THE ICT UNIVERSITY

A MODEL FOR USABILITY OF E-AGRICULTURE BY FARMERS IN UGANDA

BY

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ABSTRACT

The study examined the levels of farmers' expectancy, intrinsic motivation, extrinsic motivation and instrumentality, context of use, and usability measures in using e-agriculture. This study used a quantitative data collection and analysis techniques. The population comprised of farmers and agricultural extension workers.

The study adopted a multistage sampling approach. In the first stage, Uganda was divided into four regions including Northern Region, Eastern Region, Western Region and Central region. In the second stage, simple random sampling was used to sample farmers. A total of 125 farmers were selected from each region of the country to participate in the survey. Survey data was collected using self-administered questionnaires and an online questionnaire was also used to target farmers from remote locations. Descriptive statistics such as frequencies, percentages and means were used to analyse background information about the respondents. Correlation and regression analysis methods were then used to analyse the relationships between study variables and also to test the predicting power of the independent, moderating and mediating variables on the dependent variable. Structural Equation Modelling was used to conduct confirmatory analyses on the variable relationships and develop the model for e-agriculture usage in Uganda.

Key findings revealed that that there was a positive significant relationship between Expectancy and Instrumentality (Beta=.519, $P<0.001$); there was a positive significant relationship between Expectancy and e-agriculture usability in Uganda (Beta=.196, $P<0.001$); there was a positive significant relationship between Instrumentality and Intrinsic Motivation of farmers in Uganda (Beta=.304, $P<0.001$); there was a positive significant relationship between Intrinsic Motivation and e-agriculture usability in Uganda (Beta=.505, $P<0.001$); there was a positive significant relationship between Context of Use and Intrinsic Motivation of farmers in Uganda (Beta=.245, $P<0.001$); there is a positive significant relationship between Efficiency and Intrinsic Motivation of farmers in Uganda (Beta=.396, $P<0.001$); Context of Use inversely moderates the relationship between Expectancy and Instrumentality; Instrumentality partially mediates the relationship between Context of Use and Intrinsic Motivation; Instrumentality & Intrinsic Motivation partially mediates the relationship between Expectancy and E-Agriculture Usability.

The study proposes a model for e-agriculture usability indicating that for improved usability of e-agriculture platforms in Uganda, there is need to increase Expectancy, Instrumentality, Intrinsic Motivation, Context of Use, Efficiency, and Expectancy since all these variables were found to have a positive effect on their dependent variables in the final model explaining usability of e-agriculture by Ugandan farmers.

It is recommended that stakeholders implementing e-agriculture usability should try to enhance the expectancy and Instrumentality of farmers as well as intrinsic motivation. This will encourage farmers use the technology in anticipation of better returns.

In addition, there is need to address of user characteristics, technological issues, organizational environment, social environment and economic environment pertinent for the technology to be accepted.

There is need for system developers to address issues of efficiency since it was found to tremendously influence usability of e-agriculture. They need to ensure that e-agriculture platforms accomplish tasks in the shortest time possible, while at the same time helping farmers to save costs.

Government policy geared towards promoting usability of e-agriculture platforms should take into consideration intrinsic motivational factors that were found to enhance usability other than extrinsic motivational factors.

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LIST OF ACRONYMS

AMOS:	Analysis of a Moment Structures
CFA:	Confirmatory Factor Analysis
SEM:	Structured Equation Modelling
ICT:	Information Communication Technology
ISO:	International Standards Organization
NGO:	Non-Government Organizations
UN:	United Nation
MDG:	Millennium Development Goals
WFP:	World Food Program
UN-MDG:	United Nation Millennium Development Goals
UBOS:	Uganda Bureau of Statistics
NAADS:	National Agricultural Advisory and Development Services
NUSAF:	Northern Uganda Social Agricultural Recovery Fund
LRA:	Lord's Resistance Army
IDP:	Internally Displaced People
NARO:	National Agricultural Research Organisation
KARI:	Kawanda Agricultural Research Institute
IFAD:	International Fund for Agricultural Development
PIBID:	Banana Industrial Development
SAA:	Sasakawa Africa Association
UEDCL:	Uganda Electricity Distribution Company
ME & MD:	Ministry of Energy and Mineral Development
IFAD:	International Fund for Agricultural Development
FAO:	Food and Agriculture Organization
M:	Motivation
E:	Expectancy

I:	Instrumentality
LC:	Local Council
CAC:	Cronbach Alpha Coefficient
CVI:	Content Validity Index
SEM:	Structural Equation Modelling
CFA:	Confirmatory Factor Analysis
EFA:	Exploratory Factor Analysis
UFA:	Uganda Farmers Association
VIF:	Variance Inflation Factor
CFI:	Comparative Fit Index
DF:	Degree of Freedom
KMO:	Kaiser-Meyer-Olkin
NNFI:	Nonormed Fit Index
SMC:	Squared Multiple Correlation

GLOSSARY

Content validity is the degree of correspondence among the measures of a construct and its conceptual definition

Context of use are user characteristics, technological attributes, organizational environment, social environment, and economic environment that influences e-agriculture system usability.

E-Agriculture Usability is the degree to which farmers use different online agricultural platforms in order to realize their objectives.

Expectancy is the farmers' degree of certainty that their effort in terms of using e-agriculture will translate into excellent performance.

Extrinsic motivation is the type of motivation that is animated by external tangible factors such as rewards

Instrumentality is the extent to which an individual believes that his/her performance will lead to better outcomes that meet his/her needs.

Intrinsic motivation is motivation that is animated by personal enjoyment, interest, or pleasure

Motivation is the attribute that moves people to do or not to do something

Usability is the degree to which a technology can be used efficiently and effectively by intended users in order to realize its objectives.

Usability measures are the attributes that improve performance, effectiveness and efficiency of e-agriculture platforms.

A MODEL FOR USABILITY OF E-AGRICULTURE BY FARMERS IN UGANDA

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DEDICATION

To my Father Leonard Hector Kyeyune (RIP) and Mother Teopista N. Kyeyune for the enormous sacrifices you made so that I could be educated. Dad never lived to see the fruits of his efforts, but I am sure I have made him proud wherever he is.

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CHAPTER ONE: INTRODUCTION

1.1 Introduction

Over the past century, agriculture has been the main driver of growth and sustainability for developing nations. Families relied on farm produce for the much needed food and household income. Nevertheless, this trend is on the decrease as farm produce keeps declining. Uganda is largely an agricultural country and also widely referred to as the food basket of the East African region. For that, one would expect its citizens in every corner of the country to access food at low prices, in substantial amounts and in constant supply.

However, a considerable number of people go hungry. In a report of Food Agricultural Organization (FAO) put the number of Ugandans going hungry at 23 million, implying that 67% of the population is food insecure. Basing on the above findings, Uganda, along with other sub-Saharan countries, has a high mountain to climb in a bid to ensure a sustainable food security net for the citizenry.

Many factors contribute to food scarcity and poor farm produce. These include climate and political instability, rural-urban migration, pests, soil fertility issues, lack of insight and planning, shortage of knowledge on best farming practices. There are some practices, such as food wastage that seem trivial, but hamper food availability, especially in market places; poor storage practices and dumping sites and they seem to be ignored.

A study carried out by the Uganda Co-operative alliance (UCA) and Uganda National Farmers Federation (UNFFE) in 2014found that most grain producing districts were registering 16 Billion shilling in post-harvest losses every year. This wasted food would make a huge difference in the families of many Ugandans (Nabhan et al., 1999; Gruhn et al., 2000; Omotayo & Chukwuka, 2016).

Uganda lacks the required knowledge, skills and technologies to averse the effects of global warming. Consequently, the level of food production has declined leading to hunger and famine in different parts of the country, especially the Karamoja region in North Eastern part of the country (The Observer, 20th September 2015; Kwesiga (2013). Most Ugandans live on one meal a day yet over 80% of Ugandans are engaged in farming (Collin & Rogerson, 2010).

Further, the poor land tenure system where land is fragmented into small pieces with no legal ownership (Bomuhangi, Doss & Meinzen-Dick, 2012) and poor farm practices in the country (Nkuba, 2001; Buyinza, 2009) have rendered soils less productive and in some cases caused soil erosion. This situation is becoming worse especially as Uganda's population is on the increase. Land is becoming a more scarce resource than ever before. This calls for more technologically efficient and effective farming mechanisms. Another challenge being faced by Ugandan farmers is food processing, preservation and value addition. This is due to the fact that Ugandan farmers rely on seasonal rains. Majority of them plant and harvest at the same time. This leads to mass production during harvest periods. Since there are no mechanisms to preserve farm produce, most of the food rots away in their custody after harvesting (Michelmore, 2013).

In terms of marketing agricultural produce in Uganda, there are several challenges. Most farmers sell their produce to the nearest buyer. The prices are usually set by the buyer depending on supply conditions. Most middlemen buy non-perishable farm produce in times of plenty at very cheap prices and store them, only to re-sell back the same produce to the same farmers at exorbitant prices after a few months of storage. Collin and Rogerson (2010) argued that the poor road infrastructure and high transport costs have made it difficult for Ugandan farmers to transport their produce to better markets such as those in neighbouring countries.

Some of these problems could be mitigated by the use of e-agriculture. Which is a recent term in ICT that defines a global community practice, where people from all over the world exchange information, ideas, and resources related to the use of information and communication technologies (ICT) for sustainable agriculture and rural development.

In a study conducted by (Epstein, 2013) found that majority of farmers in Kenya are not able to sell their produce at market price due to lack of sufficient information available. This makes them to sell their products at throw away prices thereby incurring losses in addition promoting food insecurity. For such farmers to produce and sell their products at market based and competitive prices, information communication technologies (ICT) tools have to be availed to them. This is because the development of agriculture depends on how fast and relevant information is provided to the end users. This can ably mean that problems faced by Kenyan farmers are more or less similar to those encountered by their Ugandan counter parts because of the proximity of the two countries.

In Uganda, the government has no policy towards the implementation of e-agriculture even though the use of ICT tools especially mobile phones has continued to grow at an exponential rate. (CCK, 2010) report noted that in 1999, just 5% of Ugandans owned a phone of any sort; today, the figure is above 75%. Notably however, barely do the Ugandan farmers use their mobile phones on agricultural related activities.

The above discourse reveals low expectations in using e-agriculture in Uganda. Ugandan farmers have a low expectancy, which makes them make no effort to use internet enabled devices for agricultural purposes. Vroom (1964) argues that where individuals' expectancy is low, performance will be low and hence no rewards. The individual's effort is determined by the expected rewards. The farmers' degree of certainty that their effort in terms of using e-agriculture will translate into excellent performance is lacking (Robbins, 2008). Moreover, under normal circumstances, e-agriculture is expected to bring about outcomes such as better prices, easy market access, and better farm practices through knowledge sharing among others. Given that these outcomes have remained low, are not using e-agriculture (Simone, 2015; Vroom, 1964).

Factors such as context of use and usability measures advanced by the ISO (ISO 9241-11, 1998) could help explain why farmers are unwilling to use e-agriculture. There is a possibility that the available e-agriculture platforms do not present the e-agriculture services relevant to the Ugandan context. It might also be that whereas the e-agriculture technologies exist, they may not offer a blend of intrinsic and extrinsic benefits expected by farmers from e-agriculture. The lack of confidence / instrumentality (Porter & Lawler, 1969) in the outcome by farmers has led to low productivity.

This study sought to examine the farmer's motivation to use e-Agriculture by exploring their expectancy, instrumentality, intrinsic and extrinsic motivation. The study sought to assess the awareness and usage of e-agriculture in Uganda with a view to advising various stakeholders in the agricultural value chain and the government on how best they can utilize e-agriculture in promoting food security in the country. The study developed a theoretical model which can best explain and help in improving e-agriculture usability in Uganda.

1.2 Statement of the problem

Despite the fact that most Ugandans are engaged in farming, farm produce continues to dwindle. Many Ugandans live on one meal a day and there is rampant hunger in some regions such the Karamoja region where people can hardly afford a meal (The Observer, 20th September 2015**)**. According to Kwesiga (2013), a total of 60 districts were hit by famine in the year 2013. Further, there were persistent food storage problems in the country leading to most foodstuffs rotting away and or sometimes disposed of cheaply (Michelmore, 2015). The poor road infrastructure has not facilitated easy movement of farmers to markets.

Moreover, technologies exists that would support farmers to improve on the farming methods and mechanisms, food preservation, online marketing and selling via the internet but the level of usage of these technologies is very low (FAO, 2015). Because of this, the farmers are unable to access the freely available agricultural information, knowledge and international markets via the internet.

The farmers' low usage of e-agriculture could be due to the low expectancy, and low instrumentality. It could also be due to inappropriate context of use and usability measures of e-agriculture in the country (ISO 9241-11, 1998).

The study used a mix of theories of technology usability and motivation to test usability of e-agriculture by Ugandan framers and develop an extended model for understanding how Ugandan farmers could better use e-agriculture platforms. The critical aspects of examination included expectance, instrumentality, context of usage and usability measures for e-agriculture. These constructs were tested to ascertain their relevance in measuring e-agricultural usability before they are modelled using structural equation modelling techniques.

1.2.1 Purpose of the study

The study provides an understanding of how and the extent to which E-agriculture is used by Ugandan farmers and to develop a model that can be used to promote the use of E-Agriculture Usability in Uganda.

1.3 Research Questions

The following are the research questions;

1. What is the relationship between Expectancy, Instrumentality, Intrinsic Motivation, Extrinsic Motivation and e-Agriculture usability of farmers in using e-Agriculture in Uganda?
2. What is the relationship between Context of Use, Usability Measures and Intrinsic Motivation of farmers using e-agriculture platforms in Uganda?
3. What is the moderation effect of Context of Use in the relationship between Expectancy and Instrumentality of farmers’ usage of e-Agriculture in Uganda?
4. What is the mediation effect of Instrumentality in the relationship between Expectancy and e-agriculture usability by farmers in Uganda?
5. What is the mediation effect of Intrinsic Motivation and Extrinsic motivation in the relationship between Instrumentality and e-agriculture usability by farmers in Uganda?

1.4 General Objective

The general objective of this study is to develop and test a model for e-Agriculture usability in Uganda.

1.4.1 Specific Objectives

The specific objectives of this study are;

1. To examine the relationship between Expectancy, Instrumentality, Intrinsic Motivation, Extrinsic Motivation and e-Agriculture usability of farmers in using e-Agriculture in Uganda
2. To analyse the relationship between Context of Use, Usability Measures and Intrinsic Motivation of farmers using e-agriculture platforms in Uganda
3. To analyse the moderation effect of Context of Use in the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda
4. To examine the mediation effect of Instrumentality in the relationship between Expectancy and e-agriculture usability by farmers in Uganda
5. To examine the mediation effect of Intrinsic Motivation and Extrinsic motivation in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.

1.5 Subject Scope of the study

The subject matter was limited to investigating how Expectancy, Instrumentality, Intrinsic Motivation, Extrinsic Motivation Context of use, and Usability measures could positively influence usability of E-agriculture in Uganda.

1.6 Justification of the study

The strategic application of ICT to the agricultural industry, the largest economic sector in Uganda, offers the best opportunity for economic growth and poverty alleviation in the country. Food security is paramount for the survival of individuals, families and ultimately the country at large, yet Uganda's agriculture sector has been declining in the recent past. Poor farmers have largely remained poor with 70 per cent of the people living in rural areas surviving on less than a dollar a day. The Agricultural sector is disadvantaged owing to factors that include, lack of access to critical agricultural information, inadequate access to markets, unfair market conditions, inadequate access to advanced technologies, weak infrastructure, among others.

The role that ICT can play in mitigating some of these challenges is increasing as personal ICT devices, such as mobile phones or tablets PCs, are becoming more widely available. ICT, when embedded in broader agricultural stakeholder systems, can bring economic development and growth as it can help bridge critical knowledge gaps.

The purpose of this study was to provide a conceptual solution to the problem of agricultural asymmetries by coming up with a model for usability of e-agriculture by farmers in Uganda

1.7 Significance of the study

This study makes a theoretical contribution by examining the applicability of the expectancy theory, Porter and Lawler model and the ISO usability model in understanding usability of e-Agriculture by farmers in Uganda. No study has approached usability of technology from this perspective where a triangulation of these three theories is applied.

The ultimate output of this study was an extended structural equation model that depicts, in a more empirical way, how farmers can be motivated to use e-Agriculture in Uganda. Seven constructs borrowed from the three theories were tested and removed those that do not significantly influence E-agriculture usability. The final model developed using SEM had only those constructs meeting the minimum factors loadings. The study proposed factors that are responsible for causing e-Agriculture usage on the study constructs including Expectancy, Context of Use, Usability Measures, Instrumentality, Intrinsic benefits, Extrinsic benefits and e-Agriculture usage. Given that this study triangulates three theories in trying to understand and improve e-Agriculture usability, the resultant model having the listed constructs above provided a more solid theoretical basis and guidelines for e-Agriculture usability in Uganda.

Further, it is hoped that results obtained in this study will help the government of Uganda through the Ministry of Agriculture to come up with an appropriate national policies for motivating farmers to use e-Agriculture in improving farm produce, quality standards and identifying emerging markets for farmers produce.

At institutional level, Non-Government Organizations (NGO) and Cooperative Societies engaged in activities related to farming in the country will use the recommendations given in this study to improve of usage of e-Agriculture portals, thereby reducing on poverty amongst farmers through improved farming practices and accessing better prices for agricultural produce.

The study will also be relevant to universities and policy makers in the area of higher education to make informed decisions by incorporating e-agriculture curriculum in the education sector in order to produce graduates with the right knowledge and skills to implement e-agriculture in the agricultural value chain.

This study will become part of the pool of knowledge on e-agriculture, where other scholars and researchers will be in position to refer to the contents of the study for any future related studies and debate.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter covers a critical review of literature and a matrix analysis of the study concepts and theories in order to theoretically inform the study.

2.1 Literature search strategy and assessment approach

Relevant journal articles and other publications such organizational reports, newspapers, among others were obtained from internet sources. The research searched for these materials various academic platforms such as Google Scholar, Academia, ResearchGate, University web portals among others. The key words and phrases such as “Intrinsic benefits”, “Extrinsic benefits”, “Context of use”, “Expectancy theory”, “Porter and Lawler model”, “ISO usability model (ISO 9241-11, 1998 “, “Expectancy”, “Usability measures”, “Instrumentality”, “Valance”, “e-agriculture usability”, “Social media in Sub-Saharan Africa” among others. The collected literature was checked for consistence with the above themes. Those found lacking on either of the themes were removed from the review exercise. The literature assessment is presented in three sections:

The first section looks at the concepts of e-agriculture and later explores the current affairs of e-agriculture in Uganda.

The second section examines the theoretical underpinning of the study. First, the study presents the Expectancy Theory and then next - in detail, we discuss the relationship of this theory with the situation in Uganda’s Farmers. The study also looks at the factors that affect the usability of e-agriculture in Uganda. A critical review of the underpinning theories is also examined, that is the Motivation theory, the Expectancy theory and its application in E-Agriculture Usage, the ISO usability model, and the Porter and Lawler model.

The third section presents a summary and a critical comparison of the study theories by examining each theory's strengths and weaknesses in order to identify a theoretical gap. Because this study uses all the three theories, a matrix analysis method is used to triangulate them. After analysing the gap, a conceptual framework is formulated and presented together

2.1 The concept and practice of e-Agriculture

The term e-agriculture is used to refer to the use of information and communication technologies in agricultural activities such as seed enhancement and value addition, marketing of agricultural produce, and agricultural information sharing (Namisiko, Aballo, 2013). It involves the design and development of ICT based applications for usage in fostering agriculture. According to Adhau (2010) e-agriculture has led to the development of agricultural databases and data warehouses that provide immense knowledge for farmers and buyers of agricultural products globally. Meera and Jhamtani (2004) posit that e-agriculture is among the new disciplines that are receiving a lot of attention both in academia through research and publication and also in the practice, especially in trying to improve the livelihoods of rural farmers. For example, through e-agriculture platforms, farmers can access valuable information concerning their crops varieties, animal breeds and feeds, agricultural chemicals, and the market prices instantly at cheap rates.

The advent of the internet and its subsequent adoption in developing countries like Uganda has greatly influenced the growth of e-agriculture (Inklaar & Timmer, 2005). Today, anyone with a basic internet enabled device such as mobile phones, laptop, and tablets among others can easily access global e-agriculture information and use it on their farms. Further, there are several new internet-based technologies that provide multimedia agriculture information through videos, images, audio for easy understanding, especially by the semi-skilled farmers. Many of these technologies are called Social Media. They include YouTube, Skype, Facebook, and Wikipedia among others. In India for example, most farmers have used e-agriculture platforms to improve farm produce and consequently transformed their economy (Adhau, 2010). Despite these developments, many farmers in Uganda are not using e-agriculture. The resultant effect is poor yields, and low product prices due to limited knowledge about better farming practices (Epstein, 2008).

2.2 E-Agriculture usability in Uganda

Attempts have been made by groups such as the United Nation's (UN) Millennium Development Goals (MDG), the World Food Program (WFP) to mitigate famine and hunger by starting programs aimed at enhancing agricultural production amidst dwindling natural resources, necessary for agricultural production (UN-MDG, 2009). In Uganda, a National Agricultural Advisory and Development Services (NAADS) body was set up to help eradicate poverty through agricultural modernization using technologies, training and marketing among others. However, most of NAADS goals were not achieved due to rampant corruption, henceforth; the programme was suspended following a presidential directive. Although NAADS has resumed its mandate, many of the challenges highlighted above are still prevalent.

Another such intervention was through the Northern Uganda Social Agricultural Recovery Fund (NUSARF). NUSARF was a post war intervention after the ruminants of the Lord's Resistance Army (LRA) rebels had been wiped out of north and eastern parts of Uganda. Its main goal was to help the communities recover from the effects of the 20 year old LRA war that left many dead and millions displaced from their homes and living in Internally Displaced People's (IDP) camps entirely surviving on donor food. Among others, NUSARF was supposed to train people and distribute seeds and fertilizers in order to boost food production, thereby alleviating the problem of food scarcity and helping IDPs resettle in a quick but more sustainable manner. However, just like NAADS, NUSARF did not deliver on its goals. The money was embezzled by corrupt government officials some of whom are now interdicted and undergoing trials in courts of law. Consequently, the European Union (EU) (who were the main donors) and others have since stopped direct aid to the government of Uganda. The donors are exploiting other alternatives avenues through which aid money can be channelled directly to the beneficiaries without necessarily going through central government (World Bank report, 2014).

Other initiatives are the National Agricultural Research Organisation (NARO) which coordinates and oversees agricultural research in the country, and Kawanda Agricultural Research Institute (KARI) which helps in generating technologies for improvement of agricultural produce and quality in the country; and the International Fund for Agricultural Development (IFAD) for funding agricultural projects. Recently, the Banana Industrial Development (PIBID) fund was established in the Office of the President for value addition of banana projects in western Uganda. Others include upland rice farming introduced by the Office of the Vice President for supporting farmers to grow rice in dry areas. Despite these initiatives, it is still clear that agricultural production in the country is low. There are persistent food shortages especially in North Eastern parts of the country as earlier mentioned. Most of the inflationary situations experienced in Uganda are due to food shortages that lead prices of agricultural produce to shoot-up seasonally. Further, the ever increasing demand for agricultural produce by neighbouring countries such as South Sudan, Kenya and the Democratic Republic of Congo have worsened the situation. Tons of foodstuffs are exported to these countries, leaving the nation with little to feed on.

Although there are some existing programs to facilitate access to information for trade benefits at the back end of the farming process, little has been done to provide farmers with relevant knowledge for improving their productivity and address the challenges of soil infertility, climate change and poor quality produce and market accessibility (Masaba, 2014). This problem is even worse in Uganda where only few of such organizations exist to champion the cause (Kaddu, 2011). There is increasing need for farmers to connect to the knowledge networks, and institutions necessary to improve their productivity, food security and marketability of their produce (D'Costa & Voegele, 2011). Further, there is much concern to explore better ways of land utilization through research, information sharing and group farming – commonly known as smallholder farmers. Farmers need new knowledge and skills in order for them to continue engaging in sustainable farming.

There is still an ardent need to address issues of information access, capacity development, modernization of agriculture through science and technology, innovation and entrepreneurship with special emphasis on e-Agriculture. This is because e-Agriculture has been found to play an important role in addressing the above challenges and helped transform many nations such as Singapore, India and China, Brazil among others. E-Agriculture is a very important tool in ensuring economic and social-cultural transformation by alleviating poverty among the rural poor (FAO, 2015).

2.2.1 E-Agriculture platforms in Uganda

A number of e-Agriculture platforms exist including Agri-Hub Uganda platform which is an online network of agriculture professionals, farmers, financial institutions, researcher and international development agencies (Agri-Hub Uganda, 2016). The platforms exist to support farmers through information and knowledge sharing, networking, financing among others. Another platform is One Acre Fund, which provides training, financial services, distribution of seeds, and agricultural marketing services to the farmers across Africa (One Acre Fund, 2016). The Africa Innovations Institute platform, which runs programs on climate change adaptation, disease control, farmers' capacity development, value chain management (AfrII, 2016). Sasakawa Africa Association for crop productivity enhancement, post-harvest handling and processing, marketing and financing (SAA, 2016). Many more e-Agriculture platforms exist in the country. Some are in the cloud and others a mobile based. However, the challenge is that most Ugandan farmers are not using these platforms to their benefit (FAO, 2015).

Several studies have defined usability as the extent to which an innovation is being used by its intended users (Abran et al. 2003; Nielsen, 1993). This can be seen through the number of interfaces and interactions and also the resultant effect after use. The International Standards Organization (ISO) defines usability as the degree to which a technology can be used efficiently and effectively by intended users in order to realize its objectives (ISO 9241-11, 1998). Hence, for there to be usability, the users should expect some kind of outcome (outcome).

2.2.2 Farmers Expectancy in Uganda

According to Robbins (2008), expectancy shows how certain an individual is that his/her effort will lead to good performance and better outcome. Where expectancy is low, there will be low performance (Chaudhary, 2014). Farmers put in efforts by using e-Agriculture to improve their performance in anticipation for better yields and prices. However, many of them end up frustrated as the yields are still low. As earlier indicated the prices for agricultural products frequently fluctuate and are very low during harvest seasons. As a result, many farmers resign their occupation in favour of other low skill jobs such as riding commercial passenger motor cycles locally known as "boda-bodas". Others sell their farm land to buy the motorcycles. There are questions on whether the farm yields harvested by farmers can help meet their needs (valance). Porter and Lawler (1969) argue that where valance is low, individuals will not be motivated to put in efforts. The farm harvests may not be intrinsically or extrinsically motivational enough for farmers to continue in this activity. Ryan and Deci (2000); Deci and Ryan (1985) argue that for there to be motivation, intrinsic and extrinsic outcomes should be sufficient to meet an individual's needs.

