e-mails to be moderate (means < 2.4). However, these were in great variance with the opinions of AEAs in communicating with discussion (composite mean > 1.0).

Table 23: Communication with Internet Competencies of AEAs

Area	Attitude		Knowledge		Skill		Competency	
	Mean	s.d	Mean	s.d	Mean	s.d	Mean	s.d
Accessing e-mails	3.77	1.15	2.87	1.56	2.67	1.47	3.10	1.39
Creating e-mail account	3.71	1.16	2.84	1.50	2.59	1.44	3.05	1.37
Sending message to individuals	3.63	1.13	2.79	1.52	2.63	1.42	3.02	1.36
Sending message to multiple recipients	3.57	1.19	2.66	1.50	2.54	1.41	2.92	1.37
Attaching files/ pictures to e-mails	3.57	1.21	2.65	1.50	2.51	1.40	2.91	1.37
Communicating with discussion newsgroup	3.40	1.25	2.12	1.33	2.18	1.26	2.57	1.28
Composite Mean	3.61	1.18	2.66	1.49	2.52	1.40	2.93	1.36

n=217 Source: Field Survey Data, 2014.

Means were calculated from a scale of 1 – 1.44 = Very Low, 1.45 – 2.44 = Low, 2.45 – 3.44 = Moderate, 3.45 – 4.44 = High, 4.45 – 5.00 = Very High.

Internet Data Retrieval and Manipulation Competencies of AEAs

Table 24 presents data on Internet data retrieval and manipulation competencies of AEAs and indicates that the overall competencies of AEAs in Internet data retrieval and manipulation competencies is moderate (composite mean=2.86, s.d=1.35). While they have high attitude (composite mean=3.51, s.d= 1.22), they have low knowledge (composite mean=2.40, s.d=1.42) and skills (composite mean=2.37,s.d=1.33) in Internet data retrieval and manipulation competencies.

Table 24: Internet Data Retrieval and Manipulation Competencies of AEAs

Area	Attitude		Knowledge		Skill		Competency	
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
Finding information in the Internet address book	3.64	1.17	2.72	1.50	2.54	1.38	2.97	1.35
Accessing files (PDF,GIF,JPG) from the Internet	3.58	1.21	2.51	1.47	2.48	1.38	2.86	1.35
Accessing e-journals	3.43	1.24	2.26	1.38	2.28	1.30	2.66	1.31
Download files from the internet	3.63	1.20	2.64	1.56	2.51	1.43	2.93	1.40
Use an online library catalog	3.29	1.25	2.01	1.28	2.10	1.20	2.47	1.24
Composite Mean	3.51	1.22	2.40	1.42	2.37	1.33	2.76	1.32

n=217 Source: Field Survey Data, 2014.

Means were calculated from a scale of 1 – 1.44 = Very Low, 1.45 – 2.44 = Low, 2.45 – 3.44 = Moderate, 3.45 – 4.44 = High, 4.45 – 5.00 = Very High.

Specifically, the AEAs perceived the knowledge and skills for competencies in finding information in the Internet address book, accessing files

(PDF, GIF, JPG) from the Internet and downloading files from the Internet to be moderate (means>2.4). However, knowledge and skill competencies for accessing e-journals and the use of an online library catalog are low (means <2.4).

Overall Internet Competency Level of AEAs

Table 25 summarizes the overall Internet competency level of AEAs. While it shows that the overall Internet knowledge (composite mean=2.56, s.d=1.47) and the overall Internet skills (composite mean=2.46, s.d= 1.38) of AEAs is moderate, they have high attitude (composite mean= 3.58, s.d=120).

Table 25: Overall Internet Competency Level of AEAs

Area	Attitude		Knowledge		Skill		Competency	
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
Competencies of AEAs in Accessing Information on the Internet	3.61	1.19	2.62	1.50	2.49	1.40	2.90	1.36
Communication with Internet Competencies of AEAs	3.61	1.18	2.66	1.49	2.52	1.40	2.93	1.36
Internet Data Retrieval and Manipulation Competencies of AEAs	3.51	1.22	2.40	1.42	2.37	1.33	2.76	1.32
Composite Mean	3.58	1.20	2.56	1.47	2.46	1.38	2.86	1.35

n=217 Source: Field Survey Data, 2014.

Means were calculated from a scale of 1 – 1.44 = Very Low, 1.45 – 2.44 = Low, 2.45 – 3.44 = Moderate, 3.45 – 4.44 = High, 4.45 – 5.00 = Very High.

This follows the findings of Isiaka, Lawal-Adebowale and Oyekunle (2009) who reported that extension workers in Southwest States of Nigeria were moderately aware (knowledgeable) of the existence ICTs (including Internet) potential in

extension services delivery. The findings in Table 25 further suggest that the overall Internet skills of AEAs is moderate (mean=2.46, s.d= 1.38).

The generally high attitude towards the use of Internet is an important indicator of willingness and first step in effective Internet integration in agricultural extension delivery. The finding is in agreement with Ahmadpour and Soltani (2012) and Yaghoubi (2009) who found that extension workers had high and positive attitude towards the use of Internet in their work.

Benefits Respondents Derive in Using Internet

Results in Table 26 indicate that AEAs have obtained a lot of benefits from using Internet in extension delivery. The majority (89%) of AEAs indicated that the Internet is a major source of upgrading knowledge on agriculture. Again, 87.2% of AEAs indicated that Internet has provided them with an easy and timely means of accessing information on their mobile telephones or computer.

Table 26: Benefits Respondents Derive in Using Internet

Benefits	Frequency	Percent
Upgrade of knowledge on agriculture	146	89.0
Easy access to information on agriculture	143	87.2
Improved communication with AEAs	121	73.8
Reduced transport cost	117	71.3
Access to free software specialized to extension delivery	67	40.9

n=164 Source: Field Survey Data, 2014.

Findings further revealed that 73.8 percent of respondents had improved communication with colleague AEAs, reduced transport cost (71.3%), and access to free specialized software on extension delivery (40.9%). The findings generally point to the assertion that AEAs derive benefit from using Internet for extension delivery confirming earlier views of scholars that Internet is a relevant tool in extension delivery. Moreover, Internet usage in extension delivery can improve the quality of service provided as it enable better access to relevant and timely information, as well as linking them to their colleague AEAs.

Constraints /Challenges AEAs Faced when Using Internet

Most (78.5%) of the AEAs expressed high cost, especially purchasing of bundles, as a constraint to using Internet in extension delivery. Poor Internet speed and slowness in accessing Internet were, as indicated by 72.4% of AEAs, another major constraint respondents face while using the Internet. This is similar to the findings of a study in Nigeria by Ogunjobi and Fagbami (2012) where more than two-thirds (61.3%) indicated that there is limited connectivity to rural areas where they work and this poses a challenge to their use of Internet. High cost of computers was also indicated by 58.9% of the AEAs as a challenge to their use of Internet for extension delivery. Close to a third (30.7%) of AEAs indicated that information retrieval on the Internet was a challenge to them. Ogunjobi and Fagbami (2012) had earlier found that to be associated with agricultural extension and researchers in Ibadan, Oyo State of Nigeria.

Table 27: Constraints /challenges AEAs Faced in Using Internet

Constraints /challenges	Frequency	Percent
High cost of Internet (Internet bundle)	128	78.5
Poor Internet speed/ slowness in accessing Internet	118	72.4
Very limited or non-existent connectivity in rural area	100	61.3
High cost of computers	96	58.9
Inadequate information retrieval skills	50	30.7

n=163 Source: Field Survey Data, 2014.

The Relationships between Internet Competency and Backgrounds (Demographic, Work and Internet) of Agricultural Extension Agents

A correlation table showing the relationship between Internet competency and demographic, work and Internet backgrounds of AEAs is presented in Table 28. To establish the relationship between Internet competency and background characteristics (demographic, work and Internet), variables were estimated as follows: the overall Internet competency was estimated as composite mean (Y) from knowledge, attitude and skill.

Y = Internet competency

X_1 = Rank (1= Technical officer, 2= Production officer, 3= Agriculture officer.

X_2 = Marital status (1= Not married, 0= Married)

X_3= Sex (1= Male, 0= Female)

X_4 = Location (1= Rural, 0= Urban)

X_5 = Years of working Experience (Years)

X_6 = Age (Years)

X_7 = Educational Level (1= Certificate, 2= Diploma, 3= Bachelor degree, 4= Master's degree, 5= PhD).

X_8 = Monthly Salary (Ghana cedis)

X_9 = Duration of Use (Hours)

X_{10} = Training (1= Training, 0= No training)

X_{11} = Years of using Internet (Years)

There were significant relationships between Internet competency and ten (10) of the background variables (independent) except in the case sex (r=.040; p<.562) at 0.05 alpha level. The finding mirrors that of Anandarajan, Simmers and Igbaria (2000) who found that sex has no relationship with Internet competency and Internet usage of US employees at their workplace. This implies that sex had no effect on whether an AEA use Internet or not. The null hypothesis that "there is no significant relationship between sex of AEAs and Internet competency" is accepted and the alternative hypothesis rejected.