2.3 Factors affecting usability of e-agriculture in Uganda

Several factors affecting usability of e-agriculture in Uganda have been advanced by different scholars. These include lack of electricity, limited access to the internet, high levels of illiteracy among others. The following sections expound on these factors in a bid to understand e-agriculture usability challenges in Uganda.

Lack of electricity; most villages in Uganda do not have electricity. This makes it difficult for farmers to power their computers and or mobile devices that can be used to access e-agricultural services. Information from Uganda's electricity distribution company (UEDCL) shows that less than 5% of village populations have electricity. According to Clark G. S. (2016), only 2% of rural Ugandans have access to the national electricity grid. Although the Ministry of Energy and Mineral Development, Uganda plans to increase access from less than 5% to 10% by the 2022, this will still too low to create a significant impact (ME & MD, 2012).

Lack of computers; the problem of lack of computers is a general challenge for the entire rural Africans (Obidike, 2011). The IFAD (2016) argues that poverty remains resolutely ingrained in rural areas, where over 87% of Ugandans live. The high poverty is due to the fact that most of the rural farmers engage in subsistence farming. Because of this, Ugandan farmers are subsistence farmers; they can barely afford a computer or even a smart phone that can be used to access e-agricultural services (Walukamba, 2012). Consequently, only a few engaged in commercial farming are able to access and use e-agriculture (Bakyawa, 2005). The government has tried to address this issue through setting up telecenters in rural areas but still most people remain uncovered (McConnell, 2001).

Limited access to the internet: Given that Uganda is a land locked country, it is very expensive to lay fibre cables from the nearest sea point, which is currently Mombasa. The government is trying to lay national internet backbone from the sea in Mombasa to Uganda's capital city; Kampala is yet to be completed. Currently, Uganda has the lowest internet connectivity rate in the East African region where Kenya leads with, followed by Tanzania and then Uganda. The available internet connection provided by telecommunication companies is quite expensive for an average farmer (Nyirenda-Jere & Biru, 2015; ITU, 2001). Because of this, most farmers, though have intent to use e-agricultural, are unable to access the services. Consequently, there is limited usage.

High levels of illiteracy: although the Uganda Bureau of Statistics shows that there was an increase in literacy levels country wide, from 69% in 2005/06 to 71% in 2012/13, many Ugandans rural Ugandans remain illiterate. Most of them cannot comfortably read and write. This makes hard for them to use technologies that require some levels of literacy. Given that most e-agricultural content is packaged in the English language, it difficult for the Ugandan farmers to use e-agricultural services since most of them are illiterate.

Other factors; the United Nations' Food and Agriculture Organization conducted a review of e-agriculture over a ten year period and established the need for stakeholders to; 1) creating locally-adapted content such that content is relevant and applicable to the locals; 2) Building on existing systems and networks to channel agricultural information to farmers; 3) Building capacity of both people and organizations to provide information to farmers; 4) Addressing diversity by catering for information needs of women, men and children; 5) Ensuring access and empowerment by making sure that information actually reaches people and transforms their livelihoods; 6) Strengthening partnerships between farmers, extension workers, and other relevant stakeholder s; 7) Using realistic approaches for technologies to support information and communication; 8) and Developing information costs, value and financial sustainability ensure e-agricultural services are affordable and can be sustained by farmers (FAO, 2015).

2.4 Underpinning theories

A theoretical framework helps to ground research on theory. It informs the methodology, context logic and criteria for conducting a rigorous study (Crotty, 2003). This study is based on a triangulation of three theories including the Expectancy theory (Vroom, 1964), Porter and Lawler motivation model (1969) and the International Standards Organization usability model (ISO 9241-11, 1998). The succeeding section presents a detailed examination of these theories with the aim of developing and hybrid conceptual framework and formulating of hypothesis for the study.

2.4.1 Motivation

Motivation refers to "the reasons underlying behavior" (Guay et al., 2010, p. 712), while Gredler, Broussard and Garrison (2004) broadly define motivation as "the attribute that moves us to do or not to do something" (p. 106). On the other hand, intrinsic motivation is motivation that is animated by personal enjoyment, interest, or pleasure (Lai, 2011). As Deci et al. (1999) observe, "Intrinsic motivation energizes and sustains activities through the spontaneous satisfactions inherent in effective volitional action. It is manifest in behaviours such as play, exploration, and challenge seeking that people often do for external rewards" (p. 658). Researchers often contrast intrinsic motivation with extrinsic motivation, which is motivation governed by reinforcement contingencies.

Motivation involves a constellation of beliefs, perceptions, values, interests, and actions that are all closely related. As a result, various approaches to motivation can focus on cognitive behaviors (such as monitoring and strategy use), non-cognitive aspects (such as perceptions, beliefs, and attitudes), or both. For example, Gottfried (1990) defines academic motivation as "enjoyment of school learning characterized by a mastery orientation; curiosity; persistence; task-endogeny; and the learning of challenging, difficult, and novel tasks" (p. 525). On the other hand, Turner (1995) considers motivation to be synonymous with cognitive engagement, which he defines as "voluntary uses of high-level self-regulated learning strategies, such as paying attention, connection, planning, and monitoring" (p. 413).

Theories describing motivation abound in the literature. From the desire to succeed (Bong & Clark, 1999), to the need to achieve (McClelland, 1965), to the concept of individual competence in particular activities (Hartmann, Widner, & Carrick, 2013), motivation speaks strongly about an individual. While motivation has been evaluated in the job market in order to enhance productivity, it has also been assessed in the academic realm. Motivation was believed to be a crucial factor of excellent academic performance (Griffin et al., 2013). It served as a stimulus to participate in the learning environment. Motivation enhanced student engagement with learning opportunities (Moreira, Dias, Vaz, & Vaz, 2013).

Similary, motivation can be an important factor in the explaining the farming sector performance in Uganda. Farmers are motivated to continue farming despite dwindling harvest, yet if they could integrate their farming endeavours with e-agriculture, it could reverse the poor harvests currently attained by majority of farmers in Uganda.

2.4.2 Expectancy theory

Literature shows that the most accepted elucidation of motivation was provided by Victor Vroom (1964) in the Expectance theory also known as the Expectation-Value theory (Simone, 2015). This theory was developed from earlier motivation theories including the equity theory and behavioural theories. Anderson and Gaile-Sarkane (2010) argue that in the Expectancy theory, individuals are motivated to behave in such a way that will lead to production of expected results. The expectance theory rides on the understanding that perception is important in influencing ones' decisions in anticipation of positive change and likely consequences of behaviour. Anderson and Gaile-Sarkane (2010) further posit that expectancy theory is supported by the idea that individuals are driven by the need for self-satisfaction and gratification. It can be used to forecast behavioural outcomes of a person's choices (Kreitner & Kimicki, 1998). The theory presents three constructs. These include expectancy, instrumentality and Valance. Vroom (1964) argues that individuals are motivated in three aspects; 1) if they believe that their efforts will result into acceptable performance (expectancy), 2) if they believe that the resultant performance will be rewarded (instrumentality), and 3) if they believe that the value of the rewards is extremely positive (Valance). Figure 1 shows Vroom's expectance theory.

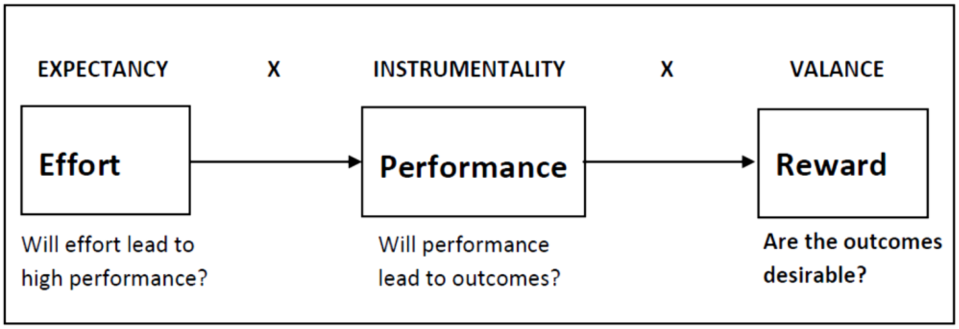

Figure 1: Expectancy theory (Source: Victor Vroom, 1964)

According to Vroom, higher levels of individual motivation will be realized where there is higher expectancy, a higher instrumentality and a higher valance causing a multiplier effect (Lunenburg, 2011). This is expressed by the following equation:

M = E * I * V (Motivation = Expectancy * Instrumentality * Valance).

2.4.3 The Relationship between Expectancy and E-Agriculture Usage

Expectancy is the degree of certainty that one's effort will lead to excellent performance (Robbins, 2008). It refers to an individual's probabilistic estimation of a performance outcome due to their efforts. This outcome ranges from 0 to 1 - where 0 means there is no performance outcome while 1 indicates 100% outcome (Chaudhary, 2014). Where the expected performance outcome is high (leaning towards 1) individuals are motivated to put in efforts. However, if individuals perceive the expected outcome to be low i.e. leaning towards 0, they will not put in effort (Simone, 2015; Vroom, 1964).

Vroom's expectancy theory is relevant in understanding motivation of Ugandan farmers to use e-Agriculture. Expectancy of farmers is seen to be high. For example, most farmers perform several activities in anticipation of positive change or rewards. Many of them cultivate their lands, even with rudimentary tools in a bid to improve food security and their household incomes. Many seek knowledge through attending seminars, workshops and other trainings hoping to utilize the gained knowledge and skills in improving their performance in terms of quality and improved production, widen their market opportunities and probably get better prices for their goods. However, many of these efforts end up with unsatisfactory outcomes. As earlier seen, the production levels are deplorable. The prices are ever fluctuating and farmers' incomes continue to remain the lowest in the country. Many of them live below the poverty line. The social-cultural and environmental factors also affect farmers. For example, female farmers in Uganda own no land due to traditional cultural norms. The emergence of global warming and its accompanying effects found most Ugandan farmers unprepared. Many of them do not know what to do in the face of challenges such as drought, soil erosion, soil infertility, pests, insects and sub-standard pesticides on the market among others that affect their output. Yet, with e-Agriculture, the farmers could access critical knowledge and skills on how to handle some of these challenges.

2.4.4 The Relationship between Instrumentality and E-Agriculture Usage

Instrumentality is the confidence that one's good performance will lead to rewards (Porter & Lawler, 1969). It shows the probabilistic estimation of the outcome due to good performance. Just like expectancy, the probability for instrumentality ranges from 0 to 1, where an instrumentality leaning towards 0 indicates negative or no outcomes (Chaudhary, 2014). For example, good performance may lead to better farm yields and / or household income (Simone, 2015; Vroom, 1964).

Farmers in Uganda maybe influenced to use e-agriculture if they have the confidence that once they use e-agriculture, their outcomes in terms of yields, market prices, knowledge sharing and better farm practices will be improved. However, there is a very low confidence in farmers' anticipation of rewards owing to their good performance. Perhaps, the only assurance that most farmers have as a reward for good performance is food security – even when it is disappointing at times. Some farmers end up abandoning farming for alternative hard labour jobs commonly known as "jua kali" or "under the sun", loosely meaning working under the hot sun. This shows that Ugandan farmers have a low confidence in the rewards offered to them from their agricultural efforts.

2.5 ISO usability model

The International Standards Organization developed a usability model that can be used to improve usability of new technologies such as e-agriculture. The ISO usability model as outlined in ISO 9241-11 (1998) posits that for proper usability of technologies, there must be consideration for Context of Use, Usability Measures and actual usability. For e-agriculture, context of use encompasses the tasks, hardware, software and environment in which the platform is being used. The model posits that context of use helps both the inventor and user in two ways; first, the inventor is able to package a new technology in the manner that suits users' needs; secondly, the user is able to use a technology once they find context of use appropriate and relevant to their situations (ISO 9241-11, 1998). The other important construct posited by the ISO model is the actual E-Agriculture Usability (ISO 9241-11, 1998). On the other hand, Usability Measures according to the ISO model help users to understand issues such as performance of the system, its effectiveness and efficiency thereby improving its use.

2.6 Porter and Lawler model

Porter and Lawler (1969) model is an improved version of the expectancy theory by Victor Vroom. The main motive was to know why and where individuals get the expectations and values that influence their motivation. Porter and Lawler also sought to establish the link between effort and performance with an individual's satisfaction. As such, Porter and Lawler (1969) introduced new constructs to the original expectancy theory of Victor Vroom. These extensions are; predictors of effort, predictors of performance, and predictors of satisfaction. According to Porter and Lawler (1969), performance leads to both intrinsic and Extrinsic Motivation. Individuals will perform based on how they perceive the rewards offered to them. Where the rewards are sufficient and considered fair, individuals will feel satisfied and perform better. Hence, the anticipated rewards have an influence on effort.

The proponents sought to examine how individual rewards led to satisfaction, thereby improving performance. Hein (2009) argues that Porter and Lawler model assumes that effort does not automatically result into performance where there is no ability to perform a given activity and a right perception. Hence, for there to be performance, the individual must have the right mind-set and the necessary competences to execute their tasks. Without rewards, motivation alone may not result into performance. The tasks should be clear to individuals so that they understand them well prior to execution. This ensures individuals' efforts are not misdirected. Porter and Lawler also make a major contribution to the Expectancy theory by adding the intrinsic and extrinsic principles of individual motivation.

2.6.1 The Relationship between Intrinsic Motivation and e-agriculture usability

Several scholars have tried to define intrinsic motivation but most notably is a definition by Munk (2011) which states that Intrinsic motivation is where individuals do certain activities “for which there are no obvious or appreciable external rewards” but rather “the rewards are inherent in the activity”. According to Deci and Ryan (1985), intrinsic motivation is “the innate, natural propensity to engage one’s interests and exercise one’s capacities, and in so doing, to seek and conquer optimal challenges”. It is a form of self-motivation of a farmer towards his work, peers, family members and the community at large (Brooks 2009). Munk (2011) argues that it is almost impossible to motivate individuals to perform where there is no intrinsic motivation. For intrinsic motivation to thrive, one must ensure the hygiene factors such a good work environment, job security and a fair salary are in place (Brooks 2009). Vockell (2011) presents a list of seven factors influencing intrinsic motivation as challenge, curiosity, control, fantasy, completion, cooperation and recognition as seen in table 1:

Table 1: Seven factors of intrinsic motivation (Source: Vockell, 2011)

Factor	**Interpretation**
Challenge	Individuals are when they are working towards meaningful goals with a persistent (intermediate) level of difficulty, where the individual is challenged with problems of manageable size
Curiosity	The individual is able to connect the dots between two already known things or able to acquire some knowledge that’s within the scope of a person’s interest and current knowledge
Control	By doing a specific thing, the individual is able to control or effect what will happen to them. It is a natural urge for individuals to want to be in control of what happens to them.
Fantasy	Use mental images of things and situations to stimulate their behavior.

	Imaging how the knowledge will be used in the future
Competition	Being able to compare how well an individual performs compared to others in a natural non-staged competition (if an individual is a losing position, it results into a bigger impact compared to when an individual is in a winning position.
Co-operation	Satisfaction from being able to help others achieve their goals
Recognition	Satisfaction when others recognize or appreciate their accomplishments Being able to achieve something that the individual is proud of and is able to show others (it is almost an extrinsic motivator)

2.6.2 The Relationship between Extrinsic Motivation and E-agriculture Usability

Scholars have argued that there are external factors that influence individuals' performance. These take various forms but can be presented in inform of financial rewards, gifts and other job-related benefits (Shields, 2007; Chetley et al. 2006). Extrinsic motivation arises where an individual executes a task with the hope of being rewarded in some form. Although most researchers have aligned extrinsic motivation to monetary rewards, Osterloh and Frey (2007) argue that it is the things that monetary rewards can do for a farmer that will influence their behaviour towards work and not the nominal value of the financial rewards. Hence, if an individuals' monetary reward is not sufficient to purchase his needs, he may not be motivated.

2.7 Theoretical gap analysis

In order to identify the theoretical gap for this study, a systematic literature review using matrix analysis method was conducted.

As earlier explained, the expectancy theory by Vroom (1964) helps to describe the underlying motivating factors for the usage of e-agriculture by farmers. The major contributions of the expectancy theory are constructs of Expectancy, Instrumentality, and Valance. However, the theory is short on explaining the intrinsic and extrinsic benefits that may influence usability of e-agriculture. Further, this theory, given its background, does not address usability measures highlighted as key factors for usability by the ISO (1998). The theory does not also give specific steps for e-agriculture usability.

On the other hand, Porter and Lawler (1969) help to explain the intrinsic and extrinsic benefits that influence farmers to use e-agriculture. The model further lists seven factors that could improve usability including Challenge, Curiosity, Control, Fantasy, Competition, Co-operation, and Recognition. However, just like the expectancy theory, Porter and Lawler model is just a motivation theory which has no regard for usability of technologies. Hence, it does not present issues such as Context of use and Usability measures, e-agriculture usability in addition to ignoring constructs of the expectancy theory i.e. Expectancy, Instrumentality and Valance.

Finally, the ISO usability model (ISO 9241-11, 1998) helps to understand usability aspects of e-agriculture. The model however, does not look at psychological factors that influence behaviour such as Intrinsic benefits, extrinsic benefits, Expectancy, Instrumentality and Valance. Table 2 below is a matrix highlighting the study theoretical gap.

Table 2: Matrix showing the theoretical gap

Construct	**Expectancy theory (Vroom, 1964)**	**Porter and Lawler model (1969)**	**ISO usability model (ISO 9241-11, 1998).**
Intrinsic benefits	×	✓	×
Extrinsic benefits	×	✓	×
Context of use	×	×	✓
Expectancy	✓	×	×
Usability measures	×	×	✓
Instrumentality	✓	×	×
Valance	✓	×	×
e-agriculture usability	×	×	✓

2.8 Conceptual Framework

The conceptual framework is a triangulation of several theories including the expectancy theory (Vroom, 1964), Porter and Lawler model of motivation (Porter & Lawler, 1968) and the International Standards Organization usability model (ISO 9241-11, 1998).

Vroom (1964) expectancy theory indicates that motivation starts with expectancy. If there is no expectancy, there will be no effort and consequently no performance outcome. The farmers in Uganda have many expectations from their efforts. For example, they expect better yields that are commensurate with their investment. Because of this expectation, they put in efforts in farming, research, in addition to using various technologies to improve their knowledge and seek better markets. It is envisaged that this effort increases instrumentality as well us usability of e-agriculture platforms. The confidence in their expected outcome in terms of farm yields and market prices is expected to influence them to use e-agriculture platforms (Simone, 2015).

Further, it is argued that where confidence in the outcome is high (high instrumentality), the farmers are likely to realize sufficient yields to meet their needs (positive valance) (Kreitner & Kimicki, 1998; Vroom, 1964). Hence, instrumentality improves usability of e-agriculture platforms as well as intrinsic and extrinsic motivation of farmers. Porter and Lawler (1968) argue that intrinsic motivation and extrinsic motivation influences performance.

The constructs borrowed from ISO helped in understanding the usability element in the study. These include Context of Use, Usability Measures and e-Agriculture Usability (ISO 9241-11, 1998). Context of Use involved the tasks, hardware, software and environment in which the platforms were being used. On the other hand, Usability Measures helped to understand issues such as performance of the system, effectiveness and efficiency of the system. In this study, Context of Use was assumed to moderate the relationship between Expectancy and Instrumentality. It was also hypothesized to positively affect Intrinsic Motivation of farmers to use e-Agriculture platforms (ISO 9241-11, 1998). It is important to note that no study has applied these theories in agriculture before. Previous studies did not map these relationships. The researcher hypothesized that e-agriculture usability was realized where; 1) expectancy is high, 2) instrumentality is high, 3) Usability measures are in favour of e-agriculture usability, 4) Context of use is appropriate, 5) intrinsic motivation is present and 6) extrinsic motivation is present. Figure 2 shows the conceptual framework mapping relationships between the various study variables.

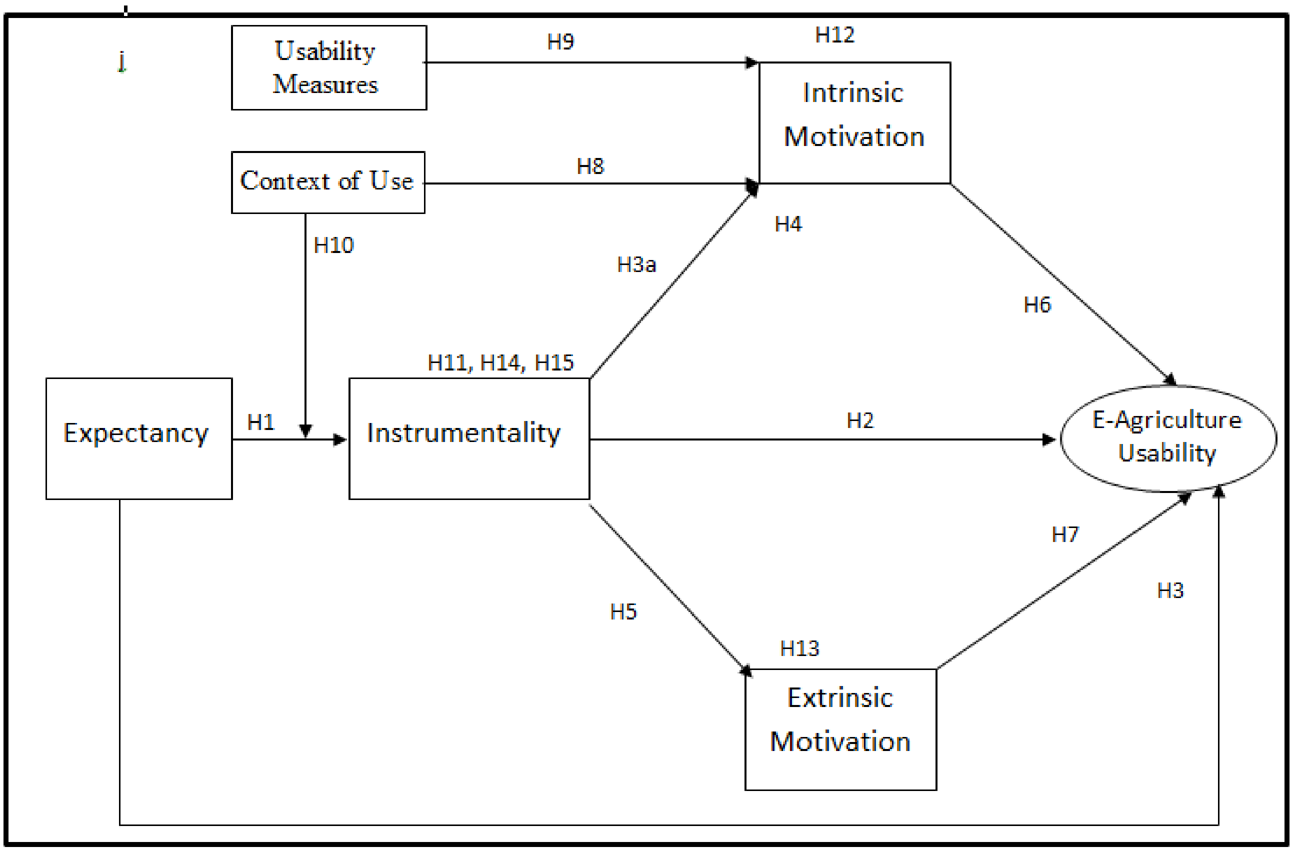

Figure 2: Conceptual framework (Source: Triangulation of Vroom, 1964; Porter & Lawler, 1968; ISO, 1998)

Table 3: Summary of the Objectives, Research Questions and Hypotheses

Objectives	**Research questions**	**Hypotheses**
1: To examine the	**1:** What is the	**H_1:** Expectancy has a positive effect on instrumentality of farmers' usage of e-Agriculture. **H_2:** Instrumentality has a positive influences

relationship between Expectancy, Instrumentality, Intrinsic Motivation, Extrinsic Motivation and e-Agriculture usability of farmers in using e-Agriculture in Uganda	relationship between Expectancy, Instrumentality, Intrinsic Motivation, Extrinsic Motivation and e-Agriculture usability of farmers in using e-Agriculture in Uganda?	usability of e-Agriculture by farmers in Uganda. **H_3:** Expectancy positively influences usability of e-Agriculture by farmers in Uganda. **H_4:** Instrumentality has a positive effect on the Intrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda. **H_5:** Instrumentality has a positive effect on the Extrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda. **H_6:** Intrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda. **H_7:** Extrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.
2: To analyze the relationship between Context of Use, Usability Measures and Intrinsic Motivation of farmers using e-agriculture	**2:** What is the relationship between Context of Use, Usability Measures and Intrinsic Motivation of farmers using e-agriculture	**H_8:** Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda **H_9:** Usability Measures has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda

platforms in Uganda	platforms in Uganda?	
3: To analyze the moderation effect of Context of Use in the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda	**3:** What is the moderation effect of Context of Use in the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda?	**H_{10}:** Context of use positively moderates the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda;
4: To examine the mediation effect of Instrumentality in the relationship between Expectancy and e-agriculture usability by farmers in Uganda.	**4:** What is the mediation effect of Instrumentality in the relationship between Expectancy and e-agriculture usability by farmers in Uganda?	**H_{11}:** Instrumentality positively mediates the relationship between Expectancy and e-agriculture usability by farmers in Uganda.
5: To examine the mediation effect of Intrinsic Motivation and Extrinsic motivation in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.	**5:** What is the mediation effect of Intrinsic Motivation and Extrinsic motivation in the relationship Instrumentality and e-agriculture usability by farmers in Uganda?	**H_{12}:** Intrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda. **H_{13}:** Extrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda. **H14:** Instrumentality has a positive mediation

		effect in the relationship Context of Use and Intrinsic Motivation of farmers in Uganda. **H15:** Instrumentality and Intrinsic Motivation have a positive mediation effect in the relationship Expectancy and e-agriculture usability by farmers in Uganda.

2.10 Study variables

According to Kaur (2013), a variable is "something that can change and or have more than one value". It is used to explain variance or the difference in things. Variables come as a result of some force due to interaction or can be the force themselves (ORI, 2016). There are different types of variables including independent variables, dependent variables, moderation variables, mediating variables among others.

Independent variables are those that are not influenced by another variable, however, once changed they influence changes in other variables (BYU, 2016). On the other hand, dependent variables are those that change once there a change in another variable where the dependence relationship is. A moderating variable is one that influences the relationship between two variables through a process called "intervention". It is not a part in the relationship, but do interject into it (Statistics solution, 2016; Baron & Kenny, 1986). On the other hand, a mediator variable is one that mediates in the relationship between two variables (Statistics Solutions, 2016). The relationship is incomplete until it goes through the mediator variable. Table 4 shows study variables.

Table 4: Summary of study variables

Independent variables	Expectancy
	Context of Use
	Usability Measures
	Intrinsic motivation
	Extrinsic motivation
	Instrumentality
Dependent variables	e-Agriculture usage
	Instrumentality
	Intrinsic Motivation
	Extrinsic Motivation
Mediator variables	Intrinsic motivation
	Extrinsic motivation
	Instrumentality
Moderator variables	Context of Use

2.11 Research hypotheses

H_1: Expectancy has a positive effect on instrumentality of farmers' usage of e-Agriculture.

H_2: Instrumentality has a positive influences usability of e-Agriculture by farmers in Uganda.

H_3: Expectancy positively influences usability of e-Agriculture by farmers in Uganda.

H_4: Instrumentality has a positive effect on the Intrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.

H_5: Instrumentality has a positive effect on the Extrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.

H_6: Intrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.

H_7: Extrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.

H_8: Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda

H_9: Usability Measures has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda

H_{10}: Context of use positively moderates the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda;

H_{11}: Instrumentality positively mediates the relationship between Expectancy and e-agriculture usability by farmers in Uganda.

H_{12}: Intrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.

H_{13}: Extrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.

H14: Instrumentality has a positive mediation effect in the relationship Context of Use and Intrinsic Motivation of farmers in Uganda.

H15: Instrumentality and Intrinsic Motivation have a positive mediation effect in the relationship Expectancy and e-agriculture usability by farmers in Uganda.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

The objective of this chapter was to lay the roadmap to discuss the philosophical foundation and methodology of this study. It details the research design and target population. The chapter also includes a discussion of the sampling plan that was followed, unit of analysis, questionnaire development and measurement strategy. The chapter is concluded with the layout of the data collection and analysis strategy, controls for potential biases and overall research plan for the study. The chapter was undertaken in view stipulated objectives and research questions.

3.1 Philosophical Foundation

Research philosophy concerns the type of knowledge and improvement of that knowledge. It expresses vital assumptions about the way in which the researcher views the world. The assumptions reinforce the research strategy and the methods to use as part of that strategy. Therefore, the adopted philosophy was influenced by practical considerations (Castellan, 2010). On the other hand, a paradigm consists of the following components: ontology, epistemology, methodology, and, methods. Every paradigm is based upon its own ontological and epistemological assumptions. Different paradigms inherently contain differing ontological and epistemological views; therefore, they have differing assumptions of reality and knowledge which underpin their particular research approach. This is reflected in their methodology and methods (Scotland, 2012).

3.2 Ontological Assumption

Ontology is the study of being and is concerned with the nature of existence, the structure of reality and the kind of world under investigation (Crotty, 2003). Guba and Lincolin (1989) posit that ontological assumptions are those that respond to the question ‘what is there that can be known?’ or ‘what is the nature of reality?’ In other words ontology helps us to study and understand the world through examining the assumptions about how the world is made up, and the nature of things therein. According to Bryman (2008), ontological issues surround on whether the social entities can be considered objective entities that have a reality external to social actors, or whether they can be considered social constructions built on perceptions and actions of social actors. These opposite points of view are referred to as Objectivism and Constructivism also known as Subjectivism respectively (Scholarios, 2005; Easterby-Smith et al., 2004). In addition Burrell and Morgan (1979) suggested Realism and Nominalism as an additional contradicting ontological point of view. A detailed discussion of constructivism, realism, nominalism and objectivism, ontologies is given in the following sections with the aim of selecting an appropriate one for this study.

3.2.1 Constructionism ontology

Constructionism (also known as subjectivism) is an ontological position asserting that social phenomenon and their meaning are continually being accomplished by social actors, and that they are in constant construction and revision (Bryman, 2008:19). Constructivism infers the continuous change, updating and rejuvenating of the existing social structures (Bryman, 2008; Becker, 1982). This ontological position challenges the suggestion that categories such as organisation and culture are pre-given and therefore confront social actors as external realities that they have no role in fashioning. This is because social phenomena and their meanings are continually being accomplished by social actors. It implies that social phenomena and categories are not only produced through social interaction but they are in constant state of revision by the interaction of social actors (Bryan & Bell, 2007). This kind of ontology is suited for qualitative research approaches where the social actors are directly involved in altering reality.

3.2.2 Nominalism

Nominalism is the view that reality is subjective and differs from person to person (Guba & Lincoln, 1994). This implies that there is no absolute right or wrong, but rather, mental constructs of what is right or wrong exist. In nominalism research, reality is mediated by senses of social actors. “Reality emerges when consciousness engages with objects which are already loaded with meaning” (Crotty, 1998, p. 43). Therefore, nominalism alludes to the belief that social actors give reality to the form of things. Crotty’s observation suggests that reality is subjectively constructed by individuals. An individual experiences many realities in life which they perceive differently. Hence, reality is a product of the individual's mind and universal ideas are a result of mental process. Research based on nominalism ontology considers individuals' opinions, feelings, experiences and inner thoughts which vary from person to person and cannot be numerically tested but rather, their qualitative values are interpreted to imply a real-life phenomenon. This study did not use nominalism ontology because the ontological assumptions of this study focused on reality as not being a product of the mind, limited mental process, and there is truth in the mental constructs of what exist in terms e-agriculture usability by farmers in Uganda.

3.2.3 Realism

Realism ontology holds that one single reality exists that can be studied, understood, and experienced as a truth, and that a real world exists independent of human experience (Moses & Knutsen, 2012). This means that, a discoverable reality exists independently of the researcher (Pring, 2000). According to Smith (2004), realism ontologies deal with concepts which are abstract than linguistic expressions, and words used owe their meaning to the things they represent and not how the researcher interprets it. Therefore, reality is mapped out of the concepts that are developed from the social connections with entities. In line with this view, Moon and Blackman (2014), identified three types of realists exist that is to say; 1) The Naive realist, 2) The structural realist and 3) The critical realist. Naıve realists argue that a single truth exists and can be proved using different approaches if it is done correctly. They assume a perfect reality exists. The structural realists on the other hand argue that although a single reality exists and can be proven, the structures defining that reality vary. The critical realists argue that whereas a single reality exist, it can never be understood perfectly because of human flaws – thus claims about a reality must be critically investigated (Bryman 2008; Guba & Lincoln 1994. According to Guba (1990), critical realism aims to study the imperfect understanding of the real world by humans. This ontology stands in between the two extreme ontologies of objectivism which seeks to prove reality using empirical data and constructivism which seeks to establish the value of reality. The main disadvantage of critical realism is that it requires using extremely big study samples. This makes the study vulnerable to unnecessary delays and high costs (Easterby-Smith et al., 2004).

3.2.4 Objectivism ontology

This is an ontological position that implies that social phenomena confront us as external factors that are beyond our reach or influence (Omoijiade, 2014). Social phenomena and their meaning have an existence that is independent of social actors. This ontological position implies that social phenomenon has been done or decided leaving the affected people with no option but to accept, and that those external facts are beyond our reach and therefore influence. Objectivism assumes that social reality has an autonomous existence outside the researcher (Eriksson & Kovalainen, 2008; Bryman & Bell, 2007). Therefore, when conducting research of objectivism ontology, the researcher aims to examine assumptions against reality. The researcher – as a social actor is independent of the study. This kind of ontology is most suitable for quantitative research.

It is on the basis of the above discussion and assumptions that the current study adopted the objectivism ontology in order to understand how Ugandan farmers used e-agricultural platforms without creating biases. This ontological stance is praised for separating the researcher from the research. This ontology is consistent with quantitative research methods where the researcher is detached from respondents. In this study, the researcher was detached from the farmers, who were being researched upon, thereby reducing bias. Objectivism ontology also helped to ensure that claims about Ugandan farmers' usability of agriculture platforms were subjected to empirical investigation so that truth in reality was established.

Further still, objectivism ontology helped to understand and enlist rational explanations of why farmers were not using e-agriculture platforms, despite their existence (FAO report, 2015), and in spite of success stories attributed to e-agriculture usability in other parts of the world. As earlier discussed in chapter one, usability of e-agriculture platforms in Uganda remained a big challenge (FAO report, 2015). Therefore, there was an urgent need to come up with practical and scientifically verifiable solutions which could help promote e-agriculture usability in the country. The key assumption was that, the farming communities are rational entities, in which rational explanations offer solutions to rational problems.

3.3 Epistemological Assumptions

Epistemology is ‘a way of understanding and explaining how we know what we know’ (Crotty, 2003 pp. 3). Epistemology is also “concerned with providing a philosophical grounding for deciding what kinds of knowledge are possible and how we can ensure that they are both adequate and legitimate” (Maynard, 1994 pp.10; Crotty, 1998, pp. 8). This study focused on three types of epistemological paradigms, namely; 1) interpretivism, 2) critical theory, 3) positivism. These epistemologies are discussed in detail below with a view of selected the most appropriate one for this study:

3.3.1 Interpretivist paradigm

Interpretivist approach generally takes an open minded approach and starts from data rather than a literature based theory or hypotheses to be tested out. Interpretivist paradigm intends to deal with different contexts through sense making rather than objectively examining reality. However, the short coming of this paradigm is that it is subjective in nature, thereby rendering it more vulnerable to bias due to human error. In addition, the results are likely to be personal - therefore cannot be necessarily generalised. According to Easterby-Smith et al. (2004), interpretivist researchers tend to involve emotion and bias in their views which may not benefit the study because the researcher gets in the way of what is really happening. Therefore, since this study was concerned with developing an e-agriculture usability model for farmers in Uganda, this paradigm was considered not the best one.

3.3.2 Critical theory paradigm

Critical research challenges the conventional research paradigms that argue for either quantitative or qualitative research methods. The underlying ontological stance for critical theory epistemology is critical realism, which calls for examination of reality with a view that there is no perfect truth (Bryman 2008; Guba & Lincoln 1994; Guba, 1990). This epistemology puts emphasis on historical methods of investigation compared to positivism and interpretivism that are extreme methods of on-going phenomenon investigation (Tashakorri & Teddlie, 1998). Dieronitou (2014) argues that critical theory research paradigm investigates on-going social-economic and political factors influencing phenomenon.

3.3.3 Positivism paradigm

When the purpose of the research is to record, measure, and predict reality through a set of predetermined variables or constructs, positivist epistemology is normally the best appropriate choice (Coviello & Jones, 2004). Positivisms epistemology posits that knew knowledge should be based solely on observable facts that can be verified rather than speculation and subjective perceptions (Tashakkori & Teddlie, 1998). In addition, Crotty (2003) argues that positivism epistemology is scientific in nature. It can be used to develop theory by testing hypothesis on empirical data. This study adopted a positivist epistemology since it lays emphasis on clarifying and predicting what transpires in the social world by identifying regularities and causal relationships between its elements or variables (Burrell & Morgan, 1979). The positivist epistemology is in-line with the objectivism ontology which was selected for this study. It allowed the current study to make justifications of events by investigating the process, mechanism, and structure of the events using quantitative research methods (Coviello & Jones, 2004). Furthermore, this approach is capable of providing a causal description and explanation of the forces at work plus implementing the traditional approach of natural science in order to understand and analyze the causal interrelationship between variables (Ardalan, 2009). Moreover, a systematic investigation of research on e-agriculture usage in developing countries as well as Uganda revealed that much of the emphasis had been put on subjective or interpretative insights and context specific issues in previous studies (Zewg and Dittrich, 2015). Therefore a positivist epistemology was necessary to close the gap. Further, literature analysis also revealed many exploratory contributions in e-agriculture, which needed to be confirmed with hypothesis testing. This gap called for theoretical configuration in explaining e-agriculture usability and elaboration on which theory has better predictive power.

Guided by a positivism epistemology, this study formulated research hypotheses to address relationships between Expectancy, Context of use, Instrumentality, Usability measures, Intrinsic motivation, Extrinsic motivation, and E-agriculture usability from the existing body of knowledge. This process offered opportunities to generate new knowledge on the nature and structure of interrelationship between the study variables whereby empirically supported hypotheses were retained while the unsupported hypotheses were dropped from the model (Burrell & Morgan, 1979).

It was against this background that it was necessary to carry out studies with both theoretical and methodological rigor in the field of ICT in agriculture, more specifically e-agriculture. Consequently, there was a need to adopt a study grounded in the positivist epistemology, in order to explain interrelationships between the study variables and utilizing an optimum sample, with a view of coming up with an e-agriculture usability model for Ugandan farmers.

3.4 Research Approach

Although relatively a new development, the interaction between inductive and deductive approaches, which appreciates both theory building and testing by adopting a mixed research methodology (Malhotra & Grover, 1998). However, this study followed a deductive research approach which focuses on theory testing using explanatory techniques (Malhotra & Grover, 1998). The deductive approach to scientific research begins with general knowledge (i.e. from experiences, existing theories and empirical studies) and works towards substantiating and/or contributing to theory (Kekale, 2001). It was used in constructing general themes and structural relationships about an observation, which were then verified or falsified through empirical evidence. For that matter the study started from theory to empirical findings. The major aim of deductive research is to test how well the aspects of the empirical world fit the theory or concepts define (Gerring, 2012). Further, within this approach, triangulation of methodology was emphasized by adopting single-item measures on respondents to reduce measurement errors and ensure reliability and validity of results.

3.5 Research design

The study adopted a two–stage cluster sampling survey research design (Andersen, 2010; Kropp et al., 2006; Ripolles & Blesa, 2011; Spyropoulou et al., 2011). In which the four regions of Uganda constituted the clusters to be considered for this study. Then afterwards a simple random subsample of farmers was selected from each cluster. The motivation of cluster sampling was intended to increase sampling efficiency and reduce costs (Ripolles & Blesa, 2011).

The cluster sampling survey design was adopted for this study because the population of farmers in Uganda is dispersed over broad geographic areas (UBOS report, 2010). This could have posed a huge logistical challenge to administer the questionnaires to potential respondents. To mitigate this problem, cluster sampling was implemented (Andersen, 2010), which involves drawing a sample from farmers of the four different geographic regions in Uganda. To do this, a list of all counties and farmers therein was obtained, who were likely to use e-agriculture in Uganda from the Ministry of Agriculture, and then data collectors were randomly dispatched to each of the of the regions. In addition an online questionnaire was also used, which was posted on the farmers WhatsApp group and e-mails, this enabled us to improve the data collection procedure from farmers whom were left out on the face to face simple random survey.

3.6 Research Timeframe

A cross-sectional study was adopted; because it has the ability to provide a good and yet quick and reliable representation of the findings of the study. Data were collected at one point in time within duration of 6 weeks. When using survey design, the data collected at one point, due to the large size of the sample is generalizable to the population.

3.7 Data and sources

Both primary and secondary data was used. Primary data came from respondents who comprised of farmers and agricultural extension workers and policy leaders from the agricultural ministry engaged in farming.

On the other hand, secondary data come from published materials in internationally recognized peer review journals, local newspapers articles, policy documents and consultancy and annual reports published by institutions at the helm of fostering e-Agriculture, value addition, marketing among others.

3.8 Study population

The study population involved farmers in Uganda using some form of e-agriculture and from government and non-government farming institutions throughout the country. Since there is no registrar of farmers and agricultural extension workers in Uganda, this number is unknown.

However, since studies indicate that 80% of Ugandans are engaged in farming activities (Collin & Rogerson, 2014) and the population of Uganda currently stands at 41 million, it loosely implies that about 32.8 million Ugandans would constitute the population for this study on the side of farmers. On the side of extension workers, no formula could be applied since there was no statistics giving any suggestion of their numbers. This is because they are not registered and are not centrally monitored.

3.9 Sample size

Owing to the fact that this research implemented Structural Equation Modelling (SEM), the sample size had to be sizeable in order to achieve better statistical power to discard alternative models (Bentler, 2004). Nevertheless, (Sivo (2006), Garver and Mentzer (1999), and Hoelter (1983) are against the maximization option and advocate for optimization of sample size. They have argued that, maximization option is both expensive and time consuming, when sample size reaches a certain critical level, the additional benefits stemming from extra numbers become negligible. Accordingly, in order to establish the optimal size, consideration was paid to the minimum sample size in order to acquire the required level of statistical power in SEM (Hoe, 2008; Schreiber, Stage, King, Nora, & Barlow, 2006).Given that the population of farmers is unknown, the population proportion sampling method was used with the assumptions that a population proportion was 50% (0.5), a margin of error of 5%, and confidence level of 95% was used in line with (Hyde, 2017). Thus;

$$n = p(1-p)\left(\frac{z}{E}\right)^2$$

Where;

n= sample size

p = population proportion

z = standard deviation

E = Margin of Error

As already indicated above, the population proportion was estimated at the highest 50% while the standard deviation was estimated at 95% confidence level. Further, the margin of error was estimated at 5%.

$$n = 0.5(1 - 0.5)\left(\frac{1.96}{0.05}\right)^2$$

$$n = 0.5 * 0.5(39.2)^2$$

$$n = 0.5 * 0.5(1536.64)$$

$$n = 0.25 * 1536.64$$

$$\boldsymbol{n = 384}$$

3.9.1 Sampling methods

This study adopted a multistage sampling approach. First cluster sampling was used to divide the population of farmers into four clusters, representing the four regions of Uganda (Northern Region, Eastern Region, Western Region and Central region), and the main reason was cost efficiency (economy and feasibility). Thereafter simple random sampling method was used in every cluster (region) to ensure that all farmers had an equal chance of representation.

It is important to note that different regions grow different types of crops and rear different types of animals. For example, in the eastern Uganda, they grow maize, beans, coffee; in northern Uganda, the grow millet, sorghum and cassava, whereas in central, the main agricultural products are bananas, sweet potatoes, cassava, coffee and fruits. On the other hand western Uganda is predominantly involved in rearing cattle and recently, growing bananas. Figure 3 is a map of Uganda showing study regions.

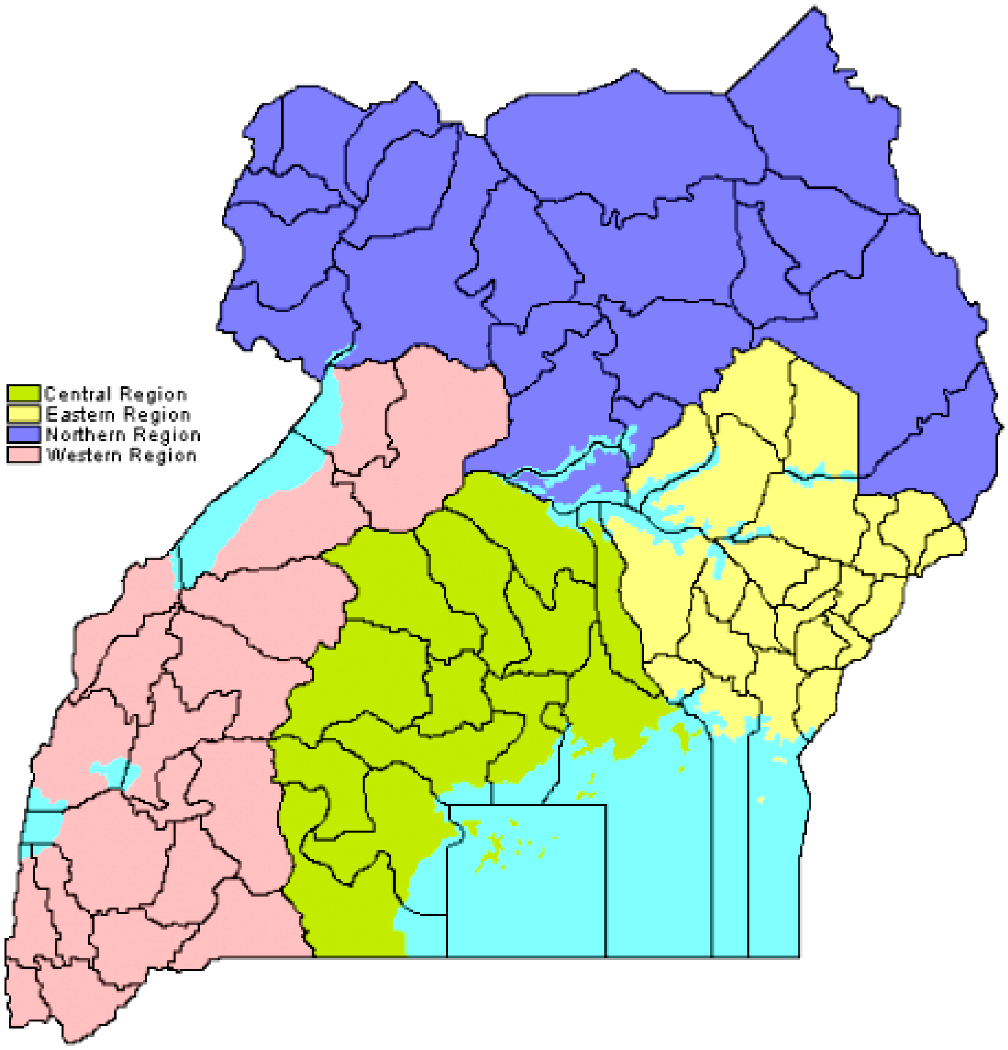

Figure 3: Map of Uganda showing regions

Given the above clusters, the national sample of 384 was divided by 4 to get the sample for each of the four regions. This gave a sample of 96 farmers for each region. Simple random sampling technique was then employed to select 96 farmers from each region to participate in the study. Table 5 shows the survey sample.

Table 5: Survey sample for farmers

No.	Region	Sampling method	Sample size
1	Eastern Uganda	Simple random	96
2	Northern Uganda	Simple random	96
3	Western Uganda	Simple random	96
4	Central Uganda	Simple random	96
	Total		**384**

3.10 Unit of Analysis and Inquiry

The relevance of determining the unit of analysis in research is well emphasized in the existing literature (Malhotra & Grover, 1998; V. A. Miller et al., 2009; Neilsen, 2014), its significant in establishing the suitable unit of inquiry and construct measures. For the current study, the unit of analysis was the farmers who were engaged in some sought of e-agriculture whereas the unit of inquiry were farmers and their employees who had acquired some formal education.

3.11 Measurement of Constructs

Measurement of constructs is the allocation of numbers to a variety of degrees of quality or property of an object or event (Bagozzi, 1994). In social research measurement concerns the definition of theoretical concepts up to empirical operationalization of the concepts (Malhotra & Grover, 1998).

According to Bagozzi (1994), the structure of a theory is made up of three probable constructs with four relationships amongst them, which are; the theoretical concepts, these are abstract and unobservable , whose relations formulates the hypothesis statement , the less abstract and more detailed derived concepts, whose relationship to the theoretical construct formulates the theoretical definition, the empirical concepts which formulates the operational definition and the empirical concept which relate to the observable event in the social world. Therefor measurement ought to start with a precise definition of the construct in view of the theory, the domain or unit of analysis at hand. By so doing it helped safe guard construct and discriminant validity (Malhotra & Grover, 1998; Miller *et al.* 2009). Consequently, measurement should form a linkage among the construct definition and items therein (Miller *et al.* 2009).

The likert scales adopted in this study provided answers on a continuum and were aimed at measuring responses on items in the questionnaires and were based on the content of the constructs to be measured. These ranged from “Strongly Agree”, “Disagree”, “Not sure”, “Disagree”, “Strongly Disagree”. Therefore, this study adopted a five point likert scale with a midpoint which was neutral in the response, to measure the exogenous, endogenous, moderating and the mediating variables and their constructs used in this study (Appendix I). According to Garland (1991), in circumstances of uncertainty, a midpoint likert scale can be implemented to escalate validity and reliability responses. These scales were based on previous research which was conducted in similar theoretical and empirically directed level of theory and measurements (Neilsen, 2014)

Expectancy was measured by Vroom (1964) and Lunenburg (2011). Within this construct, is the belief that an individual acts in a certain way because they believe their actions will yield a specific result. Inherent in this portion of the theory is the belief that action A (use of e-agriculture) yields result B (desirable outcomes), for the purpose of this study, will lead to better yields, attract good prices, provide access to expert agricultural information, provide access to better pesticides, improve the quality of farm produce.

Similarly, Instrumentality was also measured by Vroom (1964) and Lunenburg (2011), and this construct was best defined by the term performance (Scholl, 2002), whereby the motivated employee believes that his/her performance (hardworking, dedication) will ,, in this case, use of e-agriculture, will secure; better yields, good prices, expert agricultural information, access to better farm breeds, enough food for their family.

Intrinsic Motivation was measured by the seven factors of intrinsic motivation proposed by Vockell (2011). It revolves around taking pleasure in an activity rather than just working towards an external reward plus appreciation of challenges. Therefore factors such as getting manageable challenges, acquiring new knowledge, being in control, comparison of performance with peers, being satisfied assisting peers, and being recognize by peers are emphasized as the main intrinsic motivators.

On the other hand, Extrinsic Motivation was measured by the literature of Simone (2015) whereby financial rewards, gifts and incentives are highlighted as key extrinsic motivators of performance. Further, Andersone and Gaile-Sarkane (2010) argue that monetary incentives in form of better commodity prices influenced performance.

Context of Use was measured by ISO 9241-11 (1998) where possession of the necessary skills, knowledge and experience were identified as key drivers for usability of new technologies. This is supported by Kipkurui et al. (2014).

In addition, Usability Measures was measured by ISO 9241-11 (1998). Usability Measures were categorized into Efficiency and Usefulness. Efficiency measures situations where a new technology helps to accomplish tasks in the shortest time possible; save costs, as well as helping users achieve their goals while using the new technology. Abran et al. (2003) adds that Efficiency is enhanced when users enjoy using a new technology.