There were positive and substantial significant (Davis, 1971) relationships between AEA's Internet competency and educational level (r=.665; p<.001), years of using Internet (r=.652; p<.000), training (r=.580; p<.001) and rank (r=.523; p<.001). These positive relationships imply that educational level, years of using Internet, training and rank contribute to increases in Internet competency attained by AEAs. Education plays a significant role in creating awareness and interest in innovations and also fundamental to understanding the usage and functionalities of

the Internet (Eden & Ofre, 2010). This implies that the kind of education and training AEAs have about the Internet influences the competency. For example,the more trainings and higher education AEAs have, the higher their competency. Therefore, the null hypotheses that "there are no significant relationships between educational level, years of using Internet, training and rank and Internet competencies" are rejected, and the alternative hypotheses are accepted.

There was a positive and moderate significant relationship (Davis, 1971) between AEA's Internet competency and duration of Internet use ($r=.463$; $p<.001$). This implies that the duration of hours one uses the Internet affects the competency; the longer one uses the Internet the higher the competency (Okay, 2010). Therefore, the null hypothesis that "there is no significant relationship between duration of Internet use and Internet competencies" is rejected, and the alternative hypothesis is accepted.

There were negative and moderate significant relationship (Davis, 1971) between AEA's Internet competency and age ($r=-.486$; $p<.001$), years of working experience ($r=-.486$; p.001), monthly salary ($r=-.315$; $p<.001$) and location ($r=-.312$; $p<.001$). These findings support Rohde and Shapiro (2000) assertion that level of Internet competency falls with age and years of experience. The younger extension workers use Internet more than veteran extension workers and for that matter have higher Internet competency than the aged extension agents. Therefore, the null hypotheses that "there are no significant relationships between age, years of working experience, monthly salary and location and Internet competencies" are rejected, and the alternative hypotheses are accepted.

Table 28: Distribution of Relationship between Internet Competency and Demographic Background (Work and Internet) of Agricultural Extension Agents

Independent variables	Correlation Coefficient (r)	Significance (p)	Type of correlation	Strength of relationship
Rank X_1	0.523**	0.001	Biserial	Substantial
Marital status X_2	0.246**	0.001	Biserial	Low
Sex X_3	0.040	0.562	Point Biserial	-
Location X_4	-0.312**	0.001	Biserial	Moderate
Years of Experience X_5	-0.486**	0.001	Pearson	Moderate
Age X_6	-0.486**	0.001	Pearson	Moderate
Education level X_7	0.665**	0.001	Spearman	Substantial
Monthly salary X_8	-0.315**	0.001	Pearson	Moderate
Duration of use X_9	0.463**	0.000	Pearson	Moderate
Training X_{10}	0.580**	0.001	Biserial	Substantial
Years of using Internet X_{11}	0.652**	0.000	Pearson	Substantial

Source: Field Survey Data, 2014. **. p< 0.01 *. p< 0.05

The negative correlation found between monthly salary and Internet competencies are not surprising as the aged were more experienced and obtain high income; hence, the inverse relationships. This finding is inconsistent with Rohde and Shapiro's (2000) finding that income has positive relationship with Internet competency level. The explanation for this finding is that income or monthly salary of staff of MoFA increases with years of experience. The negative substantial relationship (Davis, 1971) found between AEAs' age and their Internet

competency (r=-.486; p<.001) implies that younger respondents tend to have higher Internet competency than older respondents.

Results in Table 28 also indicate a low and positive significant relationship (r=.246; p<.001) between AEA's Internet competency and marital status. In other words, married AEAs were more competent in usage of Internet than unmarried AEAs. Therefore, the null hypothesis that "there is no significant relationship between marital status and Internet competencies" is rejected, and the alternative hypothesis is accepted.

Predicting Internet Competency From the Demographics, Work and Internet Backgrounds of Agricultural Extension Agents.

Collinearity Diagnostic Test from Demographics, Work and Internet background of Agricultural Extension Agents

To predict Internet competencies from the background variables of AEAs, the collinearity diagnostic test was considered. According to Li and Valliant (2011) collinearity of predictor variables in a linear regression refers to a situation where explanatory variables are highly correlated with each other. Collinearity can cause strange results when attempting to study how well individual independent variables contribute to an understanding of the dependent variable. In general, collinearity can cause wide confidence intervals and strange 'p' values for independent variables.

Variance Inflation Factor (VIF) measures the amount by which the variance of a parameter estimator is inflated due to predictor variables being correlated with each other. The variance inflation factor allows a quick measure of how much a variable is contributing to the standard error in the regression. When significant collinearity issues exist, the variance inflation factor will be very large for the variables involved. After these variables are identified, there are several approaches that can be used to eliminate or combine collinear variables, resolving the collinearity issue (Dupuis & Victoria-Feser, 2013; O'Brien, 2007). VIF close to 10 is a cause for worry, while tolerance of 1 indicates no collinearity while tolerance value of zero (0) indicates a severe collinearity problem (Bosompem, Annor-Frempong & Achiaa, 2013; Cohen *et al*. 2003). The result of the collenearity test presented in Table 29 shows no collenearity issues, therefore, the ten (10) independent variables were used for the prediction.

Table 29: Collinearity Diagnostic Test from Demographics, Work and Internet background of Agricultural Extension Agents

Independent Variable	Variance Inflation Factor	Tolerance	p-value
Years of Internet use(X_{11})	1.860	0.538	0.000
Training (X_{10})	1.144	0.874	0.000
Duration of use (X_9)	1.099	0.910	0.005
Location (X_4)	1.322	0.757	0.006
Age (X_6)	1.305	0.767	0.002
Level of education (X_7)	1.672	0.598	0.022
Rank (X_1)	1.288	0.777	0.020

Table 29 continued

Sex (X_3)	1.000	1.000	0.979
Marital status (X_2)	1.036	0.965	0.028
Years of working experience (X_5)	1.191	0.839	0.044
Monthly salary (X_8)	1.004	0.996	0.153

n=217 *p<0.05 Source: Field Survey Data, 2014.

Results in Table 30 show that years of Internet use (X_{11}), training (X_{10}), location (X_4), duration of use (X_9), age (X_6), and educational level (X_7) were the best predictors of Internet competency level of AEAs in the study. The adjusted R-squared of 0.563 suggests that the six predictor variables explain about 56.3% of the variance/variation in Internet competency. Individually, years of Internet use is contributing 39.4% to the variation, while training contributes (7.8%), location (3.7%), duration of use (2.6%), age (1.6%), and educational level (1.2%).

The contribution of years of Internet use, although, mirrors work done by Scheer (2011) on extension educators in U.S.A, the 39.4% of the variance or variation in Internet competency ascribed to how long educators in U.S.A had used Internet. Contrary, Yakubu (2011) had reported that training of extension workers in north-west zone of Nigeria in the use of Internet contributed 25% of variation in extension worker's competency level. In this case, education contributed only 1.2% in the variation. Educational level of AEAs is generally low compared to those in Singapore.

Table 30: Stepwise Regression of Internet Competency of AEAs

Predictors	Step of Entry	Beta (standardized)	R^2	Adj R^2	Adj R^2 Change	S.E.E	F. Reg.	F. Sig*
X_{11}	1	0.344	0.398	0.394	0.394	0.705	106.465	0.000
X_{10}	2	0.208	0.479	0.472	0.078	0.658	73.512	0.000
X_4	3	-0.157	0.518	0.509	0.037	0.635	57.029	0.000
X_9	4	0.166	0.547	0.535	0.036	0.618	47.614	0.002
X_6	5	-0.184	0.564	0.551	0.016	0.607	40.691	0.012
X_7	6	0.156	0.579	0.563	0.012	0.599	35.750	0.022

n=217*p<0.05 Source: Field Survey Data, 2014.

The equation for the multiple linear regression model for Internet competency for extension delivery is provided as:

$Y= 2.787 + .344X_{11} + .208X_{10} + -.157\ X_4 + .166X_9 + -.184\ X_6 + .156\ X_7 + \varepsilon$

$Y= 2.787$ if $\beta_{11} = \beta_{10} = \beta_4 = \beta_9 = \beta_6 = \beta_7 = 0$.

Where;

Dependent Variable (Y) = Internet Competency

a= constant

ε = error term

X_{11} = Years of Internet use

X_{10}= Training

X_4 = Location

X_9 = Duration of use

X_6 = Age

X_7 = Educational level

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents the summary of key findings, conclusions, recommendations of the study and areas for further studies, based on the findings of this study.

Summary of key findings

The low information flow between AEAs and farmers necessitated the Ministry of Food and Agriculture to introduce e-extension which is based on the use of Internet for extension delivery. The application, however, of Internet in agricultural extension delivery depends on the level of knowledge and skills of AEAs on Internet. The study assessed the level of competencies of agricultural extension agents in the use of Internet for extension delivery in the Eastern Region of Ghana.

The study used a descriptive correlation survey design to collect data from 217 AEAs selected from ten (10) districts and municipalities in the Eastern Region of Ghana. A stratified proportional sampling technique was used to select AEA respondents. Frequencies, percentages, means, standard deviations, correlation and linear multiple regression were the statistical tools used to analyze the data. The

summary of major findings according to the objectives of the study is presented in the following paragraphs.

The study revealed that MoFA had more male staff than female in Eastern Region. Close to one fifth were very youthful. However, the majority of AEAs were married. More than three forth of AEAs had household size between one and five. Majority of AEAs work in rural areas, and have had education up to certificate level and are frontline staff. The mean years of experience of AEAs was 15 years with mean monthly salary of GH₵ 1,156.00.

Whilst more than half of AEAs had Internet available on mobile telephones, one third of them had it on personal computers. AEAs often use Internet three times in a week for extension delivery. AEAs use Internet for one and half hours per day with majority of them using the Internet for close to five years, even though many of these respondents have never received training on how to use Internet.

Majority of AEAs mainly use Internet to send and receive e-mails, access payslips from the Controller and Accountant General Department, search for information on agriculture, social networking and read news on agriculture.

The overall attitude of AEAs towards Internet was high. Their knowledge and skills were respectively moderate and low. The overall Internet competency level of AEAs was moderate. Specifically, competencies of AEAs in accessing information on the Internet, communication with Internet and data retrieval and manipulation competencies of AEAs were also moderate.

With the exception of sex, there were significant relationship between Internet competency level and rank, marital status, location, work experience, age, educational level, monthly salary, duration of use, training and years of using internet. This implies that sex has no relationship with AEAs Internet competency level. Also the level of education and training AEAs had received had relationship with Internet competency; the more training AEAs have received on Internet use and the higher their level of education, the higher the competency level. The longer AEAs use the Internet the more they become competent. However, as the age and years of experience of AEAs increases, their level of Internet competency decreases. The younger extension workers have higher Internet competency than the older and experienced extension workers.

Training, duration of Internet use, age, location and educational level of AEAs explained more than half (56%) of the variance in Internet competencies of AEAs. The main challenges faced by AEAs in using Internet are; high cost of Internet usage, poor internet speed or slowness in accessing Internet, poor connectivity to Internet in rural areas of the districts and very limited or non-existence information retrieval skills of AEAs.

Conclusions

Based on the summary of the findings of the study, the following conclusions were drawn:

1. The AEAs in Eastern Region are males with low level of education and mainly work at the rural area.

2. The AEAs have worked for many years but receive low salaries.
3. AEAs use Internet on mobile phones few hours in a week for the past five years.
4. The AEAs had not received formal training on the use of Internet.
5. AEAs use Internet to deliver extension via sending and receiving e-mails, checking pay slips and read news on agriculture.
6. AEAs have high attitude to use Internet but low to moderate knowledge and skills.
7. There was significant relationship between Internet competency of AEAs and the ten independent variables of the study. There is no differences between male and female AEAs in terms of their Internet competency level. Specifically the more training AEAs received on Internet use and the higher their level of education, the higher the competency level. Further, the longer time AEAs use the Internet the more competent they become. However, the more experienced AEAs have the lower level of Internet competency. AEAs with higher income have lower Internet competency.
8. The number of years of using Internet, training, duration of Internet use, age, location and education level mainly influence the Internet competency level of AEAs.

Recommendations

Based on the conclusions of the study, the following recommendations are made:

1. MoFA should consider recruiting or employing more female AEAs to attain the gender parity required in extension service. This is because programmes such as food and nutrition and the health of female farmers require the female touch for effective delivery.
2. The low level of education of extension agents could be improved by providing incentives such as study leave with pay to mid-career staff to take advantage and pursue the Diploma and the BSc. Degree programmes in the universities in Ghana. MoFA should also consider recruiting as a matter of urgency more graduates directly into the service so that more extension agent with higher education will be in the service.
3. There should be collaboration between MoFA and Internet service providers such as MTN or Vodafone to improve Internet access in the rural operational areas. As a matter of urgency, the Ghana government through parliament should enact a law that will force Internet service providers (ISP) to improve rural connectivity as part of their social responsibility. Incentives such as tax relief could be offered to (ISPs) who improve Internet access to rural areas. Specialized mobile phones and tablets that can access Internet easily should be procured for AEAs by MoFA, especially to those in rural areas so that it can help improve Internet access.

4. MoFA for that matter the Government of Ghana should consider increasing the salaries of AEAs. The extension work should be considered as professional work and given a market value as in the case of community health workers. Incentive packages such as rural allowance could be given to extension agents who have worked for many years in rural areas. This will motivate them to work hard even if they continue to receive the low salaries.
5. It was revealed that AEAs use Internet on mobile phones for few hours in a week for the past five years. This is so because AEAs pay for their use of Internet and are not able devote their little salaries to buy more credit to use the Internet for longer time and effectively for extension delivery. Therefore MoFA should provide airtime (Internet bundle) or funding for those AEAs who are using Internet for extension delivery or liaise with Internet service providers to provide toll free Internet for AEAs. This will encourage the AEAs to use the Internet for longer time and effectively.
6. AEAs should be given sufficient in-service training on how to use Internet for extension delivery and to acquire the requisite knowledge and skills in Internet use since some of the AEAs had not received formal training on the use of Internet. Also, training on how to use Internet influences one's Internet competency level. Therefore, training workshops on Internet usage should be organized by MoFA for all AEAs in Eastern Region. This would bring the AEAs irrespective of their educational level can enhance knowledge acquisition on the use of Internet for improved extension delivery in Eastern

Region. MoFA should incorporate Internet training in their regular training programmes, to enhance AEAs Internet knowledge.

7. Currently AEAs are using Internet to deliver extension via sending and receiving e-mails, checking pay slips and reading news on agriculture. AEAs should be encouraged by MoFA to use other means such as social media to communicate with farmers and researchers and for downloading agricultural journals, as a way of ensuring access to Internet for extension delivery.
8. Training workshop by MoFA to improve AEAs Internet competencies should focus more on AEAs with low levels of educations, those working in rural areas, those with less frequent use of Internet and those with less number of years in the use of Internet. This will upgrade their knowledge and skills to enable them function well like their other colleagues.

Suggested Area for Further Study

The following are suggested for further research:

1. A nationwide study of Internet competency level of AEAs in Ghana. Comparison could be made among the various regions so that policy on Internet use will target specific region.
2. Comparative study of Internet competency for researchers, extension agents and farmers.
3. A study of how the social media platform on the Internet could be used to communicate agricultural information among farmers, extension agents and researchers.

REFERENCES

Abankwah, P. (2004). *Perceived competency levels and training needs of agricultural extension agents in communication methods and teaching aids in the Greater Accra Region of Ghana.* (Unpublished master's thesis). University of Cape Coast, Cape Coast. Ghana.

Abdon, B., Raab, R., & Ninomiya, S. (2008). e-Learning for international agriculture development: Dealing with challenges. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 4* (1), 80-94.

Adebayo, E. L., & Adesope, O. M. (2007). Awareness, access and usage of information and communication technologies between female researchers and extensionists. *International Journal of Education and Development using Information Communication and Technology (IJEDICT), 3* (1), 85-93.

Adekunle, P. A., Omoba, R. O., & Tella, A. (2007). Attitudes of Librarians in selected Nigerian universities toward the use of ICT. *Library Philosophy and Practice*, *9* (2), 1-8. Retrieved May 12, 2014, from http://digitalcommons.unl.edu/libphilprac/159

Adesope, O. M., Asiabaka, C. C., & Agumagu, A. C. (2007). Effect of personal characteristics of extension managers and supervisors on information technology needs in the Niger Delta area of Nigeria. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT), 3* (2), 4-15.

Agwu, A. E., Uche-Mba, U. C., & Akinnagbe, O. M. (2008). Use of information communication technologies (ICTs) among researchers, extension workers and farmers in Abia and Enugu States: Implications for a national agricultural extension policy on ICTs. *Journal of Agricultural Extension, 12* (1), 37-49.

Agwu, A. E., & Chah, J. M. (2007). Access and utilization of modern information communication technologies among extension personnel in Benue State of Nigeria. In: M. C. Madukwe, (Ed.). *Agricultural Extension and the Challenges of the Millennium Development Goals (MDGs). Proceedings of the 12th Annual Conference of the Agricultural Extension Society of Nigeria (AESON).* Maiduguri, 4th – 7th July 2007.

Ahiawodzi, A. K. (2011). *Business statistics*. Accra: Sahabia Publications.

Ahmadpour, A., & Soltani, S. (2012). Agricultural extension workers' attitude to and experience of e-learning. *African Journal of Agricultural Research, 7* (24), 3534-3540. doi: 10.5897/ajar11.1992

Ahmadpour, A., & Mirdamadi, M. (2010). Determining the challenges in the application of e-learning in agricultural extension services in Iran. *American- Eurasian Journal Agriculture & Environmental Science, 9* (3), 292-296.

Ahmadpour, A., Mirdamadi, M., Hosseini, J. F., & Chizari, M. (2010). Factors influencing the design of electronic learning system in agricultural extension, *American Journal of Agricultural and Biological Sciences, 5*, 122-127. doi**:** 10.3844/ajabssp.2010.122.127

Akpabio, I. A., Okon, D. P., & Inyang, E. B. (2007). Constraints affecting ICT utilization by agricultural extension officers in the Niger Delta, Nigeria. *Journal of Agricultural Education and Extension*, *13* (4), 263-272.

Al-Hammadany, F. H., & Heshmati, A. (2011). Determinants of Internet use in Iraq. *International Journal of Communication*, *5*, (23). 1967-1989.

American Library Association (1989). *Presidential committee on information literacy*. *Final report.* Chicago, IL: American Library Association.

Anandajayasekeram, P., Puskur, R., Workneh, S., & Hoekstra, D. (2008). "*Concepts and practices in agricultural extension in developing countries: A source book."* Washington, DC: IFPRI (International Food Policy Research Institute), and Nairobi: ILRI (International Livestock Research Institute).