The ISO model also stipulates that new technologies should be useful to users in order to facilitate usability (ISO 9241-11, 1998). A new technology is deemed useful if it is convenient and also enables users to save time. Mtebbe and Kissaka (2015) and Hetsevich (2014) posit that new agricultural technologies should allow users unlimited access to expert agricultural information, access to better markets for their produce among others. Table 6 shows the sources of literature used to obtain the questions on study questionnaire.

Table 6: Sources of questions on questionnaire

VARIABLE	CONSTRUCT	SOURCE(S)
EXPECTANCY		Vroom (1964) and Lunenburg (2011)
INSTRUMENTALITY		Vroom (1964) and Lunenburg (2011)
CONTEXT OF USE		ISO 9241-11 (1998)
	User characteristics	ISO 9241-11 (1998)
	Technology	ISO 9241-11 (1998)
	Organizational Environment	Kipkurui et al. (2014)
	Social Environment	Kipkurui et al. (2014)
	Economic Environment	Kipkurui et al. (2014)
USABILITY MEASURES		ISO 9241-11 (1998); Nielsen (1993); Abran et al. (2003)
	Efficiency	ISO 9241-11 (1998); Nielsen (1993); Abran et al. (2003)
	Usefulness	ISO 9241-11 (1998); Nielsen (1993); Abran et al. (2003)
INTRINSIC MOTIVATION		Vockell (2011)
EXTRINSIC MOTIVATION		Simone (2015); Andersone and Gaile-Sarkane (2010); Munk (2011); Deci and Ryan (1985); Brooks (2009); Shields (2007); Osterloh and Frey (2007)
E-AGRICULTURE USABILITY		ISO 9241-11 (1998); Nielsen (1994); Mtebbe & Kissaka (2015); Hetsevich (2014)
	Platform usability	ISO 9241-11 (1998); Nielsen

		(1994); Mtebbe & Kissaka (2015); Hetsevich (2014)
	Control and Flexibility	ISO 9241-11 (1998); Nielsen (1994); Mtebbe & Kissaka (2015); Hetsevich (2014)
	Consistency and Standardization	ISO 9241-11 (1998); Nielsen (1994); Mtebbe & Kissaka (2015); Hetsevich (2014)
	Documentation and user support	ISO 9241-11 (1998); Nielsen (1994); Mtebbe & Kissaka (2015); Hetsevich (2014)

3.12 Questionnaire Design

There are a number of techniques for collecting data in research. These comprise interview, self-administered questionnaires, on-line questionnaires among others (Jenkins & Dillman, 1995). For this research self-administered and on-line questionnaires were used. Self - administered questionnaires where used in situations where the researcher needed to physically meet with respondents and brief them on the goals of the study and explain to them why they needed to participate in it, plus respondents who did not have an e-mail address or respondents who required an explanation of some terminologies used on the instrument. The online questionnaire was developed to reach respondents who could not be available physically for answering questions or farmers who were in hard to reach areas. Some farm owners were always not available at their farms during the data collection visitation. Therefore reaching them via online questionnaire was the most appropriate option. In addition, farmers whose e-mail address or WhatsApp group were known, the on-line questionnaire was the best option.

The concerns which impede the quality of the questionnaires like length, question wording, perception and motivation etc. were put into consideration during the designing of the questionnaire (Miller *et al.* 2009; Malhotra & Grover, 1998; Mason, 1996; Jenkins & Dillman, 1995). All questions were concise and precise to ensure that there was no ambiguity and also that the questionnaire was not unnecessarily wordy. A statement of purpose and motivation was placed at the start of the questionnaire, explaining the importance of the study in order to encourage the respondents to participate willingly. Further, the study utilized a uniform set of questionnaire for this research, since the potential respondents were expected to have a certain level of education, where by answering the questionnaire would not be a problem. In order to guarantee the privacy of the respondents, a proclamation statement pertaining to utmost confidentiality was included in the questionnaire, stating that it was strictly for academic purposes only. The study adopted multi-items approach to measure each construct, which is important in ensuring that adequate psychometric properties was assessed (Miller et al., 2009).

The questionnaire was designed in such a way that each construct comprised between three to twenty items. This is consistent with the view of utilizing not less than three items per construct in order to adequately run reliability tests and also Structural equation modelling tests (SEM) (Hair, Black, Babin, & Anderson, 2010). The questionnaire was designed in such a way, that there were guidelines on how to answer each section, which were in English, the official language in Uganda, and also since it was anticipated that our potential respondents must at least have acquired some formal education. The sections in the questionnaire included Section A ;- Part I: for demographics, Part II: information on e-agriculture, Section B: Part I: Expectancy, Part II: Instrumentality, Section C: Part I: Context of Use, Part I: User Characteristics, Part II: Technology, Part III: Organization Environment , Part IV: Social Environment, Part V: Economic Environment, Section D: Part I: Intrinsic Motivation, Part II: Extrinsic Motivation, Section E:E-Agriculture Usability, Part I: Control & Flexibility, Part II: Consistency & Standardization, Part III: Document & User Support.

3.13 Reliability and validity of instruments

3.13.1 Testing for reliability

Reliability of the instrument was evaluated using Cronbach (1951) coefficient alpha which is one of the most common methods in gauging reliability (Nunnally, 1978; Peter, 1979; Sekaran, 2000). This method was considered appropriate because it estimates the degree to which the items in the scale are representative of the domain of the construct being measured. It is a measure of the internal consistency of a set of items, and is considered absolutely the first measure one should use to assess the reliability of a measurement scale (Nunnally, 1978; Churchill, 1979). In addition to this, Cronbach coefficient is important in measuring multi-point scale items (that is, 5-point Likert scale used in this study) (Sekaran, 2000). Accordingly, this method of internal consistency has been adopted to assess the reliability of the measures in this study.

Multi-items scales were employed in this study; Cronbach alpha estimate was used as a verification of the reliability of the composite items comprising each scale construct. Thus, the constructs of user characteristics, technology, organization environment, social environment, economic environment, efficiency, usefulness, platform usability, control & flexibility, consistency & standardization, documentation and user support were subjected to such assessment. In assessing reliability through Cronbach Alpha, Nunnally and Bernstein (1994) suggest a rule of thumb level of higher than 0.70, with a level as low as 0.60 being accepted for new scale. Other authors such as Carmines and Zeller (1979) indicate that at least 0.80 is required to establish internal consistency. While different views have been recommended about levels of acceptance, it is generally agreed that an alpha of 0.70 and above is acceptable. Therefore, the cut-off point for this study (0.70) was used as the minimum for determining internal consistency of scale.

Before the questionnaire was administered, reliability tests were conducted on them to ensure that they are both reliable and valid. Reliability tests ensured that the questionnaire is procedurally correct, accurate, consistent, and stable and can produce similar results if repeated in another study (Carcary, 2008; Dawnson, 2002). Cronbach Alpha Coefficient (CAC) was used to test the questionnaires for reliability.

Similarly, Anderson and Gerbing (1988) expanded the scale to development procedure by including confirmatory factor analysis CFA). This was done because coefficient alpha is not a sufficient condition to assess uni-dimensionality. For this reason, other authors such as Steenkamp and Van Trijp (1991) and Byrne (2001; 2010) maintain that CFA provides a better estimate of reliability than coefficient alpha. Hinkin (1995) suggests that CFA approach is able to examine the stability of the factor structure in scale construction. Furthermore, assessing reliability by using CFA is also necessary to ensure that all measures used are reliable, thus providing the researcher with greater confidence that individual items are consistent in their measurements (Hair et al., 1995, 2010). It is against the above observations that confirmatory factor analysis approach was also used in this study to estimate reliability.

3.13.2 Validity Test

Any credible research should ensure construct validity and construct reliability, internal and external validity (Yin, 2009).

According to Hair et al., (2010), construct reliability concerns the degree of internal consistency among multiple measures of a variable, on the other hand, construct validity signifies the extent to which a scale or a set of measures accurately represents the concept being investigated (Hair et al., 2010).

Internal validity is the capacity to establish a causal relationship whereby certain conditions are shown to lead to other conditions and superior relationships are distinguished from others while external validity is the degree to which the research design is able to establish the domain to which a study's findings can be generalized (Yin, 2009).

As a result, construct reliability and validity was carried out utilizing exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), to test and confirm measurement model validity and reliability which is a pre requisite for using structural equation modelling, because structural model can only be tested when the measurement model is adequately valid (Hair et al., 2010). Besides, confirmatory factor analysis necessitates the number of factors and variable loading on each are predetermined. Consequently, EFA was used in identifying the number of factors and assigning variables to each from a set of multiple measures and then CFA was applied to confirm the measurement specifications.

Internal validity was tested by means of significance of parameter estimates for relationships conforming to hypotheses and external validity was evaluated by comparing findings of previous and similar studies relating to e-agriculture in other contexts.

3.13.3 Content Validity

Content validity is the degree of correspondence among the measures of a construct and its conceptual definition (Hair et al., 2010). It is done to confirm that theoretical, empirical and practical issues are put into consideration. Testing for content validity increases the credibility of scales adapted or borrowed from past studies by weeding out item content overlap (Hair et al., 2010) and assesses the suitability of items to the domain of the construct (Malhotra & Grover, 1998). As such, content validity is evaluated through expert reviews and pretesting of the sample data instrument on part of the population being studied (Hair et al., 2010; Malhotra & Grover, 1998; V. A. Miller et al., 2009).

Therefore, expert reviews in the field of agriculture were conducted to ascertain face or content validity of the instruments. Specifically, three (3) academic experts in the field of agriculture and three (3) researchers from agricultural research institutions were purposively selected to review and evaluate the draft questionnaire in terms of content and operationalization of the constructs, relevance, language and general understanding of questions. Items that were vague or irrelevant to the Ugandan context were removed from the instruments at this point. Thereafter changes and improvements in the construction of items were done accordingly.

After the above procedure, pretesting of the sample instrument on the actual population of the study followed. This was necessary because, the measurement scales for this study were adapted from previous studies and applied to a new context outside their normal use (Hair et al., 2010). Hence, there was need to ascertain the measure and clarity of the question wording. Moreover, reliability and validity of the scales adapted had not been replicated and tested in the agricultural context. Therefore, pretesting was done to ensure that adequate internal consistency of the measurement scales before proceeding with the main study was upheld (Hoxha & Capelleras, 2010).

The pilot study was conducted among 28 farmers over a period of one month, in the four regions of Uganda, after which 23 questionnaires were returned. The farmers that participated in the pilot study comprised 10 farmers from central Uganda (45%), 5 farmers from the Eastern part of the country 22%) and 3 farmers from the eastern Uganda (13%) and 5 farmers from western Uganda (22%).These sample statistics indeed reflected the reality about e-agriculture sector utilization in the Uganda agricultural sector.

Validity test was also out carried out to ensure that the instrument measures what it intends to measure, and the degree to which the instrument measures have meaning. Validity is viewed by Hair et al. (2010) as the extent to which a measure or set of measures correctly represents the concept of the study, and the degree to which it is free from any systematic or non-random error. Validity is also concerned with how the concept is defined by the measures. Table 7 presents reliability and validity results.

Table 7: Reliability and Validity results

Variable	**No of items**	**Cronbach Alpha Reliability**	**Content Validity Index**
Expectancy	10	.726	0.782
Instrumentality	10	.791	0.723
Context of Use			
User Characteristics	3	.914	0.765
Technology	8	.812	0.763
Organizational Environment	6	.872	0.773
Social Environment	5	.733	0.712
Economic Environment	6	.962	0.786
Usability Measures			
Efficiency	4	.910	0.863
Usefulness	4	.683	0.701
Intrinsic Motivation	7	.764	0.871
Extrinsic Motivation	7	.830	0.853
E-agriculture usability			
Platform usability	4	.789	0.847
Control and flexibility	11	.933	0.832

Consistency and Standardization	4	.944	0.754
Documentation and User Support	6	.860	0.94
Average		**0.835**	**0.797**

Reliability and validity results in table 7 revealed that the research instrument was reliable since all variables and constructs had Cronbach Alpha Reliability (CAR) above 0.7. The average CAR=0.835, which is above 0.7. Similarly, the instrument was valid since all variables had CVI greater than 0.7. The average CVI=0.797

3.14 Data analysis methods

Descriptive statistics such as frequencies, percentages and means were used to analyse background information about the respondents. Background information included the respondents' age, levels of education, occupation, marital status and the region where the farming activities were carried out among others. This informed the researcher about the credentials of respondents in helping to create confidence in findings.

Correlation and regression analysis methods were used to analyse the relationships between the study variables and also to test the predicting power of the independent, moderating, and mediating variables on the dependent variable.

Further, Structural Equation Modelling (SEM) was used to conduct confirmatory analyses on the variable relationships and also develop the model for e-agriculture usage in Uganda (Zaremohzzabieh et al. 2014)

3.15 Dealing with Outliers

According to Hair et al (2010), outliers are observations which differ from the mainstream sample responses. They may be unique across variables, they usually bring about problems during data analysis, because they do not represent the population under study, consequently, affecting the statistical results by biasing the mean results, and increasing the standard deviations. As a result, they affect the normality of data distribution. Therefore, it was vital to test for them before proceeding to parametric tests.

Outliers arising from the coding process were discarded or re-entered during data cleaning process. Then applying univariate analysis, high and low observations were noted and taken care of through converting data values to z-score, where the distribution for the mean was 0 and deviation was 1. A cut-off for Z-score + (-) 3 was adopted for the study, this is in line with (Hair et al., (2010) where sample sizes are above 80.

Similarly, outliers within the individual variables were assessed using their standardized values (Z scores) and it was observed that 8 cases had Z scores below – 3 and were consequently rendered outliers according to the threshold of (Hair et al., 2010). This shows that all of the identified outliers were extremely low values.

In addition, further analysis of the outliers was conducted at the multivariate variable level where the Mahalanobis distance of the linear combination of all of the variables was computed in SPSS and a total of 15 cases had significance levels of their respective Mahalonobis distance below 0.001 and hence were recognised as multivariate outliers.

3.16 Missing Values Analysis

Missing data are usually synonymous with survey design (Field, 2009; Hair et al., 2010). They are usually as a result of data errors or incomplete filling the entire questionnaire by the respondents. In particular, any statistical results such as correlations computed based on data with non-random missing data may be biased and erroneous. Therefore they have consequences of negatively affecting research findings and decreasing sample sizes. Moreover, Analysis of a Moment Structures (AMOS) and Structured Equation Modelling (SEM) software operate with complete data. While the reasons for missing data in this study were not well established, missing data processes could not be overlooked. Consequently, there was a need to carry out a missing value analysis to determine the extent, patterns and relationships precipitating the missing data while maintaining the original distribution of values (Hair et al., 2010). It is against this background that, it was conducted to establish: 1) if missing data were scattered randomly throughout the observations or whether there was definite identifiable patterns 2) To determine how prevalent missing data are, in order to make the decision to delete cases or replace missing values.Hence little's MCAR tests was carried out to ascertain the level and relationship of the missing data at the same time noting the initial distribution of the data, whether, the data was scattered randomly or there was a pattern (Little, 1988). So that a conclusion might be reached to remove cases or replace the missing values. Therefore if P< 0.05, it portrays that the pattern of the missing data is the same as the random pattern, and if P>0.05, then the missing data pattern is significantly different from the random pattern.

Therefore, utilizing the E-M (expectation-maximization method), there was less than 2 Percent of data missing on all variables apart from instrumentality and usability measures, which had 2 Percent and 3 Percent of missing data respectively, and the MCAR was significant (Ch-Square =8442.159; DF=7336, Sig=.000), indicating that data was missing not completely at random. Additionally, randomness of missing data was tested at the subgroup level and as presented in Table 8 below. Linear interpolation was selected because it utilizes the actual relationships among variables to replace missing values (Hair et al., 2010).

The table 8 below revealed that the missing data pattern for all constructs was not random, and for the missing data items, they were replaced through linier interpolation since it uses the actual relationships between variables to replace missing values so that Structured Equation Modelling (SEM) and AMOS software would operate smoothly, because they work with complete data.

Table 8: Little's MCAR Test Results for Subgroups of Variables

Subgroup	**Ch-Square**	**DF**	**P-value**
Expectancy	244.36	86	0.00
Instrumentality	321.15	75	0.02
Context of Use	156.78	86	0.00
Usability Measures	121.42	101	0.03
E-agriculture Usability	98.21	71	0.00

3.17 Exploratory Factor Analysis

In order to establish whether the measurement scales appropriately measured the respective constructs in the study, exploratory factor analysis was carried out using the Principal Component Analysis (PCA) technique in both the pilot and the main study. This technique was used to group together variables /items that were interrelated with orthogonal rotation by means of the Varimax method.

According to Field (2009), exploratory factor analysis (EFA) helps to facilitate the principle of parsimony by reducing the variables to maintain only those with considerable information before embarking on further analyses involving the variables. He stresses further that with EFA we are able to understand the structure and interrelations of factors for each of the constructs in the study. In order to safeguard parameter estimate stability, factor analysis necessitates that the sample size is greater than the number of items being reduced

However, factor analysis requires that the number of observations (sample size) is more than the number of items being reduced to ensure stability of parameter estimates. Therefore, a ratio of 5:1 is recommended as the minimum Sample To Variable (STV), whereas the suitable ratio is 10:1 (Hair et al., 2010). Accordingly, it is better to aim at a high STV ratio in order to circumvent sample specific factors with low generalizability. In light of the above, this was attained by obtaining a total of 378 responses for the main study per measurement scale. The table 9 below illustrates STV ratio details per scale.

Table 9: Summary of Sample to Variable (STV) Ratio

Scale	**No. of variables (V)**	**No. of observations (S)**	**Ratio (S/V)**
Expectancy	10	378	38
Instrumentality	10	378	38
Valence	8	378	47
Context Of Use	29	378	13
Usability Measures	8	378	47

Intrinsic Motivation	7	378	54
Extrinsic Motivation	7	378	54
E-Agriculture Usability	25	378	15

According to Table 9 above, on average there are 38 responses per variable or item under expectancy, 38; 47; 13; 47; 54; 54 and 15 responses per item for instrumentality, valence, and context of use, usability measures, intrinsic motivation, extrinsic motivation and e-agriculture usability respectively. Hence, the STV ratio per construct was sufficient for factor analysis to be performed.

For appropriate results to be obtained from the exploratory factor analysis method, data should possess adequate correlations amongst variables and an ample sample size. In order to measure the statistical significance of the correlation matrices, the Bartlett's test of sphericity was applied; likewise, in order to test for sampling adequacy, the Kaiser-Meyer-Olkin (KMO) method was used.

According to Field (2009), factor analysis is suitable at KMO values between 0.70 to 0.80 and the meaningful Barlett's test that shows the correlations among items are adequately large for PCA (Hair et al., 2010). Despite the fact that factor analysis requires large sample sizes, it is worth noting that the Barlett's test of Sphericity becomes more sensitive as the sample increases (Hair et al., 2010).

In the circumstances where the sample size is large, the Barlett's test of Sphericity is in position to detect even small correlations between variables as significant. In such situations, it is suggested that the data matrix should have a considerable number of correlations greater than .30 for factor analysis to be applicable (Hair et al., 2010).

There was also a need to evaluate the practical and statistical significance level of factor loadings. A factor loading is the correlation among an item and the factor, whereas the squared factor loading or communality is the total amount of variance in the variable or item accounted for by the factor (Hair et al., 2010). Therefore, a factor loading of 0.50 indicates a 25 Percent variation in the variable accounted for by the factor and those above 0.70 accounts for more than 50 Percent of variance in the variable. Hair et al (2010) emphasizes that factor loadings of .50 are practically significant on the other hand factor loadings at .70 and above are very good indicators of the factor. Therefore, variables with factor loadings equal to and above .50 and factors with eigenvalues more than one (1) were maintained for further analysis. Item-to-total correlation ratios cross loadings and individual factor loadings were tested to ensure construct validity. Factors with low cross loadings and high individual loadings were retained.

3.18 Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) is a multivariate statistical procedure that is used to test how well the measured variables represent the respective constructs. As such, the objective of confirmatory factor analysis is to test whether the data fit a hypothesized measurement model. This hypothesized model is based on theory and/or previous analytic research (Kline, 2010).Confirmatory factor analysis was considered necessary in view of the fact that testing for significant relationships in the structural model requires an adequately reliable and valid measurement model (Fornell & Larker, 1981).

CFA was implemented and the measurement models were tested for overall goodness of fit (Bentler, 2004; Hooper, Coughlan, & Mullen, 2008). In order to test for Goodness of fit index, the Chi-Square was used, however owing to its sensitive to sample size and lack of a defined power function (Fornell & Larker, 1981), additional measures were implemented. Additional model fit tests like the normed χ^2, which is the ratio of chi-square and its degrees of freedom (χ^2/DF), goodness of fit index (GFI), Adjusted goodness of fit index (AGFI), Normal fit index (NFI), Non-normal fit index (NNFI) or the Tucker-Lewis Index (TLI), comparative fit index (CFI), increment fit index (IFI), and root mean square error approximation (RMSEA) were adopted (Garver & Mentzer, 1999). This is in line with the suggestion that goodness of model fit is better tested and confirmed when more than one index is used (Hair et al., 2010). Specifically, the TLI, CFI and RMSEA were stressed in reporting because they are less affected by sample size (Schermelleh-Engel et al., 2003). Consequently, it is recommended that TLI and CFI values of .97 are a good fit and values above .95 are acceptable; and RMSEA should always be less than .08 for acceptable fit and less than .05 for good fit. To test the impact of sample size on the P-value, the normed X^2 (X^2/DF) should be 3.0 or less for good fit (Hair et al., 2010). When the results of these various indices are satisfactory, it means that the P-value that is less than 0.05 is due to the effect of larger sample size.

As such, the fit of each factor (subscale) and its observed items was evaluated individually to determine whether there were any weak items with squared factor loadings (L^2) below .20. Secondly, each factor or subscale was modelled together with other factors measuring the same theoretical construct to determine if convergent validity is achieved (first-order CFA model). Thirdly, a second-order CFA model was tested in which the first-order factors became the indicators and finally CFA was run for the hypothesized model combining all theoretical constructs and their indicators to determine whether discriminant validity had been achieved. Where necessary, improvements in the measurement model were done based on modification indices that indicated changes and standardized residual values. To improve model fitting or parsimony, variables with residual values greater than 1.96, low factor loadings and squared factor loadings (L^2) below .20 were deleted incrementally (Hooper et al., 2008; Schermelleh-Engel et al., 2003). In order to measure the statistical significance of parameter estimates, Critical Ratios (C.R) were also used. It is actually the parameter estimate divided by its standard error. Therefore, C.R works as a z- statistic or t-statistic to test whether the estimate is different from zero.

There is a need for C.R-values to be greater than 1.96 at the probability of .05 so that the hypothesis that the estimate is equal to zero can be rejected. Furthermore, reliability and validity of the measurement models was assessed using internal consistency and discriminant validity respectively (Bentler, 2004). Internal consistency is generally measured using both construct reliability and convergent validity in SEM models. Construct reliability of the scales was tested in exploratory factor analysis using Cronbach coefficient alpha and confirmatory factor analysis using Fornell and Larker (1981), based on the sum of squared loadings and the sum of error variance for each construct. Even though, the Cronbach coefficient alpha is a common method of estimating reliability, it is criticized for underestimation of reliability (Hair et al., 2010). With CFA, construct reliability was calculated using the formula below and the results are compared to Nunnally (1978)'s rule:

$$\text{Construct Reliability (CR)} = \frac{\text{Sum of (Standardized factor loadings)}^2}{\left[\text{Sum of (Standardized factor loadings)}^2\right] + \left(\text{Sum of error variance}\right)}$$

Convergent validity refers to the degree to which scores on a test correlate with (or are related to) scores on other tests that are designed to assess the same construct (Gerring, 2012; Hair et al. 2010). In accordance with Fornell and Larker (1981)'s procedure, convergent validity was tested through confirmatory factor analysis using the Average Variance Extracted (AVE). The AVE measure provides the amount of variance that a construct obtains from its indicators relative to the amount of variance due to the measurement error. Hence, convergent validity is attained if the average variance extracted is greater than 0.5 (Fornell & Larker, 1981). If the value is less than 0.5, it implies that the variance due to the measurement error is larger than the variance captured by the construct and therefore, unreliable. The Average Variance Extracted (AVE) was calculated as follows:

$$\text{AVE} = \frac{\left[\text{Sum of }\left(\text{Standardized factor loadings}\right)^2\right]}{\text{Number of items (n)}}$$

The study in addition used the squared factor loadings (L^2) to measure reliability of the observed items in relationship to the latent or unobserved construct (Schreiber et al., 2006). Thus for CFA, item reliability is achieved when L^2 is greater than 0.2 (Hooper et al., 2008; Schermelleh-Engel et al., 2003).

Furthermore, the average extracted variance was used to test for discriminant validity (Fornell & Larker, 1981). In particular, discriminant validity measures the extent to which two conceptually similar concepts are distinct (Gerring, 2012; Hair et al., 2010). Discriminant validity is realized when the average variance extracted (AVE) for each construct is higher than the square of correlation (R^2) between each construct and any other construct (Hair et al., 2010). When this requirement is met, it means that the construct in question explains more of the variance in its measured items than it shares with another construct. It is also relevant in testing of mediation and control for endogeneity bias where it is necessary to establish that the mediator is distinct from the independent and dependent variables (Zhao, Lynch, & Chen, 2010). If the relationship between the independent and the mediator is very strong, it creates multicollinearity which inflates the standard error of all variables in the model and compromises the indirect effect.

3.19 Structural Equation Modeling

Structural equation modelling (SEM) is a series of statistical methods that allow complex relationships between one or more independent variables and one or more dependent variables (Babin & Svensson, 2012; Hoe, 2008). Structural equation modelling is a combination of confirmatory factor analysis and structural covariance based analysis used to estimate a number of dependent interrelationships simultaneously (Hoe, 2008; Schreiber et al., 2006). Therefore, it is assumed to be one of the best multivariate procedure that tests both construct validity and theoretical relationships among a set of concepts measured by multiple variables. SEM is beneficial because it includes measurement error in the estimation of the dependence relationships (Hair et al., 2010). In order to examine the interrelationships among the latent variables of the study, structural models are generated using maximum likelihood method of estimation (ML).

3.19.1 Estimation Method

The estimation method used in this study was the Maximum likelihood (ML), because it is the predominantly used method and majority of the software programs, AMOS inclusive, use ML as the default parameter estimator (Ray et al., 2004; Schermelleh-Engel et al., 2003). It is used based on the assumption that the variables in the model are multivariate normal and correctly specified, model implied and empirical covariance matrices are positive definite and sample size is adequately large (N> 200). The ML method is appropriate particularly in large samples since it produces parameter estimates and standard errors that are asymptotically unbiased, consistent and efficient notwithstanding the scale whether continuous or ordinal, whether correlation or covariance matrices are analysed and whether original or transformed data are used (Schermelleh-Engel et al., 2003). Consequently, ML was considered suitable for this study because the returned sample is large enough and data are moderately normally distributed which greatly contributed to generation of consistent parameter estimates.

3.19.2 Model Validation

The SEM models for this study were developed in consistence with the research questions and hypothesis. Thereafter, they were evaluated for goodness of fit, cross validated by comparing them to other competing models and interpreted them using the variance (squared multiple correlation (SMC) explained in the dependent variables and the standardized path coefficients (Beta) which specifies the strength of relationships among the dependent and independent constructs (Hair et al., 2010; Schreiber et al., 2006). In essence, multiple indices were used to evaluate the goodness of model fit, absolute, incremental, and comparative and parsimony fit indices.

Addition validation was carried out through testing for significance of structural relationships that characterize each specific hypothesis. In order to accept or reject the hypotheses "a parameter estimates have to be statistically significant at ($p<.05$) and in the predicted direction" (Hair et al., 2010). This implies that the estimates must be greater than zero for a positive relationship and less than zero for a negative relationship. Furthermore, variance explained (R^2 or squared multiple correlation-SMC) for the endogenous constructs was used to examine the validity of the structural model which should be nontrivial (Hair et al, 2010). Consequently, hypotheses with significant coefficients in the predicted direction were accepted whereas those with non-significant coefficients and in unpredicted direction were rejected.

3.19.3 Testing for Hypotheses

In order to test for research hypotheses, total, direct and indirect effects were estimated. Researchers (Baron & Kenny, 1986) stresses that indirect effects signify the effect of the independent variables on the dependent variable through a mediating variable. As regards determining whether the mediation (indirect effects) is significant, the bootstrap test was used (Preacher & Hayes, 2004). Bootstrapping is a non-parametric approach to effect-size estimation and hypothesis testing that makes no assumption about the shape of the distribution of the variable or the sampling distribution of the statistics. According to Zhao et al.,(2010), were of the view that the bootstrap approach is superior in testing indirect effects compared to other alternative methods, because , it uses the sample data to create the sampling distribution of the indirect effect estimates from the re-samples rather than based on normal distribution.

However, Zhao et al., (2010) challenged the effectiveness of Baron and Kenny, (1986) and Sobel test in estimating indirect effects. This is because the Sobel test is based on the assumption of normal distribution which is symmetric around the mean whereas the indirect effect is a product of the relationship between the independent variable and mediator (a), and the relationship between the mediator and the dependent variable (b). Therefore, the sampling distribution of the product (ab) cannot be normal and bootstrapping overcomes this misconception. Consequently, Zhao et al, (2009), stresses that the sampling distribution of the product (ab) is always positively skewed with a shorter and flatter tail to the left. He further went on to assert that, the Baron and Kenny tests are primarily useful in establishing the type of mediation. Consequently, their three equations can only feed into the parameters of the test of indirect effect but cannot be used to establish the significance of mediation (Zhao et al., 2010).

According to Baron and Kenny (1986), a number of Scholars have classified two types of mediation to include full and partial mediation. Although, Baron and Kenny (1986)'s mediation is cantered on a significant direct effect. Nevertheless, it is also claimed that significant mediation may occur in contrast to a non-significant direct effect. There are also instances of "No effect-No mediation" when the direct and indirect paths are jointly non-significant and "Direct-only relationship" in situations of no significant indirect effect but a significant direct effect. Further, these scholars argue that the Sobel test has low power in testing the indirect effect when there is a strong correlation between the independent and mediating variable (Zhao et al., 2010).

Preacher and Hayes, (2004) contends that the Sobel test has limitations in indicating the reduced direct effect of the independent on dependent variable in instances that the mediator is added to the equation. Therefore, bootstrapping resolves this power problem as a result of asymmetries or other forms of non-normality in the sampling distribution of the product. Iacobucci, Saldanha, & Deng, (2007) emphasises that the mediation models with more than one antecedent to the mediator and/or dependent variables should cannot be tested because that inclusion of multiple antecedents or independent variables into the model creates multicollinearity which generates very different results including reversing the sign of the relationships. Therefore, a three-variable method to testing mediation would be more appropriate (Preacher & Hayes, 2004). The simple mediation model produces zero degrees of freedom suggesting that the model perfectly fits the data however it is not sufficient in distinguishing amid competing models and parameter estimates (Iacobucci et al., 2007).

Consequently, suggesting the use of bootstrap based testing for evidence of mediation in complex models was adopted (Iacobucci et al., 2007). The scholars propose an addition of a fourth variable to the model to act as an antecedent or consequence of the independent variable (X).Nevertheless, the idea that parameter estimates of the “four-variables model” should still be similar to the “three-variables” mediation model (Iacobucci et al., 2007). The addition of the fourth variable is for the purposes of making the model more complicated to generate sufficient degrees of freedom and guarantee that statistics are consistent. In addition these scholars contend that complexity of the model improves conceptual explanations and safeguards committing Type I error. Therefore when the number of variables in the model increases, so does the number of degrees of freedom. This is conformity with the tenets of SEM which necessitates that models be over identified in order to achieve more accuracy (Winship & Harding, 2008).

Finally, the interaction effects of the context of use and usability measures on the effect of expectancy on both instrumentality and valence were analysed to establish if the effect of expectancy on both instrumentality and valence changes with the different levels of the moderator variables. This was done by inclusion of interaction variables which are multiples of the expectancy variables and each of contexts of use and usability measures into the model.

3.20 Research Challenges Encountered

There were a number of challenges encountered by the researcher particularly during the data collection process. Some of these challenges were associated with the limited financing to carry out the different research activities, sampling, timing, missing data, delays and unwillingness to respond.

3.20.1 Financial Challenges

To mitigate the financial challenge, the researcher obtained a modest scholarship from Makerere University Business School to finance a number of activities associated with this study, plus also using an on-line questionnaire to partially carry out the data collection activity.

3.20.2 Sampling Challenges

In the sample screening process, the researcher noted that most farmers who were using some form of e-agriculture were concentrated in the central region, where also the capital city of Uganda, Kampala is located. Since majority of novel ideas originate from city dwellers and they are easily transferable to the population leaving in close proximity with the capital city, therefore farmers in the central region had a higher propensity to use e-agriculture platforms than their counterparts in other regions of Uganda. This state of affairs caused disparities in the sample proportions.

3.20.3 Data collection Challenges

Collecting data from farmers was a huge challenge, first and foremost majority of farmers are located in rural areas, where they are unevenly distributed in those remote areas. This proved a huge logistical challenge on both the hired data collectors and the researcher personally. In some instances some items on the questionnaire had to be interpreted to the farmers so that they could properly understand the actual meaning of the questions. Therefor considering the fact that the target farmers (respondents) were in most cases not in close proximity with each other a lot of time and financial resources had to be spent on the exercise. In addition there were instances where the potential respondent to actually fill the questionnaire were not on site and their known e-mails was not known by the workers found on site. This necessitated leaving the hard copy questionnaire behind and coming back later to collect it. However owing to the fact that , the researcher had acquired some e-mail addresses of potential respondents and their phone contacts from the Uganda farmers association and regional agricultural research stations , the researcher , were appropriate had to first make telephone calls to first explain the purpose of the questionnaire that would be sent to them and request the would be respondent to avail time and fill in the questionnaire . This approach was extremely successful and ensured that majority of respondents who had to answer online questionnaires actually filled them.

3.20.4 Missing Data

In a number of cases, questionnaires had missing data or item non-responses. The researcher had to call back to clarify on the missing responses for which most were accidental and in some cases due to misunderstanding of the statement or due to feelings that the statement does not apply to them or they were simply too busy with their chores to give the questionnaire ample time. Hence, proper explanations were given to respondents especially on the purpose and why they needed to fill the entire questionnaire, whereas in some cases missing values were carried on. A number of respondents failed to fill in the questionnaire in time claiming to be busy, which resulted into delays in collecting back questionnaires.

3.20.5 Non Responsiveness

In some instances, some respondents were suspicions of the motive of the research; some thought that it was a ploy by the tax body to collect sensitive information about them. Furthermore, many farmers seem not to appreciate the value of research. They believe that research enables their competitors to get information about their operations and would use it to out-compete them. Hence, many non-responses and uncooperativeness were due to this reasoning. In these cases non-responses were reduced through assurances especially using the recommendation letter (see Appendix 3) and confidentiality clause embedded at start of the questionnaire, however, it must be stated that there was also a voluntary clause in filling the questionnaire. In some cases, respondents demanded for payment to participate in the study. However, due to budgetary constraints it was not possible to pay respondents but to assure them of the benefits of participating in the study by filling the questionnaire, and that the benefits will be enjoyed by coming up with an e-agriculture usability model which will benefit all farmers and the agricultural policy makers in Uganda .

The lack of government policy requiring farmers to publish and provide information to the public was another challenge faced. This was further hampered by the lack of research bodies that collect farming data of public interest. Hence, it was not possible to use actual performance data in this study but subjective data based on farmers 'assessments.

3.21 Ethical considerations

Ethics is one of the components of philosophy, which was introduced by Aristotle (Bryman, & Bell 2007). It takes into considerations the human aspects of the research (Seale, 2004). A major concern in ethics is the association between the human aspect and the social world. According to Seale (2004), in research ethics, there is a requirement to contemplate how the bothering of the research on individual (with or without their consensus) can be balanced with the objective of making a world a better place. It is in light with the above considerations, that a number of ethical issues were put into consideration during this study.

3.21.1 Acknowledging information sources and materials

Due credit, acknowledgement and citation was done throughout this research. Therefore this research tried as much as possible to acknowledge the support given directly or indirectly by the different people towards this research in the acknowledgment subheading. Secondly, all appropriate citations of works of other authors used in any part of this dissertation were done.

3.21.2 Confidentiality of the respondents

The data collection instrument included a statement safeguarding the confidentiality of the respondents at all times, and besides, the respondents were not obliged to write their names. Therefore, the respondents' concealment was confirmed. This statement put to rest any respondent who might have had other alternative assumption different from the objective of the study.

3.21.3 Voluntary participation and Permission to carry out the study

The Instrument had a statement stating that the research is strictly meant for academic purposes in order to increase the response rate and one of the introduction remarks of the instrument, was the address of the university and the contact information of the supervisors was provided. This was to ensure that respondents were free to consult the university or the supervisors regarding the authenticity of this study, and also be free to consult the university authorities regarding this study. In addition, respondents participating in this study did so voluntary and were free to abandon the questionnaire at any stage.

3.22 Chapter Conclusion

Chapter three has discussed the philosophical assumption that were used in respect to this study, which was functionalism paradigm and positivist approach. The study followed a deductive research. The study used multistage sampling approach, by first dividing the country into clusters, then simple random sampling approach. The study focused on farmers who were using some form of e-agriculture on their farms, a total of 500 farmers were selected for the study. Data analysis was done using SPSS (V19) for descriptive and inferential statistics and AMOS (V20) for structural equation models. The challenges encountered and how they were mitigated was also discussed. The chapter ended by discussed the various ethical considerations that were put into consideration for one to answer the questionnaire.

CHAPTER FOUR: FINDINGS

Descriptive Statistics, Exploratory Factor Analysis and Confirmatory Factor Analysis

4.0 Introduction

The following chapter illustrates the data analysis results obtained from the research question and hypothesis from chapter two. In addition the chapter presents Descriptive Statistics, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM) used in testing for hypotheses.

4.1.0 Background characteristics

Data were collected and analysed to establish the nature of respondents that participated in the study. In this section, we examine the respondents' gender, age groups, levels of education, region of Uganda where they practiced e-agriculture, size of farmland, and duration of which the farmer had used the e-agriculture platforms.

4.1.1 Respondents' gender

Data were collected and analysed about respondents' gender in order to understand how female and males participated in e-agriculture farming activity. Table 10 presents the results.

Table 100: Respondents' gender

Gender	Frequency (N = 378)	Percent
Female	139	36.8
Male	239	63.2
Total	**378**	**100**

Results in table 10 reveal that most respondents were male (freq=239, 63%). Female respondents were 139 representing about 37%. This finding could be a measure pointing to a direction that most farmers who use e-agriculture technology in Uganda are male.

4.1.2 Respondents' age group

Further, data about respondents' age groups were collected and analyzed using descriptive statistics in order to understand the farmer age groups and those that use e-agriculture platforms. Table 11 presents the results.

Table 11: Age group

Age Group	Frequency	Percentage
Below 20 years	5	1.3
20-29 years	109	28.9
30-39 years	166	43.9
40 and above	98	25.9
Total	**378**	**100**

The results on respondents' age groups seen in Table 11 reveal that most of them were in age group 30-39 years (Freq=166, 43.9%), followed by those in age group 20-29 years (Freq=109, 29%) and those in age group 40 and above (Freq=98, 26%). Only 5 respondents constituting 1% were below 20 years of age. This finding indicates that most farmers engaged in using e-agriculture platforms in Uganda are youths below the age of 40 years.

4.1.3 Level of education

In addition, data were gathered about respondents' levels of education and analyzed using frequencies and percentages as seen in Table 12:

Table 12: Levels of education

Level of education	Frequency	Percentage
Primary	6	1.6
Secondary	17	4.5
Certificate	35	9.3
Diploma	85	22.5

Bachelor	155	41
Masters	71	18.7
PhD	9	2.4
Total	**378**	**100**

Results on respondents' highest level of education in table 12 reveal that majority of them had a Bachelor's degrees (Freq=155, 41%), followed by those with Diplomas (Freq=85, 23%). Those with Masters Degrees were 71 (19%), while those with Certificates were 35 (9%). Only 9 respondents had PhDs and 6 were primary school leavers. These results show that respondents were fairly educated and could comfortably comprehend the questions on the questionnaire.

4.1.4 Region of Uganda where farmer practices agriculture

Further, data were collected about the regions were respondents came from in order to understand how farmers were represented in the study country-wide. The data were analysed using frequencies and percentages as seen in Table 13:

Table 13: Region

Region	**Frequency**	**Percentage**
Eastern Region	78	20.6
Western Region	112	29.6
Northern Region	76	20.1
Central Region	112	29.7
Total	**378**	**100**

As seen in table 13, data on the region of Uganda where farmer practiced agriculture indicate that majority were from Western Region and Central Regions of the country (Freq=112, 30%). Eastern Region contributed 78 (21%) of the respondents while Northern Region contributed 76 (20%) respondents. This finding reveals that most e-agriculture users are farmers from Central and Western Uganda.

4.1.5 Size of farm land of the farmer

Additionally, data on land size were gathered and analysed in order to understand the sizes of land that Ugandan farmers had. The data were analysed using frequencies and percentages as seen in Table 14:

Table 14: Land size

Land size	**Frequency**	**Percentage**
Less than 1 acre	52	13.8
1-2 acres	140	37
2-5 acres	110	29.1
More than 5 acres	76	20.1
Total	**378**	**100**

Results in table 14 on size of farm land of the respondents show that most respondents had 1-2 acres (Freq=37%), followed by those with 2-5 acres (Freq=110, 30%), more than 5 acres (Freq=76, 20%), and lastly those with less than 1 acre (Freq=52, 14%). This means that most farmers using e-agriculture platforms in Uganda had land below 5 acres.

4.1.5 Duration the farmer has used the e-agriculture platforms

Further, data were collected on the duration that respondents had used e-agriculture platforms. The collected data were analysed using frequencies and percentages as seen in table 15:

Table 15: Duration of e-agriculture platforms usage

Duration	**Frequency**	**Percentage**
Less than 2 years	204	54
2 to 4 years	138	36.5
5 years and above	36	9.5
Total	**378**	**100**

Results in table 15 on the duration for which respondents had used e-agriculture platforms show that most had used it for less than 2 years (Freq=204, 54%). A total of 138 (37) respondents had used the platforms for 2 to 4 years, and 36 respondents (10%) had used it for 5 years and above. These results mean that the concept of e-agriculture is relatively new in Uganda since most users had used it for less than 5 years.

4.1.6 Devices used

Data were collected to examine the devices used by farmers to access e-agriculture. Table 16 presents the results.

Table 16: Device used

	N	Min	Max	Mean	SD
I use a Smartphone to access e-agriculture	378	1	5	4.06	0.97
I use a Laptop computer to access e-agriculture	378	1	5	3.30	1.29
I use a Desktop computer to access e-agriculture	378	1	5	2.80	1.27
I use an IPods to access e-agriculture	378	1	5	2.11	1.00
I use a Note pad to access e-agriculture	378	1	5	2.04	0.96
I use a Tablet to access e-agriculture	378	1	5	2.42	1.27

Results in table 16 reveal that respondents strongly agreed that they use smartphones to access e-agriculture (Mean=4.06, SDV=0.97). The respondents agreed that they used laptop computers to access e-agriculture information (Mean=3.30, SDV=1.29).

However, the respondents were uncertain whether they used desktop computers to access e-agriculture (Mean=2.80, SDV=1.27); they used Ipads to access e-agriculture (Mean=2.11, SDV=1.00); they used note pads to access e-agriculture (Mean=2.04, SDV=0.96) and also that they used tablets to access e-agriculture (Mean=2.42, SDV=1.27).

This finding reveals that the most commonly used devices by Ugandan farmers to access e-agriculture information are smartphones and laptop computers.

4.1.7 Knowledge of e-agriculture platforms

Data about respondents' knowledge of e-agriculture platforms were collected and analysed in order to examine the respondents' knowledge of e-agriculture platforms. Data were collected on a 4 point likert scale whereby 1 = Not Knowledgeable, 2= Quite knowledgeable, 3= Knowledgeable, and 4 Very knowledgeable. Descriptive means were used to analyze the data as seen in Table 17:

Table 17: Platforms used

	N	Min	Max	Mean	SD
E-agriculture databases	378	1	4	2.40	0.82
E-agriculture data warehouses	378	1	4	1.47	0.80
E-agriculture via YouTube	378	1	4	1.65	0.86
E-agriculture via Skype	378	1	4	1.61	0.94
E-agriculture via Facebook	378	1	4	1.84	0.93
E-agriculture via Wikipedia	378	1	4	2.11	1.00
E-agriculture websites	378	1	4	2.60	0.93
E-agriculture blogs	378	1	4	2.47	0.90
Agricultural knowledge management systems	378	1	4	1.82	0.99
Mobile agriculture applications	378	1	4	2.37	1.07

Results in table 17 indicate that respondents were knowledgeable about E-agriculture databases (Mean=2.40, SDV=0.82), E-agriculture via Wikipedia (Mean=2.11, SDV=1.00), E-agriculture websites (Mean=2.60, SDV=0.93), E-agriculture blogs (Mean=2.47, SDV=0.90), and also knowledgeable about mobile agriculture applications (Mean=2.37, SDV=1.07).

Respondents were quite knowledgeable about E-agriculture data warehouses (Mean=1.47, SDV=0.80), E-agriculture via YouTube (Mean=1.65, SDV=0.86); E-agriculture via Skype (Mean=1.61, SDV=0.94); E-agriculture via Facebook (Mean=1.84, SDV=0.93); and also quite knowledgeable about Agricultural knowledge management systems (Mean=1.82, SDV=0.99).
The above finding indicates that the respondents were knowledgeable about e-agriculture – hence they were able to understand the concepts being asked about. Therefore, their responses can be relied upon.

4.1.8 Frequency of usage

Data were collected and analysed in order to know how often farmers used e-agriculture platforms. Data were collected on a 5 point likert scale whereby 1 = Never used, 2= Very Rarely, 3= Rarely, 4= Frequently, and 5= Very frequently. Descriptive means were used to analyze the data as seen in Table 18:

Table 18: Frequency of usage

	N	**Min**	**Max**	**Mean**	**SD**
E-agriculture databases	378	1	5	2.87	1.29
E-agriculture data warehouses	378	1	4	1.72	1.12
E-agriculture via YouTube	378	1	5	1.94	1.25
E-agriculture via Skype	378	1	5	1.92	1.29
E-agriculture via Facebook	378	1	5	2.24	1.31
E-agriculture via Wikipedia	378	1	5	2.79	1.43
E-agriculture websites	378	1	5	3.45	1.30
E-agriculture blogs	378	1	5	3.34	1.26
Agricultural knowledge management systems	378	1	5	2.17	1.38
Mobile agriculture applications	378	1	5	3.12	1.43

Results in table 18 reveal that respondents frequently used E-agriculture websites (Mean=3.45, SDV=1.30); E-agriculture blogs (Mean=3.34, SDV=1.26); and also that they frequently used Mobile agriculture applications (Mean=3.12, SDV=1.43).

The respondents indicated that they rarely used E-agriculture databases (Mean=2.87, SDV=1.29), E-agriculture via Facebook (Mean=2.24, SDV=1.31), E-agriculture via Wikipedia (Mean=2.79, SDV=1.43), and also that they rarely used Agricultural knowledge management systems (Mean=2.17, SDV=1.38.

The respondents however indicated that they very rarely used E-agriculture data warehouses (Mean=1.72, SDV=1.12), E-agriculture via YouTube (Mean=1.94, SDV=1.25) and also that they very rarely used E-agriculture via Skype (Mean=1.92, SDV=1.29).

The above findings reveal that the most frequently used e-agriculture platforms are E-agriculture blogs, Agricultural knowledge management systems and Mobile agriculture applications.

4.1.9 Purpose of usage

Data were collected to analyse the purpose for which e-agriculture platforms were used. Data were collected on a 4 point likert scale whereby 1 = Strongly Disagree, 2= Disagree, 3= Agree, and 4= Strongly Agree. Descriptive means were used to analyze the data as seen in Table 19:

Table 19: Purpose of usage

	N	Min	Max	Mean	SD
I use e-agriculture to access market information	378	1	5	3.53	0.90
I use e-agriculture to connect with other farmers	378	1	5	3.53	0.77
I use e-agriculture to access information on farm practices	378	1	5	3.65	0.79
I use e-agriculture to access information on pesticides	378	1	5	3.24	1.06
I use e-agriculture to access information on crop and animal breads	378	1	5	3.29	0.78
I use e-agriculture to access expert information on farming	378	2	5	3.65	0.72

Results in table 19 show that respondents agreed that they used e-agriculture to access market information (Mean=3.53, SDV=0.90), they used e-agriculture to connect with other farmers (Mean=3.53, SDV=0.77), they used e-agriculture to access information on farm practices (Mean=3.65, SDV=0.79), they used e-agriculture to access information on pesticides (Mean=3.24, SDV=1.06), they used e-agriculture to access information on crop and animal breads (Mean=3.29, SDV=0.78), and also that they used e-agriculture to access expert information on farming (Mean=3.65, SDV=0.72).

The above findings suggest that Ugandan farmers used e-agriculture to access market information, connect with other farmers, access information on farm practices, access information on pesticides, access information on crop and animal breads, and also to access expert information on farming.

4.2.0 Assumptions for Parametric Analysis

Parametric statistical tests are used to make assumptions about the parameters and the distribution of the population from which a given set of data is drawn, while on the other hand non-parametric test do not make such assumption (Field, 2009).

4.2.1 Testing for Statistical Assumptions

It is vital to ensure that the obtained data conforms to multivariate assumptions to guarantee model robustness (Hair et al., 2010). In order to deter biased results it was crucial to test for a number of statistical assumptions prior to utilization of multivariate analysis. Therefor normality, linearity, multicollinearity and Variance Inflation factor tests were carried out.

4.2.2 Test For of Normality of the Data

According to Field (2009), normality concerns the shape of the distribution which is symmetrical and pointy with a mean of zero and standard deviation of 1. It is worth noting that non-compliance of a set of data to the normal distribution affects all successive statistical tests like F and t-statistics and makes them erroneous (Hair et al., 2010). Therefore normality tests are essential in multivariate analysis and testing for it using both univariate and multivariate analysis is extremely recommended. Univariate normality concerns a single variable while multivariate normality concerns a combination of two or more variables of the study. According to Hair et al, (2010) if a variable is multivariate normal, then it is also univariate normal. This implies that univariate normality is a requirement for multivariate normality. However, the reverse is not always true.

Normality of the variables of the study was assessed using skewness and kurtosis (Hair et al., 2010). Kurtosis is the pointedness, peakness or flatness of the distribution of data whereas skewness describes the symmetrical balance and/or pile up of scores on either side of the distribution. Particularly for data to be normally distributed, the values of both kurtosis and skewness should be equal to zero (Curran, West, & Finch, 1996; Field, 2009; Hair et al., 2010).

The Kolmogorov Smirnov test was initially used to test for the normality of data assumption, and the variables in levels. Table 20 presents normality results.

Table 20: Normality test statistic for variables in levels

	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistic	**Df**	**Sig.**	**Statistic**	**df**	**Sig.**
Expectancy	0.23	378	0.00	0.85	378	0.00
Instrumentality	0.25	378	0.00	0.85	378	0.00
Context of Use	0.37	378	0.00	0.71	378	0.00
Usability Measures	0.42	378	0.00	0.62	378	0.00
Intrinsic Motivation	0.43	378	0.00	0.58	378	0.00
Extrinsic Motivation	0.34	378	0.00	0.74	378	0.00
E-agriculture Usability	0.35	378	0.00	0.64	378	0.00
a. Lilliefors Significance Correction						

Results in table 20 show that all the variables are not normally distributed since both the Kolmogorov-Smirnov and Shapiro-Wilk test for the null hypothesis of normality were not significant. This is so because the significance levels for both tests on the variables were below 0.05. The normality plots for the variables in levels are shown in appendix II.

4.2.3 Test for normality of log-transformed variables

Since the distribution of all the variables did not follow a normal distribution, yet it is a pre-requisite of parametric statistical analysis, there was a need to transform the variables to normality. We went ahead to compute logarithms to the base 10 for positively skewed variables, that is; log (variable) and the log reflection for the negatively skewed variables, that is; log (Max+1-variable). Thereafter, the variables were subjected to Kolmogorov Smirnov and Shapiro-Wilk test as seen in Table 21.