Anandarajan, M., Simmers, C., & Igbaria, M. (2000). An exploratory investigation of the antecedents and impact of internet usage: An individual perspective. *Behavior & Informaton Technology, 19* (1), 69-85.

Anderson, J. R., & Feder, G. (2004). "Agricultural extension: Good intentions and hard realities*." The World Bank Research Observer, 19* (1), 41–60.

Andreopoulou, Z., Tsekouropoulos, G., Koutroumanidis, T., Vlachopoulou, M. & Manos, B. (2008). Typology for E-business activities in the agricultural sector. *International Journal of Business Information Systems*, *3* (3), 231-251.

Annor-Frempong, F., & Edumadze, J. (2008) Use of internet among agricultural students at University of Cape Coast in Ghana. In K. Opoku-Agyeman (Ed.), *Culture, Science and Sustainable Development in Africa.* Proceedings of the First Joint International Conference between University of Cape Coast, Ghana and University of Ilorin, Nigeria (pp. 377-387). Cape Coast, Ghana.

Annor-Frempong, F., Kwarteng, J., Agunga, R., & Zinnah, M. M. (2006). *Challenges and prospects of infusing information communication technologies (ICTs) in extension for agricultural and rural development in Ghana.* In 22nd Annual Conference Proceedings of the Association for International Agricultural and Extension Education (AIAEE), (pp, 36-46). Clearwater Beach, Florida.

Arokoyo, T. (2005). ICTs application in agricultural extension service delivery. In: F. S. Adedoyin, (ed) *Agricultural extension in Nigeria*. (pp. 245-251) Ilorin: Annual Conference of the Agricultural Extension Society of Nigeria (AESON).

Asenso-Okyere, K., & Mekonnen, D. A. (2012). The importance of ICTs in the provision of information for improving agricultural productivity and rural incomes in Africa. *African Human Development Report. Working Paper 2012-015. United Nations Development Programme (UNDP) Sponsored research Series*. Retrieved July, 2014 from http:/web.undp.org/Africa/knowledge/WP-2012-015-okyere-melonnen-ict-productivity.pdf.

Asiedu-Darko, E. (2013). Agricultural extension delivery in Ghana: A case study of factors affecting it in Ashanti, Eastern and Northern regions of Ghana. *Journal of Agricultural Extension and Rural development, 5* (2), 37-41. doi: 10.5897/jaerd 12.121.

Attewell, P. (2001). The first and second digital divides. *Sociology of Education, 74* (3), 252-259.

Babbie, E., & Rubin, A. (2010). *Research methods for social work* (7th ed.). Belmont, U.S.A: Brooks/Cole.

Badu, E. E., & Markwei, E. D. (2005). Internet awareness and use in the University of Ghana. *SAGE Journal Online*, *21* (4), 260-268.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*, New York, NY: W.H. Freeman and Company.

Barreiro, P. L., & Albandoz, J. P. (2010). Population and sample. Sampling techniques. *Behaviour and Information Technology*, *19* (4), 283-295.

Behrens, S. J. (1994), A conceptual analysis and historical overview of information literacy, *College and Research Libraries, 55* (4), 309-322.

Best, J. W., & Kahn, J. V. (1998). *Research in education,* (8th ed.). Needham Height, MA: Allyn & Bacon, Boston.

Bimber, B. (2000). The gender gap on the internet. *Social Science Quarterly, 81* (3), 868-76.

Birner, R., & Anderson. J. R. (2007). How to make agricultural extension demand-

driven? The case of India's agricultural policy. *International Food Policy Research Institute,* 729, 1-36.

Birner, R., Davis, K., Pender, J., Nkonya, E., Anandajayasekeram, P., Ekboir, J., ... & Cohen, M. (2009). From best practice to best fit: a framework for designing and analyzing pluralistic agricultural advisory services worldwide. *Journal of Agricultural Education and Extension*, *15* (4), 341-355.

Bork, C. J. (2002). *Online training in an online world*. Bloomington, IN: CourseShare Press.

Bosompem, M**.,** Annor-Frempong, F., & Achiaa, Y. (2013). Perceived entrepreneurial competencies of undergraduates and self-employment creation after graduation: implications for youth policy in Ghana. *International Journal of Business and Management Studies, 2* (3), 355–365.

Boyd, D. A., & Bee, H. (2009). *Lifespan development.* Boston: Pearson.

Brock, J. K., & Zhou, Y. (2005). "Organizational use of the internet", *Internet Research, 15* (1), 67 – 87. DOI:.org/10.1108/10662240510577077.

Brown, B. (2011). *How to use the Internet to advertise, promote, and market your business or website with little or no money*. (2nd ed). Florida: Atlantic Publishing Group, Inc.

Brown, J. D. (2001). Point-biserial correlation coefficients. *Shiken: JLT Testing & Evolution SIG Newsletter, 5* (3), 13 – 17.

Bubas, G., Radosevic, D., & Hutinski, Z. (2003). Assessment of computer mediated communication competence: Theory and application in an online environment. *Journal of Information and Organizational Sciences,* 27 (2) 53–118.

Buente, W., & Robbin, A. (2008). Trends in internet information behavior, 2000-2004. *Journal of the American Society for Information Science and Technology, 59* (1), 1743-1760.

Bunz, U. (2009). A generational comparison of gender, computer anxiety, and computer-email-web fluency. *Studies in Media & Information Literacy Education, 9* (2), 54-69.

Bunz, U. (2004). The computer-email-web (CEW) fluency scale- development and validation. *International Journal of Human- Computer Interaction, 17* (4), 477-504.

Burke, T. B. (2002). *Defining competency and reviewing factors that may impact knowledge, perceived importance and use of competencies in the 4-H proffessional job.* (Unpublished Phd thesis), North Carolina State University, Raleigh, North Carolina, USA.

Byun, S., Ruffini, C., Mills, J. E., Douglas, A. C., & Niang, M. (2009). Internet addiction: Meta-synthesis of 1996–2006 quantitative research. *CyberPsychology and Behavior, 12*, 203–207.

Castells, M. (2004). *The network society: A cross-cultural perspective.* Northampton, MA: Edward Elgar.

Cha, J. (2010). Factors affecting the frequency and amount of social networking site use: Motivations, perceptions, and privacy concerns. *First Monday*, *15* (12), 1-14. doi:10.5210/fm.v15i12.2889.

Chamala, S., & Shingi, P. M. (2010). "Establishing and strengthening farmer organizations", In: B. E,. Swanson, R. P., Bentz, and A. J. Sofranko (eds.), *Improving Agricultural Extension: A Reference Manual.* Rome: FAO.

Champoux, J. (2011). *Organizational behavior: integrating individuals, groups, and organizations* (4th ed). New York, NY: Routledge.

Cho, J., Gil de Zúñiga, H., Rojas, H., & Shah, D. (2003). Beyond access: The digital divide and internet uses and gratifications. *IT & Society, 1* (4), 46-72.

Christoplos, I. (2010). *Mobilising the potential of rural and agricultural extension*. FAO: Rome, Neuchatel Group.

Clark, W. (2001). Kids and teens on the net. *Canadian Social Trends, 62,* 6-10.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences*. London: Lawrence Erlbaum Associates

Comer, D. E. (2000). *Internetworking with TCP/IP Vol. 1: Principles, protocols, and architecture*, 4th ed., Englewood Cliffs, NJ: Prentice-Hall.

Cox, B., & Koelzer, W. (2003), *Internet marketing,* Englewood Cliffs, NJ: Prentice-Hall.

Davis, J. A. (1971). *Elementary survey analysis*. Englewood Cliffs, NJ: Prentice-Hall.

Davis, P. M. (2003). Effects of the web on undergraduate citation behavior: Guiding student scholarship in a networked age. *Libraries and the Academy, 3* (1), 41-51.

December, J. (1996). "Units of analysis for internet communication", *Journal of Communication, 46* (1), 14-38.

De Haan, J. (2003). IT and social inequality in the Netherlands. *IT & Society, 1* (4), 27-45.

De Haan, J., & Huysmans, F. (2002). Differences in time between internet users and nonusers in the Netherlands. *IT & Society, 1* (2), 67-85.

Diendorfer, G., Neumayer, C., Maier-Rabler, U., Parycek, P., Ponocny-Selinger, E., Schoßböck, J., & Wirth, M. (2010). Internetkompetenz von SchülerInnen. Aktivitätstypen, Themeninteressen und Rechercheverhalten in der 8. Schulstufe in Österreich. Projektbericht: Wien, Salzburg, Krems. Retrieved January 23, 2014 from http://www.icts.sbg.ac.at/content.php?id.

DiMaggio, P., & Bonikowski, B. (2008). Make money surfing the web? The impact of internet use on the earnings of U.S. workers. *American Sociological Review, 73* (2), 227–250.

DiMaggio, P., Hargittai, E., Russell Neuman, W., & Robinson, J. P. (2001). Social implications of the internet, *Annual Reviews Sociology, 27,* 307-336.

Doyle, C. S. (1994). *Information literacy in an information society: A concept for the information age*. Syracuse, NY: ERIC Clearinghouse.

Driskill, G., & Brenton, A. (2005). *Organizational culture in action: A cultural analysis handbook*. Thousand Oaks, CA: Sage Publications.