Table 21: Test for normality of log-transformed variables

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Expectancy	.20	378	.00	.91	378	.00
Instrumentality	.24	378	.00	.86	378	.00
Usability Measures	.32	378	.00	.79	378	.00
Context of Use	.10	378	.00	.98	378	.00
Intrinsic Motivation	.25	378	.00	.88	378	.00
Extrinsic Motivation	.29	378	.00	.76	378	.00
E-agriculture Usability	.09	378	.00	.96	378	.00
a. Lilliefors Significance Correction						

Results of both the Kolmogorov-Smirnov and Shapiro-Wilk tests in table 21 show that the transformed variables are not normally distributed owing to the significance level statistics which are below 0.05, which finding leads us to reject the null hypothesis of normality. However on keenly observing the coefficients of skewness, we noted that all of the statistics were tending towards zero, with the lowest being that of E-Agriculture usability of 0.09 and 0.96 for Kolmogorov-Smirnov and Shapiro-Wilk tests respectively. This low coefficient of skewness for E-Agriculture usability qualifies it for a non-normally distributed data, which points to a possible weakness of both tests for normality.

4.2.4 The Z test for normality of log-transformed variables

Table 22: Log-Transformed variables

Variable	**Skewness**	**Kurtosis**

	Coefficient	Std. Error	Z Statistic	Coefficient	Std. Error	Z Statistic
Log (Expectancy)	0.11	0.13	0.86	.28	0.25	1.12
Log (Instrumentality)	-0.24	0.13	-1.95	.65	0.31	1.91
Log (Efficiency)	-0.26	0.13	-2.00	1.01	0.58	1.74
Log (Context of Use)	0.13	0.13	1.01	0.71	0.41	1.73
Log (Intrinsic Motivation)	-0.32	0.17	-1.88	.93	0.50	1.86
Log (Extrinsic Motivation)	0.03	0.13	0.25	-1.42	0.72	-1.97
Log (E-Agriculture Usability)	-0.36	0.19	-1.89	1.17	0.61	1.91

According to Powell and Owen (2002) when the sample size is high, both the Kolmogorov Smirnov and Shapiro-Wilk tests become very sensitive to small variations, making it hard to reject the null hypothesis of normality basing on the test results. In that case the Z test statistic can be employed where the decision to reject or fail to reject the null hypothesis is based on the z values, which are a quotient of sample skewness and kurtosis by their standard error. If Z values for skewness and kurtosis are between −2 and +2, even when the KS test is significant, we can conclude that the data on the variable is fairly normally distributed.

The Z skewness statistics of all variables fall within the acceptable range of -2 to +2 implying normal distribution. Further, the log transformed values for all variables are normally distributed. Therefore the log transformed values of all of the variables were used in subsequent analyses as opposed to the variables in levels.

4.2.5 Test for Homogeneity

The levenes statistics (W) test for equal variance, otherwise referred to as homogeneity was performed on both the variables in levels and on the log-transformed variables. The null hypothesis for this test is that homogeneity exists which is rejected when the P value for W statistic is below 0.05. In other words, when the P value for the levene's statistic W is above 0.05, then the homogeneity assumption is supported.

Results in table 24 below show that beside expectancy whose significance levels for the test was below 0.05, (W = 4.56, p = .03), an indication of rejection of the equal variance hypothesis, for all the other variables, the null hypothesis of homogeneity was supported. For instance; instrumentality (W = 2.27, P = .13), Usability Measure (W= 1.59, P= 0.21), Context of Use (W = 2.33, P=0.13), Intrinsic Motivation (W= 6.46, P= 0.01), Extrinsic Motivation (W= 0.07, P= 0.80), E-Agriculture Usability (W= 1.62, P=0.02)

On the other hand looking at the levenes tests for the log transformed variables, we noted that the tests on all variables had significance levels above 0.05, which indicates a failure to reject the null hypothesis of equal variance and hence the homogeneity assumption is upheld. Specifically, expectancy (W = 1.61, p = .21), instrumentality (W = .06, p = 0.80), Usability Measure (W= 0.82, P= 0.36), Context of Use (W = 5.83, P=0.60), Intrinsic Motivation (W= 1.75, P= 0.19), Extrinsic Motivation (W= .02,P= 0.90), E-Agriculture Usability (W=4.60, P=0.06)

Table 24: Test of Homogeneity of Variance for both variables in levels and after log transformation

		Variable in Levels				Log Transformed Variables			
		Levene Statistic	**df1**	**df2**	**Sig.**	**Levene Statistic**	**df1**	**df2**	**Sig.**
Expectancy	Based on Mean	4.56	1	376.00	.03	1.61	1	376.00	0.21
	Based on Median	4.93	1	376.00	.03	1.86	1	376.00	0.17
	Based on Median and with adjusted df	4.93	1	348.21	.03	1.86	1	375.50	0.17
	Based on trimmed mean	4.04	1	376.00	.05	1.82	1	376.00	0.18
Instrumentality	Based on Mean	2.27	1	376.00	.13	.06	1	376.00	0.80
	Based on Median	2.07	1	376.00	.15	.79	1	376.00	0.38
	Based on Median and with adjusted df	2.07	1	372.09	.15	.79	1	376.00	0.38
	Based on trimmed mean	1.18	1	376.00	.28	.04	1	376.00	0.84
Usability Measure	Based on Mean	1.59	1	376.00	.21	.82	1	376.00	0.36
	Based on Median	0.16	1	376.00	.69	.09	1	376.00	0.77
	Based on Median and with adjusted df	0.16	1	375.97	.69	.09	1	365.38	0.77
	Based on trimmed	1.19	1	376.00	.28	.24	1	376.00	0.63

	mean								
Context of Use	Based on Mean	2.33	1	376.00	.13	5.83	1	376.00	0.60
	Based on Median	3.09	1	376.00	.08	6.62	1	376.00	0.61
	Based on Median and with adjusted df	3.09	1	366.53	.08	6.62	1	375.42	0.67
	Based on trimmed mean	2.80	1	376.00	.09	6.25	1	376.00	0.58
Intrinsic Motivation	Based on Mean	6.46	1	376.00	.01	1.75	1	376.00	0.19
	Based on Median	1.73	1	376.00	.19	.19	1	376.00	0.66
	Based on Median and with adjusted df	1.73	1	358.59	.19	.19	1	375.82	0.66
	Based on trimmed mean	5.26	1	376.00	.02	1.22	1	376.00	0.27
Extrinsic Motivation	Based on Mean	0.07	1	376.00	.80	.02	1	376.00	0.90
	Based on Median	0.14	1	376.00	.71	.09	1	376.00	0.76
	Based on Median and with adjusted df	0.14	1	362.55	.71	.09	1	324.57	0.76
	Based on trimmed mean	0.05	1	376.00	.83	.01	1	376.00	0.91
E-Agriculture Usability	Based on Mean	1.62	1	376.00	.20	4.60	1	376.00	0.06
	Based on Median	1.07	1	376.00	.30	3.28	1	376.00	0.07
	Based on Median and	1.07	1	374.25	.30	3.28	1	364.86	0.07

	with adjusted df								
	Based on trimmed mean	1.42	1	376.00	.23	4.19	1	376.00	0.09

E-Agriculture Usability (W=0.02, P=0.06)

4.2.6 Test for linearity

In order to test whether the independent variables are linearly related with the dependent variable, which would imply that there existed proportionate covariance between the independent and dependent variable, we employed a bivariate correlation analysis where particular attention was focused on whether there was significant correlation between the independent and the dependent variable. Table 25 shows bivariate correlation analysis results.

Table 25: Bivariate Correlation analysis

Correlations							
	1	2	3	4	5	6	7
Expectancy (1)	1						
Instrumentality (2)	.701**	1					
Usability Measure (3)	.511**	.510**	1				
Context of Use (4)	.381**	.470**	.326**	1			
Intrinsic Motivation (5)	.504**	.615**	.624**	.512**	1		
Extrinsic Motivation (6)	.087	.160**	.039	.529**	.158**	1	
E-Agriculture Usability (7)	.451**	.456**	.429**	.383**	.607**	.037	1
**. Correlation is significant at the 0.01 level (2-tailed).							

The results in table 25 show that there is a significant positive correlation between the dependent variable, that is; E-Agriculture usability and five of the six independent variables, which are; Expectancy ($r = .451$, $p<.01$), Instrumentality ($r = .456$, $p<.01$), Usability Measure ($r = .429$, $p<.01$), Context of Use ($r = .383$, $p<.01$), Intrinsic Motivation ($r = .607$, $p<.01$). This implies that there is a possibility that those five independent variables are linearly related to the dependent variable. On the other hand the results in the table show that there is no significant relationship between Extrinsic Motivation and E-Agriculture Usability ($r = .037$, $p<.01$).

A further analysis of the scatter plots of the pairs of variables in appendix II show that for the plots between all of the five independent variables that had a significant relationship with E-Agriculture Usability, that is; Expectancy Instrumentality Usability Measure Context of Use Intrinsic Motivation, the plots depict a straight line pattern with an upward movement from left to right. This is indicative of the existence of a linear relationship between the variables. Hence the linearity assumption held true for the relationship between the five independent variables and the dependent variable. On the other hand, the plot of Extrinsic Motivation and E-Agriculture Usability does not portray any definite shape and following from lack of a significant correlation between the two variables, the assumption of linearity does not suffice.

4.2.7 Test for Multicollinearity

The assumption that there is no multicollinearity between the independent variables was assessed to ensure that the independent variables are not highly correlated such that reliable statistics could be generated from the regression of the dependent variable on all of the independent variables. Besides the Bi-variate correlations between the independent variables, the Variance Inflation factor (VIF) of the regression model of E-Agriculture Usability were assessed as summarized in Table 26 below.

Table 26: Estimates of the Variance Inflation Factor (VIF)

Coefficients							
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Collinearity Statistics**	
	B	**Std. Error**	**Beta**			**Tolerance**	**VIF**
(Constant)	.678	.194		3.490	.001		
Expectancy	.153	.053	.168	2.907	.004	.474	2.110
Instrumentality	.001	.063	.001	.014	.989	.405	2.472
Usability Measure	.013	.053	.013	.246	.806	.553	1.809
Context of Use	.133	.051	.148	2.637	.009	.503	1.988
Intrinsic Motivation	.492	.064	.458	7.663	.000	.444	2.251

Extrinsic Motivation	-.127	.047	-.129	-2.690	.007	.693	1.443

Results in table 26 above show that the Variance Inflation factor (VIF) for all of the independent variables was between the ranges of 1 to 10 units, an indication that there is no multicollinearity among the independent variables. This means that individual influence of each independent variable on E-Agriculture Usability cannot be fused with the influence of any other independent variables in a particular regression model.

4.3 Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA)

4.3.1 Expectancy Scale

4.3.1.1 EFA Results

Expectancy was measured using 10 items on a 5-point scale, and results in Table 27 show that out of the original 10 items, 9 items were found to measure Expectancy (Eigen value=3.516, accounting for 69.132 % of the variance. The obtained Kaiser-Meyer-Olkin (KMO) for sample adequacy was .793, which is above 0.5. Hence the sample was appropriate for factor analysis (Field, 2009). Bartlett s test of sphericity of approximately chi-square =1671.628, df = 45, and p=.000 indicate that the retained factors have significant relationships and can help measure Expectancy. The Determinant = .011, which is evidence of no multicollinearity or singularity between variables since it is significantly greater than 0.00001.

Table 27: Expectancy Component Matrix

	Factor Loading
I am certain that my effort to use e-agriculture will enable me have access to extension workers	.904
I am certain that my effort to use e-agriculture will provide access to access better pesticides	.886
I am certain that my effort to use e-agriculture will attract good prices for my agricultural products	.817

I am certain that my effort to use e-agriculture will provide access to better farm breeds	.793
I am certain that my effort to use e-agriculture will lead to better yields	.789
I am certain that my effort to use e-agriculture will make me more knowledgeable about good farming practices	.702
I am certain that my effort to use e-agriculture will provide access to expert agricultural information	.659
I am certain that my effort to use e-agriculture will enable me improve the quality of my far produce	.567
I am certain that my effort to use e-agriculture will enable me have enough food for my family	.592
Eigen value	***3.516***
Variance (%)	***69.132***
Cumulative Variance (%)	***69.132***

Determinant = .011; KMO= .793; Bartlett s test= chi-square =1671.628, df=45, p=.000

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 5 iterations.

4.3.1.2 CFA Results for Expectancy

CFA model for Expectancy is presented in Figure 4 below. This procedure confirmed only five indicators, which were arrived at by (1) deleting items that had low factor loadings and (2) by co-varying the error terms that had high covariance (Kenny & McCoach, 2003). In the figure below, co-varying was done on error terms e1 to e4 and e3 to e4.

The measurement model reflects the relationship between Expectancy and its indicators or observed variables. According to results in Table 28 below, the model generated a chi-square value of 2.6 at P= 0.14 for 2 degrees of freedom. The P-value is greater than .05 suggesting a good model fit. Other model fit indices including GFI = .99, AGFI =.97, TLI= .99 which are above the cut-off point of 0.9 and RMSEA =.05 further showed good model fit since it was below 0.08.

In addition, Table 28 below also shows critical ratios (C.R.) that are above 1.96 and p-values less than .001. These results indicate existence of significant relationships between Expectancy and its indicators. This further means that the regression coefficients in the model were significantly different from zero. A comparison of factor loadings with their respective standard errors confirmed existence of a relationship between the construct and the observed variables. The AVE (Average Variance Extracted) of .53 indicates strong convergent validity among the five indicators of Expectancy. Finally, overall construct reliability for Expectancy of .85 was achieved; one factor and five item measures for the construct were confirmed which is different from the hypothesized model. Therefore, there is a significant difference between the hypothesized and observed measurement model of Expectancy of farmers in Uganda. The hypothesised model in this case involves all of the indicators that were brought forward as measuring Expectancy and the observed model included only those indicators that were finally retained after performing the confirmatory factor analysis.

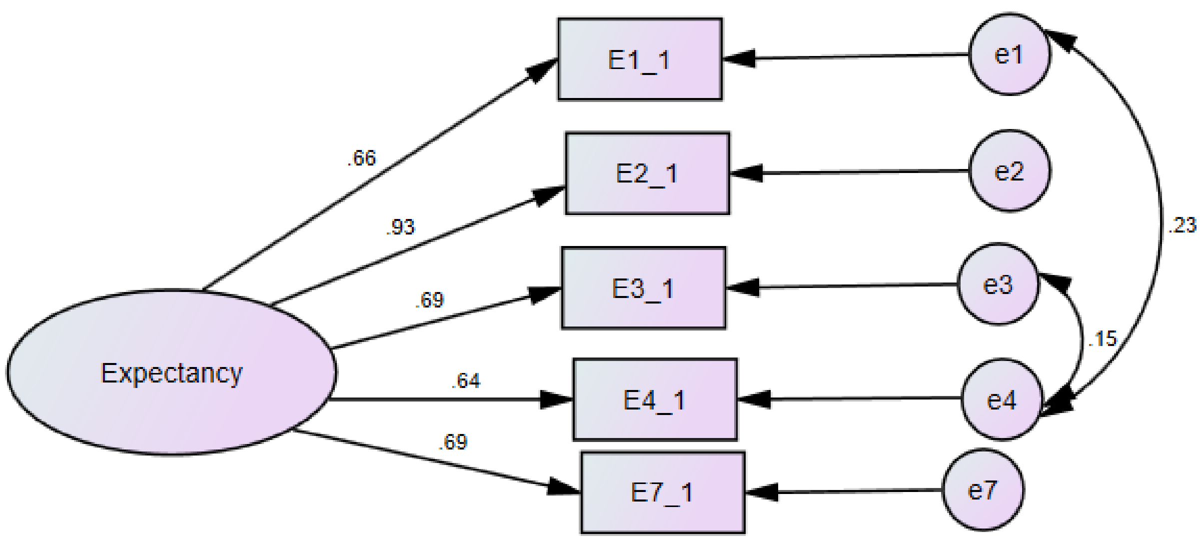

Figure 4: One Factor CFA Model for Expectancy

Table 28: CFA Model Estimates for Expectancy

Model	χ^2	χ^2 **/DF**	**P**	**GFI**	**AGFI**	**TLI**		**RMSEA**	
Expectancy	5.502	1.83	0.14	0.99	0.97	0.99		0.05	
Path			**B**	**S.E.**	**C.R.**	**B**	$\mathbf{L^2}$	**P**	**AVE**

E1_1	<---	Expectancy	1			0.66	0.43		0.53
E2_1	<---	Expectancy	1.557	0.115	13.535	0.93	0.86	***	
E3_1	<---	Expectancy	0.996	0.085	11.728	0.69	0.48	***	
E4_1	<---	Expectancy	1.078	0.086	12.541	0.64	0.41	***	
E7_1	<---	Expectancy	1.056	0.09	11.749	0.69	0.48	***	

CR = 0.85 (Composite reliability)/Construct Reliability

4.3.2 Instrumentality Scale

4.3.2.1 EFA Results

Instrumentality was measured using 10 items on a 5-point scale, and results in Table 29 below show that all the original 10 items, were found to measure Instrumentality (Eigen value=3.179, accounting for 63% of the variance. The obtained Kaiser-Meyer-Olkin (KMO) for sample adequacy was .828, which is above 0.5. Hence the sample was appropriate for factor analysis (Field, 2009). Bartlett s test of sphericity of approximately chi-square =1950.472, df = 45, and p=.000 indicate that the retained factors have significant relationships and can help measure Instrumentality. The Determinant = .005, is evidence of non multicollinearity or singularity between variables since it is significantly greater than 0.00001.

Table 29: Instrumentality Component Matrix

	Factor loading
I am confident that my effort to use e-agriculture will enable me have access to extension workers	.929
I am confident that my effort to use e-agriculture will provide access to better pesticides	.845
I am confident that my effort to use e-agriculture will make me more knowledgeable about good farming practices	.799
I am confident that my effort to use e-agriculture will provide access to better farm breads	.785
I am confident that my effort to use e-agriculture will lead to better yields	.780
I am confident that my effort to use e-agriculture will enable me improve the quality of	.779

my far produce	
I am confident that my effort to use e-agriculture will enable me access to latest weather updates for planning purposes	.680
I am confident that my effort to use e-agriculture will provide access to expert agricultural information	.674
I am confident that my effort to use e-agriculture will attract good prices for my agricultural products	.670
I am confident that my effort to use e-agriculture will enable me have enough food for my family	.567
Eigen value	***3.179***
Variance (%)	***63.059***
Cumulative Variance (%)	***63.059***

Determinant = .005; KMO= .828; Bartlett s test, chi-square =1950.472, df=45, p=.000 *Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 3 iterations.*

4.3.2.2 CFA Results

CFA model for Instrumentality is presented in Figure 5 below. This procedure confirmed five indicators, out of the original 10, which were arrived at by (1) deleting items that had low factor loadings and (2) by co-varying the error terms that had high covariance (Kenny & McCoach, 2003). In the figure below, co-varying was done on error terms e2 to e3 and e3 to e9. The measurement model reflects the relationship between Instrumentality and its observed variables. According to results in Table 30 below, the model generated a chi-square value of 3.4 at P= 0.34 for 3 degrees of freedom. The P-value is greater than .05 suggesting a good model fit. Other model fit indices including GFI = 1, AGFI =0.98, TLI= 1 which are greater than 0.9 and RMSEA =0.02 further showed good model fit.

In addition, Table 30 below shows critical ratios (C.R.) that are above 1.96 and p-values less than .001. These results indicate existence of significant relationships between Instrumentality and its item indicators. This further means that the regression coefficients in the model were significantly different from zero. A comparison of factor loadings with their respective standard errors confirmed existence of a relationship between the construct and the observed variables. The AVE of .58 indicates strong convergent validity among the five indicators of Instrumentality. Squared factor regressions (L^2) are all above 0.5 which confirms item reliability. In other words Instrumentality accounts for a large percentage of the variance in its measured variables. Finally, overall construct reliability for Instrumentality of .77 was achieved; one factor and five item measures for the construct were confirmed which is different from the hypothesized model. Therefore, there is a significant difference between the hypothesized and observed measurement model of Instrumentality of E-Agriculture in Uganda.

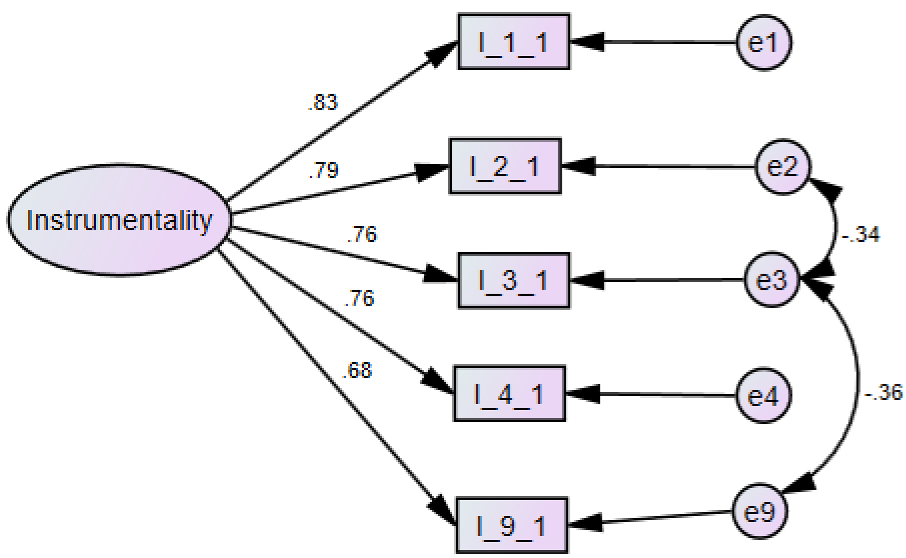

Figure 5: One Factor CFA Model for Instrumentality

Table 30: CFA Model Estimates for Instrumentality

Model	χ^2	χ^2**/2DF**	**P**	**GFI**	**AGFI**	**TLI**	**RMSEA**		
Instrumentality	3.38	3	0.34	1	0.98	1	0.02		
Path			**B**	**S.E.**	**C.R.**	**Beta**	L^2	**P**	**AVE**
I_1_1	<---	Instrumentality	1			0.83	0.68		0.58
I_2_1	<---	Instrumentality	1.36	0.08	16.23	0.8	0.63	***	

I_3_1	<---	Instrumentality	1	0.07	14.48	0.76	0.57	***	
I_4_1	<---	Instrumentality	1.19	0.07	16.62	0.76	0.57	***	
I_9_1	<---	Instrumentality	0.99	0.07	13.55	0.68	0. 46	***	

CR = .77

4.3.3 Usability Measures

4.3.3.1 EFA Results

This scale consisted of all the eight (8) items measured using a 5-point anchor. The Kaiser-Meyer-Olkin (KMO) was used to verify the sampling adequacy for factor analysis. Results for Usability Measures indicate KMO = .827, is above 0.70 according to Field (2009) indicating that the sample was adequate for factor analysis. Bartlett's test of sphericity of Approx. Chi-Square= 1336.712, DF=10, p=.000 is significant, which indicates that correlations between items were sufficiently large for factor analysis. In addition, the determinant of 0.000 is greater than 0.00001 which reveals that there is no multicollinearity or singularity between variables.

As presented in Table 31 below, principle component analysis (PCA) extracted two factors of Usability Measures with Eigen values greater than 1 (Nunally, 1978) whereas the rotated item to factor loadings for the two factors were above .68. The items that loaded on the same component were interpreted as representing Efficiency and Usefulness. Efficiency was measured by 3 items out of the initial 4, while usefulness was measured by 2 items out of the hypothesized 4. Thus 3 items were dropped from Usability measures.

These two factors had Eigen values of 2.581 and 1.623 5respectively. The percentage variance explained by the two factors was 51.61 and 32.457 respectively and altogether explained 84.067% of the variance in Usability Measures.

Table 31: Usability Measures Rotated Component Matrix

	Efficiency	**Usefulness**
I achieve my tasks well when using the available e-agriculture	.927	

platforms		
I save costs when I use e-agriculture platform	.896	
I enjoy using e-agriculture platform to accomplish my tasks	.880	
Using e-agriculture platforms provides me access to unlimited expert agricultural information		.846
Using e-agriculture platforms enables me to access better markets for my produce		.798
Eigen value (sh be above one and means that there is discriminant validity)	*2.581*	*1.623*
Variance (%) (% contribution towards the variable)	*51.61*	*32.457*
Cumulative Variance (%)	*51.61*	*84.067*
Determinant = .028; KMO= .827; Bartlett s test, chi-square =1336.712, df=10, p=.000		
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 3 iterations.		

4.3.3.2 CFA Results

CFA was used to confirm components of Usability Measures as seen in figure 6 below. The hypothesized measurement model for Usability Measures comprised of both measures of Efficiency and Usefulness of E-Agriculture, however the Estimated /Observed measurement model revealed that there was lack of discriminant validity between the two constructs of Efficiency and Usefulness, because the correlation between them was 0.87, which was less than AVE of 0.724. However, given that AVE was above 0.5, there was convergent validity. Further CFA retained only four items of each construct. We arrived at the observed model by deleting items that had low factor loadings.

According to results in Table 32 below, the model generated a chi-square value of 1.537 at P= .215 for 1 degrees of freedom. The P-value is greater than .05 suggesting a good model fit (Schlermelleh-Engel et al. 2003, Vandenberg 2006). This implies that the observed model is not significantly different from the default model. Other model fit indices including GFI = .998, AGFI =.980, TLI= .997 which are above the cut off 0.9 and RMSEA =.038 further showed good model fit.

In addition, Table 32 below shows critical ratios (C.R.) that are above 1.96 and p-values less than .001. These results indicate existence of significant relationships between the construct Efficiency and Usefulness and their indicators. This further means that the regression coefficients in the model were significantly different from zero. A comparison of factor loadings with their respective standard errors confirmed existence of a relationship between the construct and the observed variables. Squared factor regressions (L^2) are all above 0.5 which confirms item reliability. In other words Efficiency and Usefulness account for a large percentage of the variance in the measured variable. Although both constructs were retained, only 2 item measures for each construct were confirmed which is different from the hypothesized model. Therefore, there is a significant difference between the hypothesized and observed measurement model of Usability Measures of farmers in Uganda.

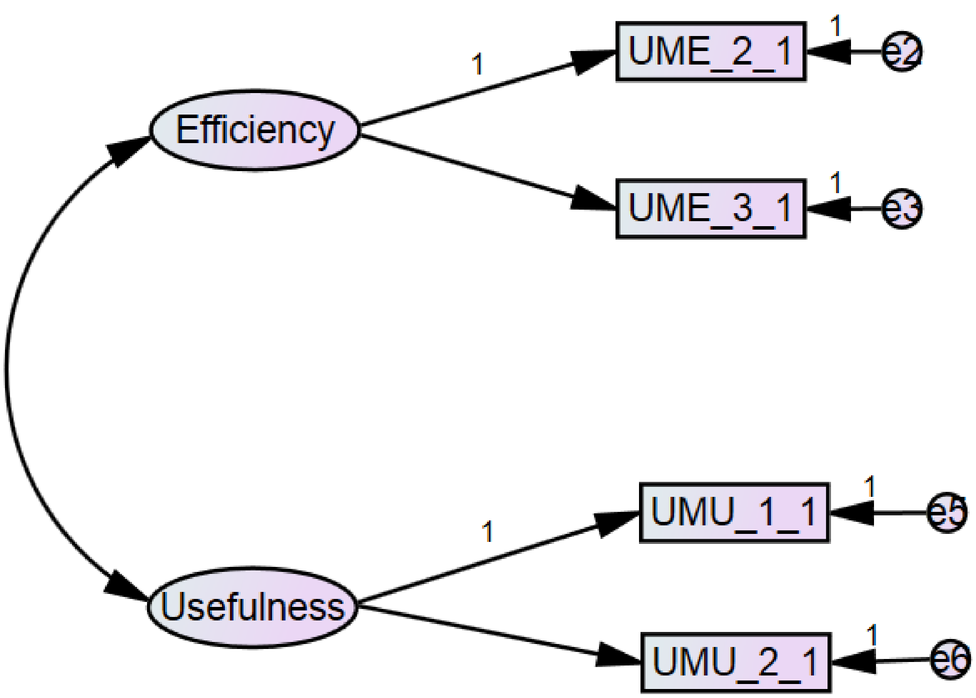

Figure 6: One Factor CFA Model for Usability Measures

Table 32: CFA Model Estimates for Usability Measures Scale

Model	X^2	X^2/DF	**P**	**GFI**	**AGFI**	**TLI**	**RMSEA**	**AVE**
	1.537	1	.215	.998	.980	.997	.038	.724
Path			**B**	**S.E.**	**C.R.**	**Beta**	L^2	**P**
UME_2_1	<---	F1	1.000			.929	.693	
UME_3_1	<---	F1	.949	.036	26.308	.924	.486	***
UMU_1_1	<---	F2	1.000			.697	.854	
UMU_2_1	<---	F2	1.144	.084	13.582	.832	.863	***

4.3.4 Intrinsic Motivation Scale

4.3.4.1 EFA Results

Intrinsic Motivation was measured using 7 items on a 5-point scale, and results in Table 33 show that all the 7 items were found to measure Intrinsic Motivation (Eigen value=*2.359*, accounting for *58.969*% of the variance . The obtained The Kaiser-Meyer-Olkin (KMO) for sample adequacy was .768, which is above 0.5. Hence the sample was appropriate for factor analysis (Field, 2009). Bartlett's test of sphericity of approximately chi-square =801.346, df = 6, and p=.000 indicate that the retained factors have significant relationships and can help measure Intrinsic Motivation. The Determinant = .117, which is evidence of no multicollinearity or singularity between variables since it is significantly greater than 0.00001.

Table 33: Intrinsic Motivation Component Matrix

	Factor Loading
I compare my performance in terms of using e-agriculture platforms to the performance of my peers	.784
I am always in control when using e-agriculture platforms	.747
I intend to use my newly acquired knowledge from e-agriculture platforms for better future yields	.718
I get satisfied when I help my peers to use e-agriculture platforms	.674
I am able to acquire some new knowledge by using e-agriculture	.654

platforms	
I get manageable challenges when using e-agricultural platforms to achieve my goals	.615
I get satisfied when people in my society recognize me for using e-agriculture platforms	.512
Eigen Value	*2.359*
Variance (%)	*58.969*
Cumulative Variance (%)	*58.969*
Determinant = .117, KMO = .768, Bartlett's test, Chi-Square = 801.346, df = 6, P= .000, Sphericity	
Extraction Method: Principal Component Analysis.	

4.3.4.2 CFA Results for Intrinsic Motivation

CFA model for Intrinsic Motivation is presented in Figure 7 below. This procedure confirmed five indicators. The measurement model reflects the relationship between Intrinsic Motivation and its observed variables. According to results in Table 70 below, the model generated a chi-square value of 4.28 at P= 0.118 for 2 degrees of freedom. The P-value is greater than .05 suggesting a good model fit. Other model fit indices including GFI =0.995, AGFI =0.966, TLI= .98 which are above the cut off 0.9 and RMSEA =0.06further showed good model fit.
Additionally, we arrived at the observed model by (1) deleting items that had low factor loadings and (2) by co-varying the error terms that had high covariance (Kenny & McCoach 2003). In the figure below, co-varying was done on error terms e3 to e6, e6 to e7 and e3 to e9.

Furthermore, Table 34 below shows critical ratios (C.R.) that are above 1.96 and p-values less than .001. These results indicate existence of significant relationships between Intrinsic Motivation and its indicators. This further means that the regression coefficients in the model were significantly different from zero. A comparison of factor loadings with their respective standard errors confirmed existence of a relationship between the construct and the observed variables. The AVE of .47 indicates strong convergent validity among the five indicators of Intrinsic Motivation. Squared factor regressions (L^2) are all above 0.5 which confirms item reliability. In other words Intrinsic Motivation accounts for a large percentage of the variance in its measured variables. Finally, overall construct reliability for Intrinsic Motivation of .82 was achieved; one factor and five item measures for the construct were confirmed which is different from the hypothesized model. Therefore, there is a significant difference between the hypothesized and observed measurement model of Intrinsic Motivation of farmers in Uganda.

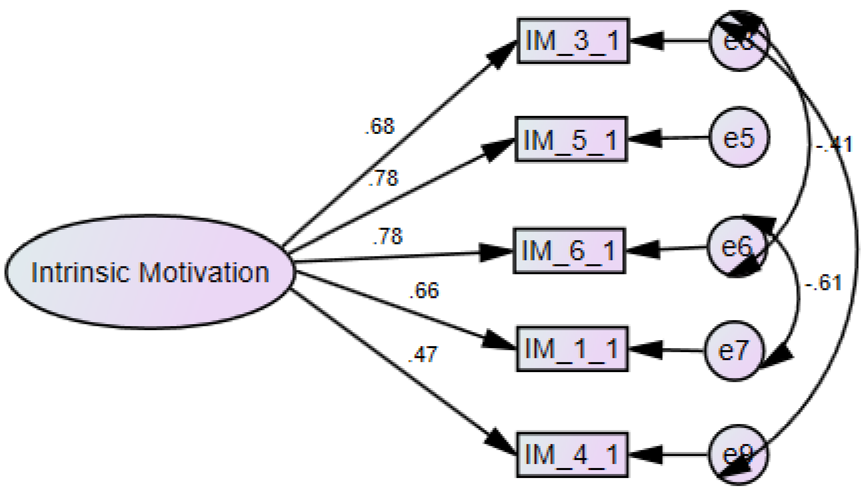

Figure 7: One Factor CFA Model for Intrinsic Motivation

Table 311: CFA Model Estimates for Intrinsic Motivation Measures Scale

Model	χ^2	χ^2 **/DF**	**P**	**GFI**	**AGFI**	**TLI**		**RMSEA**	
	4.28	2	0.118	0.995	0.966	0.98		0.06	
Path			**B**	**S.E.**	**C.R.**	**Beta**	$\mathbf{L^2}$	**P**	**AVE**
IM_3_1	<---	Intrinsic Motivation	1			0.68	0.46		0.47
IM_5_1	<---	Intrinsic Motivation	1.36	0.13	10.89	0.78	0.61	* **	
IM_6_1	<---	Intrinsic Motivation	1.31	0.13	9.93	0.78	0.61	* **	
IM_1_1	<---	Intrinsic	1.04	0.11	9.77	0.66	0.44	*	

		Motivation						**	
IM_4_1	<---	Intrinsic Motivation	0.59	0.07	8.78	0.47	0.22	***	

CR =.82

4.3.5 Extrinsic Motivation Scale

4.3.5.1 EFA Results

Extrinsic Motivation was measured using 7 items on a 5-point scale, and results in Table 35 below show that 6 items were found to measure Extrinsic Motivation (Eigen value=4.426, accounting for 63.227% of the variance. The obtained The Kaiser-Meyer-Olkin (KMO) for sample adequacy was .835, which is above 0.5. Hence the sample was appropriate for factor analysis (Field, 2009). Bartlett's test of sphericity of approximately chi-square =2101.745, df = 21, and p=.000 indicate that the retained factors have significant relationships and can help measure Extrinsic Motivation. The Determinant = .004, which is evidence of no multicollinearity or singularity between variables since it is significantly greater than 0.00001.

Table 312: Extrinsic Motivation Component Matrix

	Factor 1
I get gifts from government for using e-agriculture platforms	.890
I get gifts from service providers for using e-agriculture platforms	.890
I get financial rewards from government for using e-agriculture platforms	.868
I get financial rewards from service providers for using e-agriculture platforms	.842
I get incentives from government for using e-agriculture platforms	.842
I get other incentives from service providers for using e-agriculture platforms	.818
Eigen value	*4.426*
Variance (%)	*63.227*
Cumulative Variance (%)	*63.227*
Determinant = .004; KMO= .835; Bartlett s test, chi-square =2101.745, df=21, p=.000	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser	

Normalization. a. Rotation converged in 3 iterations.

4.3.5.2 CFA Results

CFA model for Extrinsic Motivation is presented in Figure 8 below. This procedure confirmed five indicators. The measurement model reflects the relationship between Extrinsic Motivation and its observed variables. According to results in Table 36 below, the model generated a chi-square value of 5.39 at P= 0.37 for 2 degrees of freedom. The P-value is greater than .05 suggesting a good model fit. Other model fit indices including GFI =. 0.995, AGFI =0.98, TLI= .98 which are above the cut off 0.9 and RMSEA =0.014 further showed good model fit. Additionally, we arrived at the observed model by) deleting items that had low factor loadings and 2) by co-varying the error terms that had high covariance (Kenny & McCoach, 2003). In this case we co-varied e1 to e2, e2 to e3, e1 to e3, e5 to e6.

Furthermore, Table 36 below shows critical ratios (C.R.) that are above 1.96 and p-values less than .001. These results indicate existence of significant relationships between Extrinsic Motivation and its indicators. This further means that the regression coefficients in the model were significantly different from zero. A comparison of factor loadings with their respective standard errors confirmed existence of a relationship between the construct and the observed variables. The AVE of .64 indicates strong convergent validity among the five indicators of Intrinsic Motivation. Squared factor regressions (L^2) are all above 0.5 which confirms item reliability. In other words Extrinsic Motivation accounts for a large percentage of the variance in its measured variables. Finally, overall construct reliability for Extrinsic Motivation of.91 was achieved; one factor and six item measures for the construct were confirmed which is different from the hypothesized model. Therefore, there is a significant difference between the hypothesized and observed measurement model of Extrinsic Motivation of farmers in Uganda.

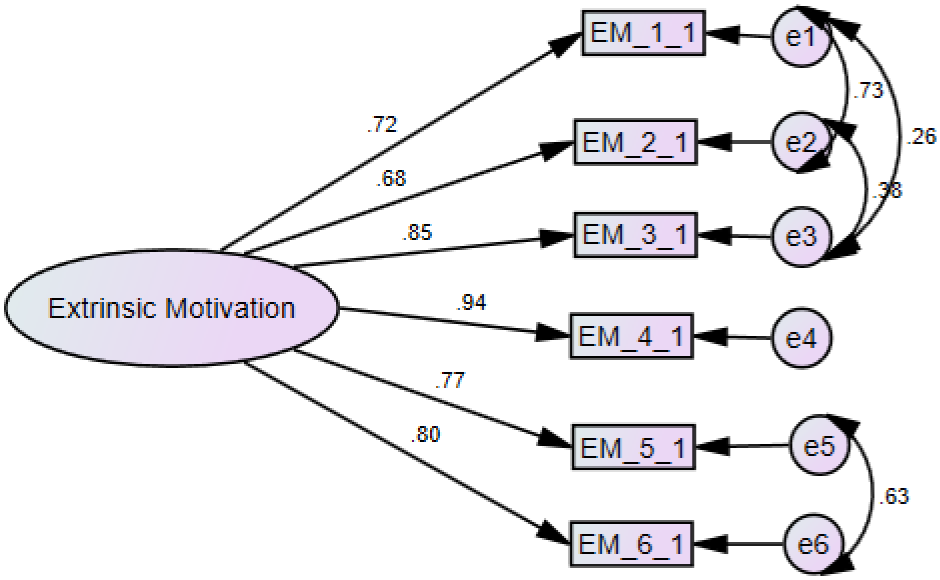

Figure 8: One Factor CFA Model for Extrinsic Motivation

Table 313: CFA Model Estimates for Extrinsic Motivation Measures Scale

Model	χ^2	χ^2 **/DF**	**P**	**GFI**	**AGFI**	**TLI**	**RMSEA**		
	5.39	1.08	0.37	0.995	0.98	0.999	0.014		
Path			**B**	**S.E.**	**C.R.**	**Beta**	**L2**	**P**	**AVE**
EM_1_1	<---	Extrinsic Motivation	1			0.72	0.52		0.64
EM_2_1	<---	Extrinsic Motivation	1.08	0.04	24.48	0.68	0.46	***	
EM_3_1	<---	Extrinsic Motivation	1.11	0.06	18.58	0.85	0.72	***	
EM_4_1	<---	Extrinsic Motivation	1.35	0.08	16.99	0.94	0.89	***	
EM_5_1	<---	Extrinsic Motivation	1.29	0.09	14.65	0.77	0.6	***	
EM_6_1	<---	Extrinsic Motivation	1.3	0.09	15.25	0.8	0.64	***	

CR = .91

4.3.6 Context of Use

4.3.6.1 EFA Results

This scale consisted of originally twenty nine (29) items measured using a 5-point anchor belonging to five factors, namely User Characteristics (User Char), Organizational Environment (Org Env) , Social Environment (Social Env), Economic Environment (Econ Env), Technology (Tech)

The results in Table 37 below show that out of the original 28 items, 6 items were found to measure Economic Environment, 6 items were found to measure Technology, 3 items were found to measure Social Environment, 3 items were found to measure User Characteristics, and 1 item was found to measure Economic Environment. The Kaiser-Meyer-Olkin (KMO) was used to verify the sampling adequacy for factor analysis. Results for context Of Use indicate KMO = 0.882, is above 0.70 according to Field (2009) indicating that the sample was adequate for factor analysis. Bartlett's test of sphericity of Approx. Chi-Square= 9784.229, DF=351, p=.000 is significant, which indicates that correlations between items were sufficiently large for factor analysis. In addition, the determinant of 0.000 is greater than 0.00001 which reveals that there is no multicollinearity or singularity between variables.

As presented in Table 37 below, principle component analysis (PCA) extracted five factors of Context of Use with Eigen values of greater than 1. The items that loaded on the same component were interpreted as representing User Characteristics, Technology, Organizational Environment, Social environment, Economic Environment.

These five factors had eigenvalues of 5.972, 5.201; 3.479; 2.862; and 2.295respectively. The percentage variance explained by the five factors was 22.117; 19.262; 12.885; 10.599and 8.499 respectively and altogether explained 73.362 Percent of the variance in Context of Use.

Table 314: Context of Use Rotated Component Matrix

	Economic Environment	Technology	Social Environment	User Characteristics	Organizational Environment
I receive financial support to enable me repair and maintain and use e-agriculture platforms	.920				
I receive financial support to enable me procure the hardware for using e-agriculture platforms	.909				
I receive financial support to enable me procure the software for using e-agriculture platforms	.883				
I receive financial support to enable me procure the software for using e-agriculture platforms	.883				
I receive financial support from the government to enable me use e-agriculture platforms	.850				
I receive financial support from service providers to enable me use e-agriculture platforms	.793				
The software I have is compatible with the available e-agriculture platforms		.915			
The hardware I that I have is compatible with the available e-agriculture platforms		.894			
I have the required software for using e-agriculture platforms		.872			
The available e-agriculture hardware facilities are easy to use		.864			
I have the required hardware for using e-agriculture platforms		.826			
The available e-agriculture technology is user friendly		.596			
I have access to the internet for using e-agriculture platforms		.594			

My superiors encourage me to use e-agriculture platforms to access agricultural information			.850		
My family members encourage me to use e-agriculture platforms to access agricultural information			.770		
My community's social norms allow me to use e-agriculture platforms to access agricultural information			.767		
I possess the necessary knowledge for using the available e-agriculture platforms				.874	
I possess the necessary skills for using the available e-agriculture platforms				.865	
I possess the necessary experience in using the available e-agriculture platforms				.840	
There is a national policy for using e-agriculture platforms					.734
E-agriculture service providers provide user feedback to farmers concerning the available e-agriculture platform					.718
I receive e-agriculture user support from the service providers					.609
Eigen value	*5.972*	*5.201*	*3.479*	*2.862*	*2.295*
Variance (%)	*22.117*	*19.262*	*12.885*	*10.599*	*8.499*
Cumulative Variance (%)	*22.117*	*41.379*	*54.264*	*64.863*	*73.362*
Determinant = .026; KMO= .882; Bartlett s test, chi-square =9784.229, df=351, p=.000					
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 6 iterations.					

4.3.6.2 CFA Results

CFA model for Context of Use is presented in Figure 9 below. This procedure confirmed all the five factors of Context of Use and their relationships with observed variables, which were arrived at by (1) deleting items that had low factor loadings and 2) by co-varying the error terms that had high covariance (Kenny & McCoach 2003). In this case we co-varied error terms for Economic Environment of e23 to e26 and e26 to e27.The factors were interpreted as User Characteristics (User Char), Organizational Environment (Org Env), Social Environment (Social Env), Economic Environment (Econ Env), Technology (Tech) as shown in Figure 9 below.

Further, CFA confirmed three measures for User Characteristics, three measures for organizational environment, four measures for Social Environment, five measures for Economic Environment and five measures for Technology. The model fit estimates for each factor are presented in Table 38 below. The results reveal that the individual factor models (User Char, Org Env, Social Env, Econ Env, and Tech) fit the observed data well and hence are good representatives of Context of Use. As a result, all the five factors were included in the CFA model for Context of Use.

The first-order CFA model for Context of Use in Figure 9 below and as presented in Table 39 below generated a chi-square value of 586 at P= .000. The P-value is below .05 suggesting poor model fit. However, other fit indices such as the normed X^2 (X^2/DF) = 158, GFI = 0.88, AGFI =.0.84, TLI= 0.94 and RMSEA =.0.09 all confirm acceptably good model fit.

The critical ratios were all above 1.96 and p-values were less than .001 indicating existence of significant relationships between the constructs and the observed variables. This means that the regression coefficients in the model were significantly different from zero. In addition, a comparison of regression weights with their respective standard errors confirms existence of a relationship between Context of Use and its components. The average variance explained (AVE) is .51 which indicates convergent validity among the five dimensions of Context of Use. Squared factor regressions (L^2) are all above .20 which reveals item reliability.

Finally, composite reliability for Context of Use of .90 was achieved with five factors and twenty (20) item measures. These results in addition confirm construct validity and reliability of Context of Use scale and its dimensions. Therefore, it is concluded that there is no significant difference between the hypothesized factor structure of Context of Use and what was observed among farmers in Uganda.

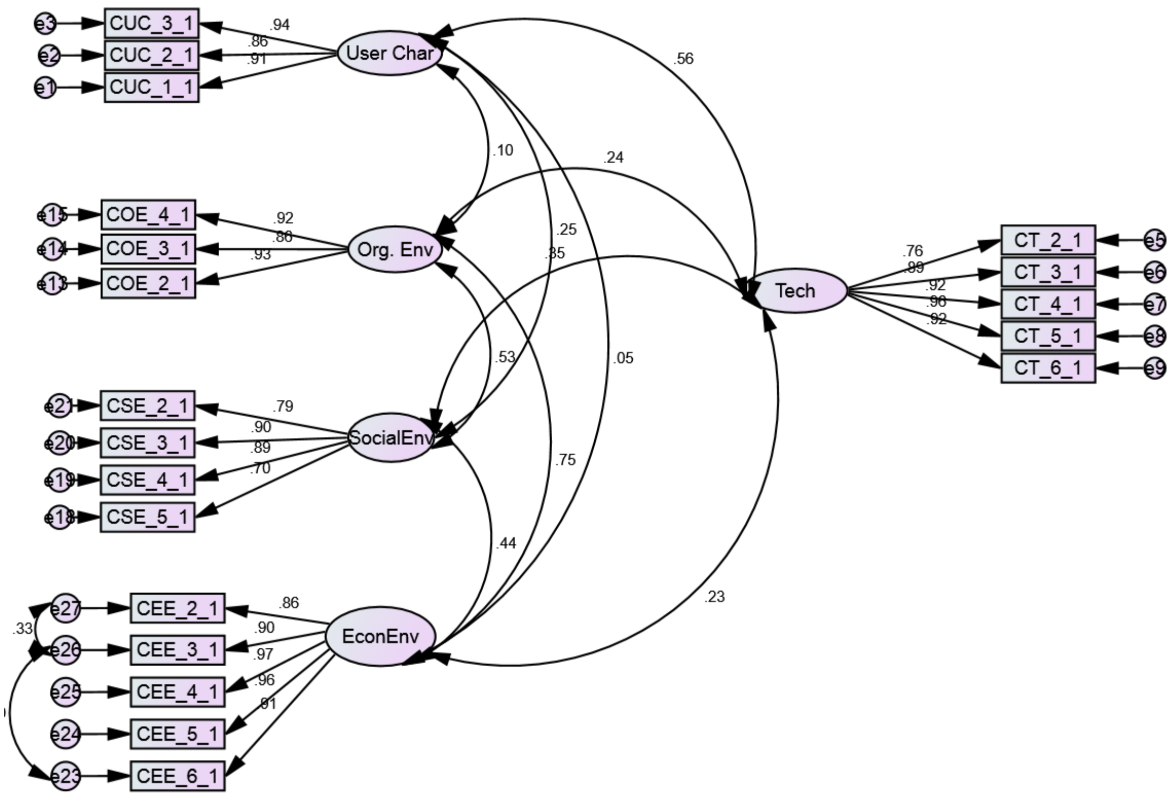

Figure 9: A Five Factor CFA Model for Context of Use with Observed Variables

Table 315: CFA Model Estimates for Context of Use Scale

Model	χ^2	χ^2 **/DF**	**P**	**GFI**	**AGFI**	**TLI**	**RMSEA**	
Context of Use	586	158	0	0.88	0.84	0.94	0.09	
Path			**B**	**S.E.**	**C.R.**	**B**	**L2**	**P**
CUC_1_1	<---	User Characteristics	1			0.91	0.82	
CUC_2_1	<---	User Characteristics	0.99	0.04	24.76	0.86	0.75	***
CUC_3_1	<---	User Characteristics	1.06	0.04	29.55	0.95	0.89	***
CT_2_1	<---	Technology	1			0.76	0.58	
CT_3_1	<---	Technology	1.13	0.06	19.3	0.89	0.8	*

					1			**
CT_4_1	<---	Technology	1.08	0.05	20.11	0.92	0.85	***
CT_5_1	<---	Technology	1.24	0.06	21.3	0.97	0.93	***
CT_6_1	<---	Technology	1.14	0.06	19.98	0.92	0.84	***
COE_2_1	<---	Organisational Environment	1.08	0.04	30.42	0.93	0.87	***
COE_3_1	<---	Organisational Environment	1	0.04	25.14	0.86	0.74	***
COE_4_1	<---	Organisational Environment	1			0.92	0.85	
CSE_5_1	<---	Social Environment	1			0.7	0.49	
CSE_4_1	<---	Social Environment	1.53	0.1	16.11	0.89	0.8	***
CSE_3_1	<---	Social Environment	1.49	0.09	16.15	0.9	0.8	***
CSE_2_1	<---	Social Environment	1.3	0.09	14.42	0.79	0.62	***
CEE_6_1	<---	Economic Environment	1			0.91	0.83	
CEE_5_1	<---	Economic Environment	1.19	0.03	35.98	0.97	0.93	***
CEE_4_1	<---	Economic Environment	1.16	0.03	37.14	0.97	0.95	***
CEE_3_1	<---	Economic Environment	1.17	0.05	25.25	0.9	0.81	***
CEE_2_1	<---	Economic	1.14	0.04	25.9	0.86	0.75	*

		Environment						**

4.3.6.3 Testing for Construct Validity and Reliability for Context of Use

The result in Table 39 below reveals that there was discriminant validity between the dimensions since squared correlations (R^2) between the factors or dimensions were all lower than their corresponding AVE seen in Table 40

Further still the AVE values of any particular construct are greater than the squared correlation with any other constructs indicating discriminant validity which implies that the construct are considerably distinct. The estimated construct reliability (CR) statistics for all constructs were found to be greater than .70 indicating strong internal consistency of measurement scales. Therefore, it can be concluded that all constructs in the hypothesized model are significantly different from each other and highly valid and reliable in their measurement.

Table 39: Construct Reliability (CR), AVE and Squared Correlations for the Measurement Model

Variable	**CR**	**No. of items**	**AVE**	**Squared Correlations (R^2)**				
				1	**2**	**3**	**4**	
User Characteristics (1)	0.93	3	0.82	1				
Technology (2)	0.95	5	0.80	0.31	1			
Organisational Environment (3)	0.93	3	0.82	0.01	0.05	1		
Social Environment (4)	0.89	4	0.68	0.06	0.72	0.28	**1**	
Economic Environment (5)	0.97	5	0.85	0.00	0.05	0.56	0.19	1

4.3.7 E-Agriculture Usability

4.3.7.1 EFA Results

The table below 41 consisted of twenty five (25) items measured using a 5-point anchor. The Kaiser-Meyer-Olkin (KMO) was used to verify the sampling adequacy for factor analysis. Results for E-Agriculture indicate KMO = 0.868, which is above 0.70 according to Field (2009) indicating that the sample was adequate for factor analysis. Bartlett's test of sphericity of

Approx. Chi-Square= 7510.956, DF=300, p=.000 is significant, which indicates that correlations between items were sufficiently large for factor analysis. In addition, the determinant of 0.000 is greater than 0.00001 which reveals that there is no multicollinearity or singularity between variables.