Duffour, K. (2009). Agriculture is the strength of Ghana's industrial growth. *Ghana News 158694.* Retrieved November 2, 2013 from http://www.ghanaweb.com/GhanaHomePage/NewsArchive/artikel.php?ID=158694.

Durand, T. (1998). The alchemy of competence. *Strategic Flexibility*, 303-330.

Durndell, A., & Haag, Z. (2002). Computer self-efficacy, computer anxiety, attitude towards the internet and reported experience with the Internet by gender in an East European sample. *Computers in Human Behavior, 18*, 521–535.

Dupuis, D. J., & Victoria-Feser, M. (2013) Robust VIF regression with application to variable selection in large data sets. *The Annals of Applied Statistics, 7* (1), 319–341. doi: 10.1214/12-AOAS584.

Eden, M. B., & Ofre, E. T. (2010). Reading and internet use activities of undergraduate students of the University of Calabar, Calabar, Nigeria. *African Journal of Library, Archives & Information Science*, *20* (1), 11-18.

Emmanouilides, C., & Hammond, K. (2000). Internet usage: Predictors of active users and frequency of use. *Journal of Interactive Marketing, 14* (2), 17-32.

Fawole, O. P. (2008). Pineapple farmers' information sources and usage in Nigeria. *Bulgarian Journal of Agricultural Sciences*, *14* (4), 381 – 389.

FAO (2012). *Gender inequalities in rural employment in Ghana*. An overview Prepared by gender, equity and rural employment Division of FAO Rome

Italy, Retrieved June 12, 2013, from www.fao.org/docrep/016.

Feder, G., Just, R. E., & Zilberman, D. (1985). Adoption of agricultural innovations in developing-countries: A survey. *Economic Development and Cultural Change, 33* (2), 255–298.

Feed the Future (2013). *Ghana.* Retrieved September 24, 2013 from http://www.feedthefuture.gov/country/ghana

Ferguson, D. A., & Perse, E. M. (2000). "The World Wide Web as a functional alternative to television," *Journal of Broadcasting & Electronic Media*, *44* (2), 155–174. doi:org/10.1207/s15506878jobem4402_1

Fiedler, F. E. (2007). *Theory of leadership effectiveness.* New York, NY: McGraw-Hill.

Fox, S. (2004). Older Americans and the Internet. Retrieved May, 2014 from http://www.pewinternet.org.

Fraenkel, J. R., & Wallen, N. E. (2000). *How to design and evaluate research in education,* New York, NY: Mc Grawhill Companies Inc.

Fu, X., & Akter, S. (2012). *The impact of ICT on agricultural extension services delivery: Evidence from the rural e-services project in India.* TMD Working Paper Series No. 046, Department of International Development, University of Oxford.

Ganesh Kumar, P., & Ratnakar, R. (2011). A scale to measure farmers' attitude towards ICT-based extension Services. *Indian Research Journal for Extension Education, 11* (1), 109-112.

George, D., & Mallery, P. (2003). *SPSS for windows step by step: A simple guide and reference.* (4th ed.). Boston: Allyn & Bacon.

Ghana Statistics Service (2012). *Ministry of local government and rural development*: Report of the committee on district boundary disputes relating to the 2010 population and housing census, Accra: GSS. Retrieved fromhttp://www.statsghana.gov.gh/docfiles/2010phc/district_boundaries_final_report_may_2012.pdf.

Goldin, C., & Katz, L. F. (2008). *The race between education and technology.* Cambridge, MA: The Belknap Press of Harvard University.

Goulding, A., & Spacey, R. (2002). *Women and the information society: Barriers and participation.* Paper presented at 68th IFLA Council and general conference, Glasgow. Retrieved on February, 2014 from http://ericit.org/fulltext/IR058567.pdf.

Hargittai, E. (2010). Digital natives? Variation in Internet skills and uses among members of the "Net generation." *Sociological Inquiry, 80* (1), 92-113.

Hargittai E. (2008). The digital reproduction of inequality. In D. Grusky (ed), *Social stratification. Boulder,* (pp. 936–944). Boulder, CO: Westview Press.

Hargittai, E., & Shafer, S. (2006). Differences in actual and perceived online skills: the role of gender. *Social Science Quarterly, 87* (2), 432-448.

Hargittai, E. (2002). Second-level digital divide: Differences in people's online skills. *First Monday, 7* (4), 1-8. doi:org/10.5210/fm.v7i4.942

Hassan, M. S. & Shaffril, H. A. M. (2009). Internet usage among agro-based entrepreneur: can it affect productivity? *Journal of Agricultural Social Science, 5*, 61–66.

Hefny, M. A. M. (2013). Diffusion and adoption of e-extension technology (computers and the internet) among extension agents in extension work in Sohag Governorate, Egypt. *African Journal of Agricultural Education, 1*(5), 94-99.

Hiralaal, A. (2012). Student's experiences of blended learning in accounting education at the Durban University of Technology. *South African Journal of Higher Education, 26* (2), 316-328.

Hobbs, S. D. (2002). Measuring nurses' computer competency: an analysis of published instruments. *Computers Informatics Nursing*, *20* (2), 63-73.

Holden, G., Cuzzi, L., Spitzer, W., & Rutter, S. (1997). The hospital social work self-efficacy scale: A partial replication and extension. *Health & Social Work, 22* (4), 256-263.

Hong, K. S., Ridzua, A. A., & Kuek, M. K. (2003). Students' attitude toward the use of the internet for learning: A study at a University in Malaysia. *Educational Technology and Society, 6* (2), 45-49.

Isiaka, B. T, Lawal-Adebowale, O. A., & Oyekunle, O. (2009). Agricultural extension agents' awareness of ICT potentials and training needs on usage for improved extension service delivery in selected Southwest States. *Nigeria Journal of Human Social Science& Creative Arts, 4* (1), 18-30.

Jaaskelainen, P., & Savolaine, R. (2003). "Competency in network use as a

resource for citizenship implications of the digital divide". *Information Research, 8* (3), 153-159.

Johnston, B., & Webber, S. (2003). Information literacy in higher education: A review and case study. *Studies in Higher Education, 28* (3), 335-351.

Judge, T. A., Jackson, C. L., Shaw, J. C., Scott, B. A., & Rich, B. L. (2007). Self-efficacy and work-related performance: The integral role of individual differences. *Journal of Applied Psychology*, *92* (1), 107-127. doi: 10.1037/0021-9010.92.1.107.

Kallioranta, S. M., Vlosky, R. P., & Leavengood, S. (2006). Web-based communities as a tool for extension and outreach. *Journal of Extension, 44* (2), 1-12.

Khan, S. A., Khan, A. A., & Bhatti, R. (2011). Internet access, use and gratification among university students: A case Study of the Islamia University of Bahawalpur, Pakistan. *Chinese Librarianship: an International Electronic Journal*, *31*, 1-14. Retrieved May, 2014 from http://www.iclc.us/cliej/cl31KKB.pdf.

Kling, R. (2000). Learning about information technologies and social change: The contribution of social informatics. *The Information Society, 16* (3), 217-232.

Knepper, E. T. (2002). *Factors affecting the use of fertilizer by small- and medium-sized farming households in Zambia, 1997 to 2000.* Unpublished master's thesis, Michigan State University, Michigan.

Knobel, M. & Lankshear, C. (eds.) (2008). *Digital literacies: Concepts, policies and practices*. New York, NY: Peter Lang.

Ko, H., Chang-Hoan Cho. & Roberts, M. S. (2005). "Internet uses and gratifications: A structural equation model of interactive advertising," *Journal of Advertising*, *34* (2), 57–70. doi: org/10.1080/67.2005.10639191.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, *30*, 607-610.

Kushner, J., & Chong, P. (2004). *Conducive environments for promoting community e-centers*. Indonesia, Bali: Asian Development Bank Regional.

Joiner, R., Brosnan, M., Duffield, J., Gavin, J., & Maras, P. (2005). The relationship between Internet identification, Internet anxiety and Internet use. *Computers in Human Behavior 23* (2007) 1408–1420. doi:10.1016/j.chb.2005.03.002.

Lance, K. (2013, April 4). *Ghana Agricultural GIS online Platform.* Retrieved September 13, 2013, from http://lists.gsdi.org/pipermail/sdi-africa/2013-April/001578.html

Lane, W., & Manner, C. (2011). Computer, phones and the internet: Domesticating information technology. *International Journal of Business and Social Science*, *2* (17), 22-28.

Larsson, L. (2002). *Digital literacy checklist*. Retrieved November 25, 2013 from http://depts.washington.edu/hserv/teaching/diglit

Leh, S., Waldspurger, R. W., & Albin, B. (2004). The student/faculty international exchange: Responding to the challenge of developing a global perspective in nursing education. *Nursing Education Perspectives, 25* (2), 86-90.

Leung, L. (2001). "College student motives for chatting on ICQ," *New Media & Society*, *3* (*4*), 483–500. doi: org/10.1177/14614440122226209.

Li, J., & Valliant, R. (2011). Linear regression influence diagnostics for unclustered survey data. *Journal of Official Statistics*, *20*, 99-119.

Lin, C. A. (2004). "Webcasting adoption: Technology fluidity, user innovativeness, and media substitution," *Journal of Broadcasting & Electronic Media*, *48*, (3), 446–465. doi:org/10.1207/s15506878jobem4_6.

Litt, E. (2013). Measuring users' internet skills: A review of past assessments and a look toward the future. *New Media Society, 15* (4), 612–630. doi: 10.1177/1461444813475424.

Livingstone, S., & Helsper, E. (2010). Balancing opportunities and risks in teenagers' use of the internet: the role of online skills and internet self-efficacy. *New Media and Society, 12* (2), 309-329. doi: 10.1177/1461444809342697.

Lundt, J. C., & Vanderpan, T. (2000). It computes when young adolescents teach senior citizens. *Middle School Journal, 31* (4), 18-22.

Mabe, L. K. (2012). Constraints related to use of information communication technologies tools among extension officers in the North-West Province, South Africa. *Life Science Journal, 9* (3), 1616-1619.

Mabe, L. K., & Oladele, O. I. (2012). Awareness level of use of information communication technologies tools among extension officers in the North-West Province, South Africa. *Life Science Journal*, *9* (3), 57-62.

Machin-Mastromatteo, J. D. (2012). Participatory action research in the age of social media: Literacies, affinity spaces and learning. *New Library World*, *113* (11/12), 571-585.

Marquire, J. C., Jourdan-Boddaert, L., & Huet, N. (2002). Do older adults underestimate their actual computer knowledge? *Behavior and Information Technology, 21* (4), 273-280.

Marrelli, A. F., Tondora, J., & Hoge, M. A. (2005). Strategies for developing competency models. *Administration and Policy in Mental Health, 32* (5), 533–561. doi: 10.1007/s10488-005-3264-0.

Maunder, A. H. (1978). *Agricultural Extension, a reference manual*, Rome: FAO.

McCall, M.W. (2004). Leadership development through experience. *Academy of Management Executive, 18,* 127-130.

McDaniel, M. A., Anderson, J. L., & Wildman, M. K. (2007). Using quizzes to enhance summative assessment performance in a web-based class: An experimental study. *European Journal of Cognitive Psychology, 19,* 494–513.

McDonald, T., & Siegall, M. (2008). The effects of technological self-efficacy and job focus on job performance, attitudes, and withdrawal behaviors. *Journal of Psychology, 126,* 465–475.

McMillan, J. H., & Schumacher, S. (2001). *Research in education. A conceptual*

introduction. (5th ed.). New York, NY: Longman.

Metzger, M. J., Flanagin, A. J., & Zwarun, L. (2003). College student web use, perceptions of information credibility, and verification behavior. *Computers & Education, 41* (3), 271-290.

Michailidis, A. (2007). Adoption of internet in agriculture. *Journal for Extension Systems, 23* (1), 1-13. Retrieved November, 2013 from http://www.jesonline.org/2007Jun.htm#Michailidis.

Ministry of Food and Agriculture (2013). *Technology Dissemination by Directorate of Agricultural Extension Services (DAES).* Retrieved September, 2013, from http://mofa.gov.gh/site/?page_id=5267.

Ministry of Food and Agriculture (2010). Agriculture in Ghana: Facts and figures. *Government of Ghana Publications*, 1-41.

Ministry of Local Government/ Rural Development & Environment & Maks Publications & Media Services (2013). Retrieved on December 2013 from http://www.ghanadistricts.com/region.

Minton, M. C. (2002). Is your organization ready for e-learning? Seven key questions you need to answer. *Communication Project Magazine, 3* (1), Retreived July 25, 2014, from, http://www.comproj.com/Minton.htm.

Mtega, W. P., & Msungu, A. C. (2013). Using information and communication technologies for enhancing the accessibility of agricultural information for improved agricultural production in Tanzania. *The Electronic Journal of Information Systems in Developing Countries*, *56* (1), 1-14.

Muijs, D. (2004). *Doing quantitative research in education with SPSS.* London: SAGE Publications Ltd.

Mukoko, B. (2012). Determinants of computer and internet adoption and use in Cameroon. *African Review of Economics and Finance, 3*(2), 96-128.

National Development Planning Commission, (2010). Ghana shared growth and development agenda (GSGDA) costing framework (2010 – 2013) Volume II Costing and Financing of Policies and Strategies. Retrieved September 9, 2013 from http://www.ndpc.gov.gh/images/ebia/GSGDA

Ndubisi, N. (2004). *Factors influencing e-learning adoption intention: Examining the determinant structure of the decomposed theory of planned behaviour constructs,* (Unpublished MSc thesis) University Malaysia Sabah, F.T. Labuan, Malaysia.

Neufeld, J. D., Reddy, J. S., Miller, C. A., Shock, L., Jensen, N. L. Olsen, W., Bohl, B., Hopkins, T., & Shock, C. C. (2007). Rapid delivery of regional pest alerts using an interactive internet site. *Journal of Extension, 45* (5), 1-6. Retrieved November, 2013 from http://www.joe.org/2007oct/iw5.php.

O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity. 41,* 673–690.doi:10.1007/s11135-006-9018-6.

Oghenevwogaga, B. A, & Oghenevwogaga, D. T. (2006). "The Impact of the Internet on Research: the Experience of Delta State University, Nigeria." *Library Philosophy and Practice*, *8* (2), 1-9.

Ogunjobi, T. E., & Fagbami, O. O. (2012). Use of internet by researchers in agricultural research institutes in Ibadan, Oyo state. *International Journal of Library and Information Science, 4* (4), 52-56. doi:10.5897/ijlis11.068.

Ojedokun, A. O., & Owolabi, E. O. (2003). Internet access competence and the use of the internet for teaching and research activities by University of Bostwana academic staff. *African Journal of Library, Archives and Information Science, 13* (1) 43-53.

Okay, S. (2010). A research on investigation of Internet using purposes of technical teacher candidates. *Electronic Journal of Machine Technologies, 7,* 97-109.

Oketunji, I. (2001). Libraries and the Internet connectivity: What benefits? In J. Lasis, O. K. Odunsanya, S. E. A. Sonaike, & L. F. Osinulu (Eds.), *Automation of cataloguing practices in Nigerian libraries* (pp.32-40), Ijebu-Ode: Nigerian Library Association.

Oladele, O. I. (2010). Information sources use patterns among agricultural researchers in Southwestern Nigeria. *The Journal of International Social Research, 3* (12), 322-326.

Omidi Najafabadi, M., Farajollah Hosseini, J., Mirdamadi, M., & Moghadasi, R. (2008). Designing an efficient information and communication technology (ICT) system to train private agricultural insurance brokers in Iran. *Australian Journal of Basic and Applied Sciences, 2* (4), 1041-1051.

Omotesho, K. F., Ogunlade, I. O., & Muhammad, L. (2012). "Assessment of access to information and communication technology among agricultural

extension officers in Kwara State, Nigeria", *Asian Journal Agriculture and Rural Development*, *2* (2), 220-225.

Ono, H., & Zavodny, M. (2003). Gender and the internet. *Social Science Quarterly, 84* (1), 111-121.

Osei-Boateng, A. (2012, September 9). Ghana to adopt e-extension service to boost agriculture productivity. *China.org.cn.* Retrieved on December, 2013, from http://www.china.org.cn/world/Off_209/19/content.htm.

Pallant, J. (2011). *SPSS Survival manual: A step by step guide to data analysis using SPSS for windows* (4th ed.). Australia: Allen & Unwin.

Papacharissi, Z., & Rubin, A. M. (2000). Predictors of internet use. *Journal of Broadcasting & Electronic Media*, *44* (2), 175-196.

Paris, P. (2004). E-learning: A study on secondary students' attitudes towards online web assisted learning. *International Education Journal, 5* (1), 98-112.

Park, H. W. (2002). The digital divide in South Korea: Closing and widening divides in the 1990s. *Electronic Journal of Communication, 12* (1), 1-11.

Payne, M. (2005). *Modern Social Work Theory* (3rd ed). New York City, NY: Palgrave MacMillan.

Peters, C., Amato, C. H., & Hollenbeck, C. R. (2007). "An exploratory investigation of consumers' perceptions of wireless advertising," *Journal of Advertising*, *36* (4), 129–145. doi: org/10.2753/JOA0091-3367360410.

Petrovich, A. (2004). Using self-efficacy theory in social work teaching. *Social Work Education, 40* (3), 429-443.

Pew Internet & American Life Project, (2009). "Adults on social network sites, 2005–2009," Retrieved July, 2014 from http://pewinternet.org/Infographic

Potosky, D. (2002). A field study of computer efficacy beliefs as an outcome of training. The role of computer playfulness, computer knowledge, and performance during training. *Computers in Human Behavior, 18,* 241-256. doi:10.1016/s0747-5632(01)00050-4

Rader, H. (1991). Bibliographic instruction or information literacy, *College and Research Libraries News, 51* (1), 18-20.

Revere, D. (2005). *Digital literacy self-assessment*. Retrieved December, 2014 from http://courses.washington.edu/hsstudev/studev/self-assess.html

Richardson, D. (2005). ICTs- transforming agricultural extension. *International Journal of Educational Telecommunications, 5 (*2), 263-275.

Ridgeway, T. (1990), Information literacy: an introductory reading list, *College and Research Libraries News, 51* (7), 645-648.

Robinson, J. P., DiMaggio, P., & Hargittai, E. (2003). New social survey perspectives on the digital divide. *IT & Society, 1* (5), 1-22.

Robson, C. (2002) *Real world research*, (2nd ed). Oxford, England: Blackwell.

Rohde, G. L., & Shapiro, R. (2000). *Falling through the net: Toward digital inclusion. A Report on Americans' access to technology Tools*. New York, NY: Guilford Press.

Rose, R., & Grosvenor, I. D. (2001). *Doing research in special education: Ideas into practice*, London: David Fulton.

Ruzgar, N. S. (2005). A research on the purpose of Internet usage and learning via Internet. *The Turkish Online Journal of Educational Technology*, *4* (4), 27-32.

Salau E. S., & Saingbe, N. D. (2008). Access and utilization of information and communication technologies (ICTs) among agricultural researchers and extension workers in selected institutions in Nasarawa State of Nigeria. *PAT, 4* (2), 1-11. ISSN: 0794-5213

Sam, H. K., Othman, A. E. A., & Nordin, Z. S. (2005). Computer self-efficacy, computer anxiety, and attitudes toward the internet: A Study among undergraduates in Unimas. *Educational Technology & Society*, *8* (4), 205-219.

Sanchez, J. I., & Levine, E. L. (2009). What is (or should be) the difference between competency modeling and traditional job analysis? *Human Resource Management Review, 19* (2), 53-63.

Sanou, B. (2013). ICT facts and figures. *International Telecommunications Union*. Retrieved on May, 12th 2014 from http://www.itu.int/ict

Sarfo, J. O., & Asiedu, M. (2013). e-Health efficacy in Ghanaian nursing: a pilot thematic analysis on benefits and challenges. *European Scientific Journal*, *9* (23), 209-221.

Saucier, P. (2010). *Level of influence of selected factors upon Missouri agricultural education teachers' choice to instruct agricultural mechanics curriculum*. (Unpublished doctoral thesis) University of Missouri, Missouri.

Scheer, S. D. (2011). Competency modeling in extension education: integrating an academic extension education model with an extension human resource management model. *Journal of Agricultural Education, 52* (3)*,* 64–74. doi: 10.5032/jae.2011.03064.

Schumacher, P., & Morahan-Martin, J. (2001). Gender, internet and computer attitudes and experiences. *Computers in Human Behavior, 17* (1), 95-110.

Sekaran, U. (2003). *Research methods for business: A skill building approach* (4th Edition). New York, NY: John Wiley & Sons Inc.

Shea-Shultz, H., & Fogarty, J. (2002). *Online learning today: Strategies that work.* San Francisco, CA: Barrett-Koehler.

Shklovski, I., Kraut, R., & Rainie, L. (2006). The internet and social participation: Contrasting cross-sectional and longitudinal analyses. *Journal of Computer Mediated Communication, 10* (1), 1-12. doi: 10.1111/j.1083 6101.2004.tb00226.x.

Sife, A. S. (2010). *Contribution of mobile telephony, radio and television to rural livelihoods and poverty reduction in Morogoro Region, Tanzania.* (Unpublished PhD thesis) University of Dares Salaam, Dares Salam, Tanzania.

Sinkaye, T. (2005). Agricultural extension participatory methodologies and approaches. *Agricultural Extension in Nigeria.* 220-233.

Smithers, J., Lamarche, J., & Alun, J. E. (2008). Unpacking the terms of engagement with local foods at the farmers' market: Insights from Ontario. *Journal of Rural Studies, 24*(3), 337-350.

Stanovich, K. (2007). *How to think straight about psychology*. Boston, MA: Pearson.

Steers, R. (2011). *Introduction to organizational behavior.* Glenview, IL: Scott-Foresman.

Stribhadung, R. A., (2006). *Mobile device in e-learning.* Third International Conference on e-Learning for Knowledge-Based Society. Bangkok, Thailand 35, 1-5.

Taylor, W. J., Zhu, G. X., Dekkers, J., & Marshall, S. (2012). Socio-economic factors affecting home internet usage patterns in Central Queensland. *Informing Science Journal, 6* (1), 233–242.

Teo, T. S. H. (2001). Demographic and motivation variables associated with Internet usage activities. *Internet Research: Electronic Networking Applications and Policy, 11* (2), 125-137.

Thomas, P. Y. (2010). *Towards developing a web-based blended learning environment at the University of Botswana*. Unpublished Doctoral thesis, University of Botswana, Botswana.

Toki, E. I., & Pange, J. (2010). Social learning theories as tools for learning in an ICT educational system. *The Online Journal of New Horizons in Education*, *3* (1)*,* 53-55.

Trochim, W. (2006). *Research methods knowledge base*. (2nd ed.). Cincinnati, OH: Atomic Dog Publishing,

van Deursen, A. J. A. M. (2010). *Internet skills. Vital assets in an information society*. Enschede, the Netherlands: University of Twente.

van Deursen, A. J., van Dijk, J. A., & Peters, O. (2011). Rethinking Internet skills: the contribution of gender, age, education, Internet experience, and hours online to medium-and content-related Internet skills. *Poetics*, *39* (2), 125-144.

van Deursen, A., & van Dijk, J. (2010). Internet skills and the digital divide. *New Media & Society, 13* (6), 893–911.

van Dijk, J. (2005). *The deepening divide. Inequality in the information society*. London: Sage Publications.

van Dijk, J. (2006). Digital divide research, achievements and shortcomings. *Poetics, 34* (4-5), 221-235.

Vanderstoep, S. W., & Johnston, D. D. (2009). *Research methods for everyday life: Blending qualitative and quantitative approaches*. San Francisco, CA: Jossey-Bass.

Volman, M., van Eck, E., Heemskerk, I., & Kuiper, E. (2005). New technologies, new differences. Gender and ethnic differences in pupils' use of ICT in primary and secondary education. *Computers & Education, 45* (1), 35-55.

Wangpipatwong, S., Chutimaskul, W., & Papasratorn, B. (2008). "Understanding citizen's continuance intention to use e-government website: a composite view of technology acceptance model and computer self-efficacy" *The Electronic Journal of e-Government* , 6 (1), 55 – 64. ISSN 1479-436-9X 55

Warschauer, M. (2003). *Technology and social inclusion: Rethinking the digital divide.* Cambridge, MA: The MIT Press.

Wasserman, I. M., & Richmond-Abbott, M. (2005). Gender and the internet: Causes of variation in access, level, and scope of use. *Social Science Quarterly, 86* (1), 252-270.

Wilson, E. J. (2006). *The Information revolution and developing countries.* Cambridge, MA: MIT Press.

Woods, J., Raab, R.T., & Abdon, B. (2002). ICTs, e-learning, and simulations: Bringing knowledge-intensive management to Asian agriculture. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 6* (3), 19-36.

Wunnava, P.V. & Leiter, D. B. (2009). Determinants of intercountry internet diffusion rates. *American Journal of Economics and Sociology, 68*, (2), 413-426.

Yaghoubi, J. (2009). Assessment of agricultural extension and education graduate students' perceptions of e-learning in Iran. *Procedia Social Behavior. Science, 1* (1), 1914-1918. doi: 10.1016/j.sbspro.2009.01.336.

Yakubu, D.H. (2011). *Socio-economic factors affecting the adoption of ICTs by extension workers in the North-West zone of Nigeria*. Unpublished Master's thesis, Usmanu Danfodiyo University, Sokoto, Nigeria.

Yakubu, D. H., Abubakar, B. Z., Atala, T. K., Muhammed, A., & Abdullahi, M. K. (2013). Assessing the effects of socio-economic factors on ICTS adoption among extension workers in the north-west zone of Nigeria. *International Journal Agricultural Policy Research, 1* (9), 255-269.

Yang, K. C. C., & Kang, Y. (2006). "Exploring factors influencing internet users' adoption of Internet television in Taiwan," *First Monday*, *11* (3), 1-14. doi:10.5210/fm.v11i3.1319.

Zajonc, R. B. (2001). "Mere exposure: A gateway to the subliminal". *Current Directions in Psychological Science 10* (6), 224-228. doi:10.1111/1467-8721.00154.

Zhang, Y. (2004). Age, gender, and internet attitudes among employees in the business world. *Computers in Human Behavior, 21,* 1–10.

Zimic, S. (2009). Not so 'techno-savvy': Challenging the stereotypical images of the 'net generation'. *Digital Culture & Education, 1* (2), 129–144.

Zizi P, & Rubin, A. M. (2010). "Predictors of internet use," *Journal of Broadcasting & Electronic Media*, *44* (2), 175-96. doi:org/10.1207/s15506878jobem4402_2.

Zurkowski, P. (1974). *The information service environment: Relationships and priorities*, Washington, DC: National Commission on Libraries and Information Science.

Zwane, E. M. (2009). *Participatory development of an extension approach and policy for Limpopo province South Africa.* Unpublished Doctoral thesis, University of Pretoria, South Africa.

APPENDICES

Appendix A: Table for Determining Sample Size from a Given Population

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	377
160	113	800	260	20000	375
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	100000	384

Note- *N* is population size. *S* is sample size

Source: Krejcie, R. V. & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, *30*, 607-610.

Appendix B: Davis Convention for Describing Magnitude of Correlation Coefficients

	Magnitude of Correlation Coefficients (r)	Description
1	1.0	Perfect
2	0.70 - 0.99	Very High
3	0.50 - 0.69	Substantial
4	0.30 - 0.49	Moderate
5	0.10-0.29	Low
6	0.01 - 0.09	Negligible

Source: Davis. J. A (1971). *Elementary Survey Analysis*. Englewood. NJ: Prentice-Hall. 175

Appendix C: Questionnaire

COMPETENCIES OF AGRICULTURAL EXTENSION AGENTS IN THE USE OF INTERNET FOR EXTENSION DELIVERY IN THE EASTERN REGION, GHANA

The main purpose of this study is to assess the level of competencies of agricultural extension agents in the use of Internet for extension delivery in Eastern Region of Ghana.

It is anticipated that the results would be used by Ministry of Food and Agriculture and other stakeholders to plan training programmes for Agricultural Extension Agents and formulate policies to address the use of Internet for agricultural development in Ghana. The study is being conducted as part of requirement for award of MPhil. Agricultural Extension at the University of Cape Coast.

The information you provide would be used for the purpose it is provided only. Therefore, be sincere in expressing your opinions and suggestions as much as possible. Your confidentiality is assured.

THANK YOU

Questionnaire ID No:…….

Municipal/ District:……

Community/ Operational area…….

Rural [ ] Semi-rural [ ] Urban [ ]

A. Personal information

1. Sex: [ ] Male [ ] Female
2. Age as at last birthday:…….

3. Marital Status: [ ] Single [ ] Married [ ] Divorced [ ] Widow

4. Number of dependents in the household……..

5. Number in household with Internet knowledge……

6. Do you reside in your area of operation? [ ] Yes [ ] No

7. What is your highest level of education?

   [ ] Certificate level
   [ ] Diploma level
   [ ] Bachelor degree level
   [ ] Master's degree Level
   [ ] PhD degree
   [ ] Others (specify)…….

8. What is your major area of specialization/ training?
   [ ] General Agriculture
   [ ] Agricultural extension
   [ ] Animal science
   [ ] Animal health (Veterinary)
   [ ] Crop science
   [ ] Horticulture
   [ ] Agriculture engineering
   [ ] Post harvest
   [ ] Others (specify)……..

9. What is your grade?

   Technical class: T.O [ ] S.T.O [ ] P.T.O [ ] A.C.T.O [ ] C.T.O [ ]

   Sub-Professional class: P.O. [ ] S.P.O [ ] P.P.O [ ] A.C.P.O [ ] C.P.O [ ]

   Professional class: A.A.O [ ] A.O [ ] S.A.O [ ] A. D [ ] D.D [ ]

10. What is your position?

[ ] Frontline staff

[ ] District/Municipal Agric. officer

[ ] M.I.S officer

[ ] Director

[ ] Other (specify)……

11. What is your major job responsibility? (*tick all that apply*)

[ ] Administration

[ ] Supervision

[ ] Extension delivery

[ ] Report writing

[ ] Training

[ ] Research

[ ] Other (specify)……

12. How many years have you been working with MoFA?.....

13. What is your Monthly salary (gross)? Gh₵……..

Salary scale: Level……Point……

B. Internet Use/ Availability

14. Do you have desktop or laptop computer?

[ ] Yes [ ] No

15. Do you use a laptop or desktop computer for your job?

[ ] Yes [ ] No

16. If you have a computer/laptop, is it connected to the Internet?

[ ] Yes [ ] No

17. Do you use a mobile phone in your area of operation?

[ ] Yes [ ] No

18. If yes, is your mobile phone to connect Internet?

[ ] Yes [ ] No

19. Do you have internet connectivity in your area of operation?

    [ ] Yes [ ] No [ ] Cannot tell

20. Do you use Internet in your area of operation?

    [ ] Yes [ ] No

21. Where do you access Internet? (*tick all that apply)*

From office computer/ laptop:	Yes [ ]	No [ ]
From home computer/ laptop:	Yes [ ]	No [ ]
Personal Mobile internet (phone/tablet):	Yes [ ]	No [ ]
Internet café or Business centre:	Yes [ ]	No [ ]

22. How frequent do you use Internet at the following places?

    1= Never (not usual at all) 2= Somehow (1-2 times a week)

    3= Often (3-4 times a week) 4= Always (5-7 times a week)

From office computer/ laptop:	1 [ ]	2 [ ]	3[ ]	4[ ]
From home computer/ laptop:	1 [ ]	2 [ ]	3[ ]	4[ ]
Personal Mobile internet (phone/tablet):	1 [ ]	2 [ ]	3[ ]	4[ ]
Internet café or Business centre:	1 [ ]	2 [ ]	3[ ]	4[ ]

23. Duration of use per day……hours

24. Which of these Internet Service Providers (ISP) do you or your organization subscribe to? (*tick all that apply)*

MTN	Yes [ ]	No [ ]
Vodafon	Yes [ ]	No [ ]
Tigo	Yes [ ]	No [ ]
Glo	Yes [ ]	No [ ]
Expresso	Yes [ ]	No [ ]
Airtel	Yes [ ]	No [ ]

25. Who pays for your use of Internet services?

    [ ] Always by office

    [ ] Sometimes by office

[ ] Always by self

[ ] Sometimes by self

[ ] Others (specify)……

Training

26. Have you received any training on how to use the Internet?

[ ] Yes [ ] No

27. If yes where did you receive your training on Internet? (*tick all that apply)*

Formal training (University/ College)	Yes [ ]	No [ ]
Professional courses/ workshops/ seminar	Yes [ ]	No [ ]
Internet café/ Business centre	Yes [ ]	No [ ]
Colleagues	Yes [ ]	No [ ]
Self-taught	Yes [ ]	No [ ]

28. How many years have you been using Internet?.....

Purpose of using Internet

29. What do you use (purpose) Internet for? (*tick all that apply)*

Sending e-mail	Yes [ ]	No [ ]
Receiving e-mail	Yes [ ]	No [ ]
Communicate with other work using skype, viber	Yes [ ]	No [ ]
Social (eg. Facebook, Whatsapp, Twitter)	Yes [ ]	No [ ]
Access MoFA's website	Yes [ ]	No [ ]
Search for information on agriculture	Yes [ ]	No [ ]
Read news on agriculture	Yes [ ]	No [ ]
Listen to online radio on agricultural program	Yes [ ]	No [ ]
Do online shopping	Yes [ ]	No [ ]

Download media (audio and video) files	Yes [ ]	No [ ]
Chat with collegues	Yes [ ]	No [ ]
Communicate with farmers	Yes [ ]	No [ ]
Communicate with researchers	Yes [ ]	No [ ]
Communicate with collegue AEAs	Yes [ ]	No [ ]
Subscribe/ read newspaper	Yes [ ]	No [ ]
Access Controller and Accountant General Dept. payslip (e-payslip)	Yes [ ]	No [ ]

C. Internet competencies

NB: please use the information below to answer statements on the next page.

Indicate your level of competencies (knowledge, attitude, skill and aspiration) with respect to use of Internet for extension delivery.
Rate your opinions with the scales below:

30. **Knowledge**:- having information about the existence and use of Internet for extension delivery.

1=very low (VL), 2=low (L), 3=moderate (M), 4=high (H), 5=very high (VH)

31. **Attitude**: - perceived importance to extension delivery.

1=not very important (NVI), 2=not important (NI), 3=moderately important (MI), 4=important (I), 5=very important (VI)

32. **Skill**:- extent to which you are able to manipulate the items to access Internet.

1=very low (VL), 2=low (L), 3=moderate (M), 4=high (H), 5=very high (VH)

33. **Aspiration**: - willingness to use the Internet

1=not willing (NW), 2=somehow willing (SW), 3=moderately willing (MW), 4=willing (W), 5=very willing (VW)

NB: Please use the above information to answer statements on the next page.

	30. Knowledge (having information)					31. Attitude (perceived importance)					32. Skill (ability)					33.Aspiration (willingness)				
	VL	L	M	H	VH	NVI	NI	MI	I	VI	VL	L	M	H	VH	NW	SW	MW	W	VW
Internet Competencies	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Creating e-mail account																				
Accessing e-mails																				
Attaching files/ pictures/ to e-mails																				
Finding information in the Internet address book																				
Sending files/ text to individuals																				
Sending files/ text to multiple recipients																				
Entering web address																				
Using URL to locate website																				
Navigating pages on the internet																				
Using search engines (Google, Internet explorer) to locate information																				
Listing favourites sites(bookmarking) for quick viewing																				
Finding pages you recently viewed																				
Accessing files (PDF,GIF,JPG) from the Internet																				
Accessing e-journals																				
Accessing databases/ libraries																				
Download files from the internet																				
Joining discussion list/ newsgroup																				
Use an online library catalog																				

34. What benefits do you gain as a result of the using Internet; (*tick all that apply)*

[ ] Upgrade of knowledge

[ ] Improved user skills

[ ] reduce transport cost

[ ] Easy access to information

[ ] Improved communication with others

[ ] Improved entertainment

[ ] Access to free software

[ ] Other (*specify*)……

35. What are the Constraints/Challenges you face using Internet; (*tick all that apply)*

[ ] High cost of Internet usage (Internet bundle)

[ ] High cost of equipment and broadband services

[ ] Poor internet speed/ slowness in accessing Internet

[ ] Connectivity to many (rural area) of the districts is very limited or non-existence

[ ] Computers are not easily affordable

[ ] Inadequate information retrieval skills

[ ] No Internet connectivity/ access

[ ] Other (*specify*)……

36. Suggestions/ ways of making the Internet easily accessible and more useful to AEAs

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