As presented in Table 40 below, principle component analysis (PCA) extracted four factors of E-Agriculture with Eigen values of greater than 1. The items that loaded on the same component were interpreted as representing Platform Usability, Control and Flexibility, Consistency and Standardization, Documentation and User Support. These four factors had eigenvalues of 5.797; 4.474; 3.208; and 2.907respectively. The percentage variance explained by the four factors was 23.19; 17.897; 12.832; and 11.627respectively and altogether explained 65.546 Percent of the variance in E-Agriculture.

Table 40: E-Agriculture Rotated Component Matrix

	Control & Flexibility	**Consistency & Standardization**	**Documentation & User Support**	**Platform Usability**
The available e-agriculture platforms allow me to redo previous actions that I want to save	.817			
The available e-agriculture platforms allow me to undo previous actions I do not want to save	.775			
The available e-agriculture platforms allow me to change my login details	.727			
The available e-agriculture platforms allow me to customize information held on them	.712			
The available e-agriculture platforms ask me to confirm my actions before saving them	.693			
The available e-agriculture platforms provide me with shortcuts tools for accomplishing tasks	.676			

The available e-agriculture platforms allow me to exit when there is an error	.628			
The available e-agriculture platforms allow me to print information held on them	.609			
The available e-agriculture platforms allow me to access information in different formats	.595			
The available e-agriculture platforms allow me to save information in different formats	.502			
The available e-agriculture platforms have consistent colours		.922		
The available e-agriculture platforms have uniform user menus		.899		
The available e-agriculture platforms have a consistent interface		.868		
The available e-agriculture platforms have consistent text fonts and types		.837		
The available e-agriculture platforms have offline user manuals			.740	
The available e-agriculture platforms have online help tools			.707	
The available e-agriculture platforms have training materials			.619	
The user manuals for e-agriculture platforms are written in my local language			.557	
The information provided by available e-agriculture platforms is easy to read				.875
The information I get from available e-agriculture platforms is easy to understand				.851
The information provided by the e-agriculture platform is logically organized				.729
The information provided by available e-agriculture platforms is clear				.643
Eigen value	*5.797*	4.474	3.208	2.907
Variance (%)	*23.19*	17.897	12.832	11.627
Cumulative Variance (%)	*23.19*	41.087	53.919	65.546
Determinant = .0013; KMO= .868; Bartlett s test, chi-square =7510.956, df=300, p=.000				

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 7 iterations

4.3.7.2 CFA Results

Figure 10 below shows the measurement model for E-Agriculture Usability, which reveals that the factors were pairwise lowly covarying, an indication of discriminant validity since their covariances were all below 0.85. Out of the 4 items under platform, 3 one was deleted and 3 retained. For Control and Flexibility, only 5 items were retained out of the hypothesized 11, while only 3 items were retained to measure Documentation and user support out of the initial 6. Consistency and standardization however retained the 4 hypothesized items. Items with low estimates were deleted, while error terms of those items with high covariances were paired to improve on the goodness of fit indices.

The results in the Table 41 below show that the model was not fit owing to the various statistics which include the chi-square value (CMIN/X^2) of 294.18 and X^2/df of 5.896 which is more than 5, with 80 degrees of freedom at P=.000 which is less than 0.5 and the RMSEA is 0.084 which is also more than .08. Other goodness of fit measures indicate GFI of .908, AGFI of .862, and TLI of .941, all of which should be within the region of 0.9 or above.

The dimensions of E-Agriculture Usability namely; platform usability, Consistency and standardization, Control and Flexibility and Documentation and User support had considerable pairwise covariance apart from Control and Flexibility and Consistency and Standardization with a covariance value of .07.

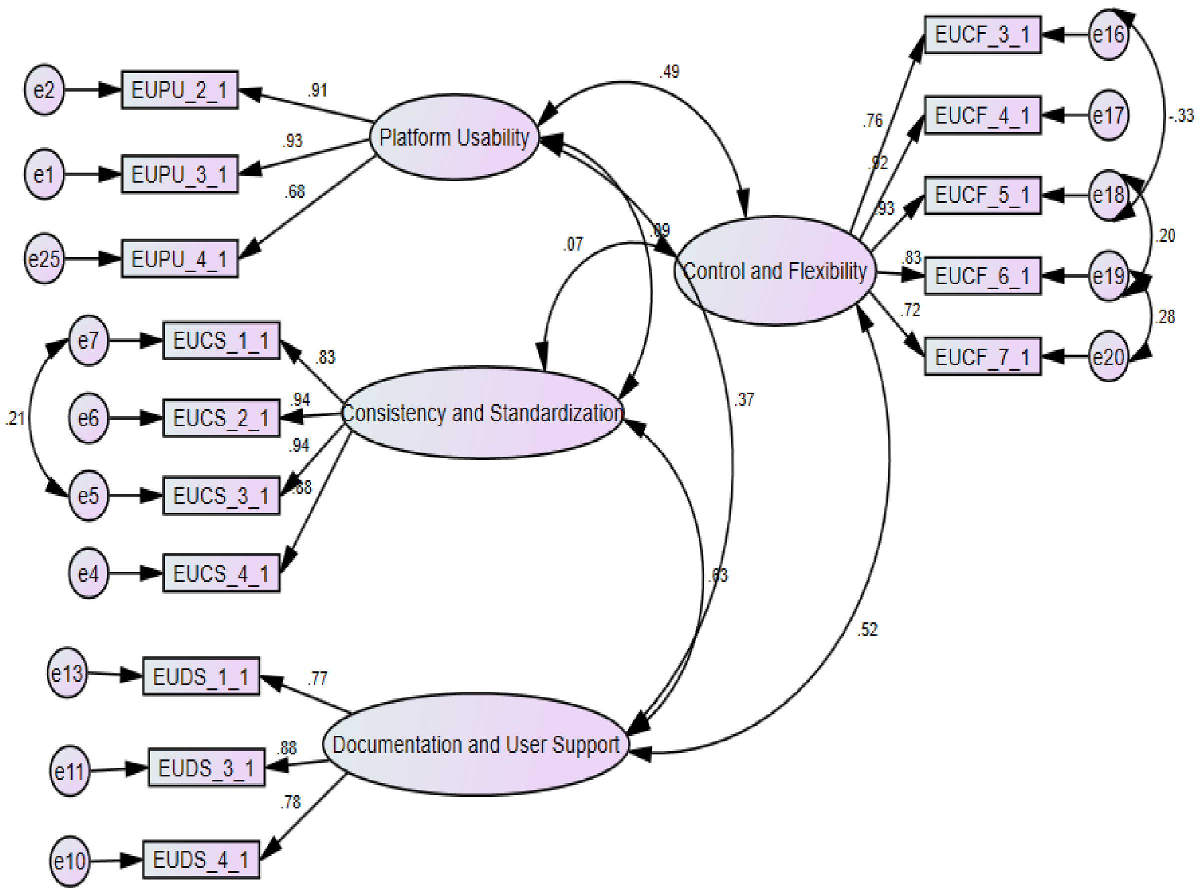

Figure 10: A Four Factor CFA Model for E-Agriculture with Observed Variables

Table 41: Model for E-Agriculture Fit Summary

Model	χ^2	χ^2 **/DF**	**P**	**GFI**	**AGFI**	**TLI**	**RMSEA**	
	194.18	2.428	0	0.908	0.862	0.941	0.084	
Path			**B**	**S.E.**	**C.R.**	**Beta**	L^2	**P**
EUPU_3_1	<---	Platform Usability	1			0.93	0.86	
EUPU_2_1	<---	Platform Usability	0.89	0.04	23.63	0.908	0.82	***
EUPU_4_1	<---	Platform Usability	0.88	0.06	15.57	0.679	0.46	***
EUCS_4_1	<---	Consistence & Standardization	1			0.881	0.78	
EUCS_3_1	<---	Control & Flexibility	1.12	0.04	28.31	0.941	0.89	***

EUCS_2_1	<---	Control & Flexibility	1.06	0.04	28.18	0.937	0.88	***
EUCS_1_1	<---	Control & Flexibility	0.9	0.04	21.66	0.835	0.7	***
EUDS_4_1	<---	Documentation & User Support	1	0.07	15.36	0.785	0.62	***
EUDS_3_1	<---	Documentation & User Support	1.3	0.08	17.05	0.881	0.78	***
EUDS_1_1	<---	Documentation & User Support	1			0.765	0.59	
EUCF_3_1	<---	Control & Flexibility	1			0.756	0.57	
EUCF_4_1	<---	Control & Flexibility	1.24	0.07	18.51	0.923	0.85	***
EUCF_5_1	<---	Control & Flexibility	1.27	0.07	17.22	0.929	0.86	***
EUCF_6_1	<---	Control & Flexibility	1.17	0.07	16.52	0.827	0.68	***
EUCF_7_1	<---	Control & Flexibility	1.12	0.08	14.35	0.724	0.52	***

4.3.7.3 Testing for Construct Validity and Reliability of E-agriculture Usability

Results in Table 41 above reveal that the estimated model had AVE values above 0.5 which is indicative of convergent validity. Since the Squared factor regressions (L^2) are all above .20 it implies that item reliability is guaranteed.

Further still the result in table 42 below show that the AVE values of any particular construct are greater than the squared correlation (r^2) with any other constructs indicating discriminant validity which implies that the construct are considerably distinct in their measurement of E-agriculture Usability. The estimated construct reliability statistics for all constructs were found to be greater than .70 indicating strong internal consistency of measurement scales. Therefore, it can be concluded that all constructs in the hypothesized model are significantly different from each other and highly valid and reliable in their measurement.

Table 42: Construct Reliability (CR), AVE and Squared Correlations for the Measurement Model

Variable	**CR**	**No. of items**	**AVE**	**Squared Correlations (r^2)**			
				1	**2**	**3**	**4**
Platform Usability (1)	0.88	3	0.71	1			
Consistence & Standardization (2)	0.945	4	0.81	0.01	1		
Control & Flexibility (3)	0.876	4	0.69	0.24	0.00	1	
Documentation & User Support (4)	0.914	4	0.66	0.14	0.4	0.3	**1**

4.4 Testing for variable relationships

Correlation analysis was used to establish the relationships between variables while hierarchical regression analysis method was used to determine the predicting power of independent variables on the respective dependent variables in the structural model. These covered objective 1 and 2. Table 43 shows correlation results.

Table 43: Correlation results

Correlations							
	1	2	3	4	5	6	7
Expectancy (1)	1						
Instrumentality (2)	.701**	1					
Usability Measure (3)	.511**	.510**	1				
Context of Use (4)	.381**	.470**	.326**	1			
Intrinsic Motivation (5)	.504**	.615**	.624**	.512**	1		
Extrinsic Motivation (6)	.087	.160**	.039	.529**	.158**	1	

E-Agriculture Usability (7)	.451**	.456**	.429**	.383**	.607**	.037	1
**. Correlation is significant at the 0.01 level (2-tailed).							

Results in Table 43 above reveal that there is a significant positive relationship between expectancy and instrumentality (r=.701**); significant positive relationship between usability measures and instrumentality (r=.510**); significant positive relationship between usability measures and expectancy (r=.511**); there is a positive significant relationship between instrumentality and e-agriculture usability (r=.456**); there is a significant positive relationship between expectancy and e-agriculture usability (r=.451**); a significant positive relationship between instrumentality and intrinsic motivation (r=.615**); a significant positive relationship between instrumentality and extrinsic motivation (r=.160**); a significant positive relationship between intrinsic motivation and e-agriculture usability (r=.607**); there no significant relationship between extrinsic motivation and e-agriculture usability (r=.037); a significant positive relationship between context of use and e-agriculture usability (r=.512**); a significant positive relationship between usability measures and intrinsic motivation (r=.624**).

4.4 Hierarchical Regression Analysis for Instrumentality

Hierarchical Regression analysis method was used to examine the individual predicting power of each of the independent variables on their respective dependent variables. This was assessed by having first regression model in the hierarchy involving only control variables such as the farmers' gender, age, region, education level and size of land they own. In the first model particular attention is accorded to the R^2 change, which indicates the combined influence of control variables on the respective variables. In subsequent models, which involved addition of the independent variables to the control variables, we would be able to gauge the contribution of the independent variables at explaining the dependent variable from the R^2 value of the model. The respective hierarchical models are as summarized in tables 44 to 49.

Table 44: Hierarchical Regression results for Instrumentality

	Model 1		**Model 2**	
Variable	**B**	**Beta**	**B**	**Beta**

(Constant)	3.457**		2.067**	
Gender	0.087	0.079	0.084	0.076
Age	.138**	.201**	.125**	.183**
Region	-0.033	-0.071	-0.014	-0.029
Land Size	-0.018	-0.033	-.097**	-.176**
Education	-0.031	-0.070	-0.035	-0.078
Expectancy			.405**	0.610**
R	0.234		0.633	
R^2	0.055		0.400	
Adj R^2	0.042		0.391	
R^2 Change	0.055		0.346	
F Change	4.319		213.886	
Sig. F	0.001		0.000	
F	4.319		41.307	
Sig.	0.001		0.000	
	****.Significant at 0.01**			
	***. Significant at 0.05**			

Results on control variables in Table 44 above show that Gender does not have a significant relationship with Instrumentality (Beta=0.079), Age significantly influences Instrumentality (Beta = 0.201**), Region does not have a significant relationship with Instrumentality (Beta= -0.071), Land Size also does not have a significant relationship with Instrumentality (Beta= -0.033) and Education also does not have a significant relationship with Instrumentality (Beta=-0.070). This finding suggests that whereas a farmer's age controlled the relationship between Expectancy and Instrumentality, all the other control variables including Gender, Region, Land size, and level of Education did not have any significant control influence on the relationship between Expectancy and Instrumentality. Overall, all control variables as seen in Model 1 explain only 4.2% of variance in Instrumentality (Adj R^2=0.042).

On the other hand, results in Model 2 above show that Expectancy has a significant relationship with Instrumentality (Beta= 0.610**). While control variables alone explained 4.2% of variance in Instrumentality, a combination of control variables and expectancy explained 39.1% of variance in Instrumentality (Adj R^2=0.391). Expectancy alone contributed 34.6% towards variance in Instrumentality (R^2 Change =0.346).

Given the above findings, H1 stating that Expectancy has a positive effect on instrumentality of farmers' usage of e-Agriculture was accepted.

4.4.1 Hierarchical Regression Analysis for Intrinsic Motivation

Hierarchical Regression analysis method was used to examine the predicting power of expectancy, instrumentality, context of use and usability measures on intrinsic motivation of farmers. Table 45 below shows the results.

Table 45: Hierarchical Regression results for intrinsic motivation

	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Variable	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**
(Constant)	3.679**		2.244**		1.801**		1.649**		.626**	
Gender	0.091	0.097	0.048	0.052	0.042	0.045	0.035	0.037	-0.002	-0.002
Age	0.046	0.079	0.016	0.027	-0.021	-0.037	0.015	0.026	0.006	0.010
Region	-0.018	-0.045	0.000	-0.001	0.001	0.003	-4.556	0.000	-0.003	-0.007
Land Size	-.058*	-.124*	-.084**	-.180**	-.057**	-.123**	-.073**	-.157**	-.057**	-.121**
Education	0.011	0.028	0.004	0.012	0.022	0.059	0.015	0.041	.032*	.084*
Expectancy			.432**	.542**	.121*	.152*	0.084	0.106	-0.051	-0.064
Instrumentality					.427**	.503**	.232**	.273**	.210**	.248**
Context of Use							.332**	.361**	.264**	.287**
Usability Measures									.458**	.481**
R	.163		0.554		.633		0.679		0.794	

R^2	.027	.307	.401	.461	.630
Adj R^2	.014	.295	.390	.450	.621
R^2 Change	.027	.280	.094	.061	.168
F Change	2.041	149.691	58.252	41.544	167.239
Sig. F	.072	.000	.000	.000	.000
F	2.041	27.329	35.361	39.525	69.543
Sig.	.072	.000	.000	.000	.000

****.Significant at 0.01**

***. Significant at 0.05**

Model 1

Results on control variables in Table 45 above show that Gender does not have a significant relationship with Intrinsic motivation (Beta=0.097), Age does not significantly influence Intrinsic motivation (Beta=0.079), Region does not have a significant relationship with Intrinsic motivation (Beta=-0.045) and Education also does not have a significant relationship with Intrinsic motivation (Beta= 0.028). However, the results reveal that Land Size significantly influences Intrinsic motivation (Beta= -.124*). This relationship implies that when land size increases, intrinsic motivation reduces. The total contribution of control variables on intrinsic motivation is 1.4% and is not significant (Adj R^2=.014, Sig. = .072).

Model 2

Results in Model 2 reveal that only land size significantly controls expectancy and intrinsic motivation (Beta=-.084**) among control variables. The other control variables have no significant relationship with intrinsic motivation. Further, Expectancy has a significant relationship with intrinsic motivation (Beta=.542**). This implies that an increase in expectancy also increases intrinsic motivation of farmers. The total contribution of control variables and expectancy towards intrinsic motivation is 29.5% (Adj R^2= .295). Expectancy alone explains 28% of variance in intrinsic motivation (R^2 Change= .280).

Model 3

In model 3, results reveal that only land size has a significant relationship with intrinsic motivation amongst control variables (Beta=-.123**). This means increasing land size reduces intrinsic motivation. Results also reveal that Expectancy has a significant relationship with intrinsic motivation (Beta=.152*). This implies that an increase in Expectancy increases intrinsic motivation. Further, Instrumentality has a positive significant relationship with intrinsic motivation (Beta=.503**). This implies that increasing instrumentality also increases intrinsic motivation. Control variables combined with expectancy and instrumentality explain 39% of intrinsic motivation (Adj R^2= .390). Instrumentality alone explained 9.4% of intrinsic motivation (R^2 Change= .094). Therefore H4 stating that H_3: Instrumentality positively influences intrinsic motivation of usability of e-Agriculture by farmers in Uganda was accepted.

Model 4

Results in model 4 show that land size has a significant negative relationship with intrinsic motivation amongst control variables (Beta=-.157**). This implies that an increase in land size reduces intrinsic motivation. Context of Use has a significant positive relationship with (Beta=.361**). This implies that an increase in context of use also increases intrinsic motivation. The total contribution of control variables, expectance, instrumentality and context of use on intrinsic motivation is 45% (Adj R^2= .450). Context of use alone explains 6.1% of intrinsic motivation (R^2 Change = .061). Therefore hypothesis H8 stating that Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda was accepted.

Model 5

Finally, results in model 5 indicate that land size and level of education had significant relationships with intrinsic motivation (Beta=-.121**) for land and (Beta=.084*) for level of education, respectively. Whereas land size negatively influenced intrinsic motivation, implying that an increase in land size reduces intrinsic motivation, level of education had a positive influence on intrinsic motivation, implying that an increase in level of education improves intrinsic motivation. Results also show that Usability Measures positively and significantly influenced the intrinsic motivation of farmers (Beta=.481**). The total contribution of all control variables, Expectancy, Instrumentality, Context of Use and Usability Measures on intrinsic motivation is (Adj R^2= .621), while Usability Measures alone contributed 16.8% of variance in intrinsic motivation (R^2 Change= .168). This finding accepts hypothesis H9 stating that Usability Measures has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda.

4.4.2 Hierarchical Regression Analysis for Extrinsic Motivation

Data were analyzed using Hierarchical Regression analysis method in order to establish the influence of expectancy and instrumentality on extrinsic motivation while controlled by gender, age, region, land size and level of education. Table 46 below presents the results.

Table 46: Hierarchical Regression results for Extrinsic Motivation

	Model 1		Model 2		Model 3	
Variable	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**
(Constant)	1.909**		.872**		.503**	
Gender	0.038	0.043	0.008	0.009	0.002	0.003
Age	.105**	.190**	.083**	.151**	0.052	0.095
Region	-0.016	-0.042	-0.003	-0.008	-0.002	-0.005
Land Size	0.012	0.027	-0.007	-0.016	0.015	0.034
Education	-.071**	-.196**	-.076**	-.209**	-.061**	-.167**
Expectancy			.312**	.410**	0.053	0.070
Instrumentality					.356**	.439**
R	0.288		0.493		0.562	
R^2	0.083		0.243		0.315	
Adj R^2	0.071		0.231		0.302	
R^2 Change	0.083		0.160		0.072	
F Change	6.744		78.655		38.882	
Sig. F	0.000		0.000		0.000	
F	6.744		19.902		24.355	
Sig.	0.000		0.000		0.000	

****.Significant at 0.01**

***. Significant at 0.05**

Model 1

Results on control variables in Table 46 above show that Age has a significant influence on extrinsic motivation (Beta = .105**). This implies that the more mature the farmer is the more he/she will be extrinsically motivated. Education on the other hand has a negative significant influence on extrinsic motivation (Beta = -.071**). This implies that the more educated a farmer is the less he/she will be extrinsically motivated. However Gender, Region and land size do not have significant relationships with Extrinsic Motivation (Beta= 0.038, Beta= -0.016, Beta= 0.012 respectively). The total contribution of control variables on Extrinsic motivation is 7.1% and is significant (Adj R^2=0.071, Sig. = .000).

Model 2

Results in Model 2 reveal that among control variables it is only Age and education that significantly control expectancy and Extrinsic motivation (Beta= 0 .151**) and (Beta=-.209**) respectively. These results reveal that while the age of the farmer significantly positively influences Extrinsic Motivation, education of the farmer negatively influences Extrinsic Motivation. All other control variables have no significant relationship with extrinsic motivation. Further, Expectancy has a significant relationship with Extrinsic motivation (Beta =.410**). This implies that an increase in expectancy also increases extrinsic motivation of farmers. The total contribution of control variables and expectancy towards Extrinsic motivation is 23.1 % (Adj R^2= 0.231). Expectancy alone explains 16 % of variance in intrinsic motivation (R^2 Change= .160).

Model 3

Results in Model 3 reveal that among control variables, it is only education that significantly controls Instrumentality and Extrinsic motivation (Beta= -.167**). These results reveal that an increase in the farmer education negatively reduced Extrinsic Motivation. All other control variables have no significant relationship with extrinsic motivation. Further, Instrumentality has a significant relationship with Extrinsic motivation (Beta = .439**). This implies that an increase in Instrumentality also increases extrinsic motivation of farmers. The total contribution of control variables, expectancy and Instrumentality towards Extrinsic motivation is 30.2 % (Adj R^2= 0.302). Instrumentality alone explains 7.2 % of variance in Extrinsic motivation (R^2 Change= 0.072). The findings in model 3 show that hypothesis H5 stating that Instrumentality has a positive effect on the Extrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda was accepted.

4.4.4 Hierarchical Regression Analysis for e-agriculture

Table 16: Regression results for e-agriculture

	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**		**Model 6**		**Model 7**	
Variable	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**
(Constant)	2.965**		1.705**		1.409**		.592**		.520**		0.354		0.344	
Gender	.101*	.106*	0.064	0.067	0.059	0.062	0.029	0.031	0.025	0.027	0.026	0.027	0.026	0.027
Age	0.000	0.000	-0.026	-0.044	-0.051	-0.087	-.053*	-.089*	-0.018	-0.030	-0.019	-0.032	-0.020	-0.034
Region	.045*	.109*	.060**	.147**	.061**	.149**	.059**	.144**	.058**	.141**	.059**	.143**	.059**	.143**
Land Size	-.074**	-.156**	-.097**	-.204**	-.079**	-.167**	-.069**	-.145**	-.085**	-.179**	-.070**	-.147**	-.070**	-.147**
Education	.077**	.199**	.072**	.185**	.084**	.216**	.095**	.246**	.088**	.226**	.079**	.204**	.080**	.206**
Expectancy			.379**	.467**	.171**	.211**	0.060	0.074	0.035	0.043	0.049	0.060	0.048	0.059
Instrumentality					.286**	.330**	.238**	.275**	0.055	0.063	-0.001	-0.001	-0.004	-0.004
Usability Measures							.355**	.366**	.323**	.333**	.201**	.207**	.203**	.209**
Context of Use									.319**	.340**	.249**	.266**	.246**	.262**
Intrinsic Motivation											.266**	.260**	.266**	.261**
Extrinsic Motivation													0.011	0.010
R	.321		0.557		0.592		0.670		0.709		0.726		0.726	

R^2	.103	.310	.351	.450	.503	.528	.528
Adj R^2	.091	.299	.339	.438	.490	.515	.514
R^2 Change	.103	.207	.041	.099	.053	.025	.000
F Change	8.548	111.542	23.126	66.066	39.229	19.520	.046
Sig. F	.000	.000	.000	.000	.000	.000	.830
F	8.548	27.831	28.581	37.665	41.307	41.000	37.180
Sig.	.000	.000	.000	.000	.000	.000	.000

****.Significant at 0.01**

***. Significant at 0.05**

Model 1

Results on control variables in Table 47 above show that Gender, Region ,Education, and land size have a significant relationship with e-agriculture (Beta=0. .106*), (Beta=0.109 *), (Beta=0. 199**) and (Beta= - 0.156**) respectively. Whereas an increase in land size negatively influenced e-agriculture usage, increasing gender, region, and education levels also increased e-agriculture usability. Age does not significantly influences e-agriculture (Beta=0.000). The total contribution of control variables on e-agriculture is 9.1 % and is significant (Adj R^2=.091, Sig. = .000).

Model 2

Results in Model 2 reveal that it is Region, land size and Education that significantly controls expectancy and e-agriculture (Beta= 0 .147**), (Beta= 0-.204**) (Beta = 0.185) respectively. These results imply that while Region and Education have a positive relationship on expectance and e-agriculture, Land size has a negative relationship on expectance and e-agriculture. On the other hand, Gender and Age have no significant influence on expectance and e-agriculture (Beta=0.067 and -0.044) respectively. Further, Expectancy has a significant relationship with e-agriculture (Beta=.467**). This implies that an increase in expectancy increases e-agriculture usage of farmers. The total contribution of control variables and expectancy towards e-agriculture is 29.9% (Adj R^2= .299). Expectancy alone explains 20.7 % of variance in intrinsic motivation (R^2 Change= .207). This finding reveals that H3 stating that Expectancy positively influences usability of e-Agriculture by farmers in Uganda was accepted.

Model 3

Results in Model 3 reveal that it is among control variables, Region , land size and Education significantly controls Instrumentality and e-agriculture (Beta= 0 .149**), (Beta= -.167**), (Beta = .216**) respectively. These results imply that while Region and Education have a positive relationship on Instrumentality and e-agriculture, Land size has a negative relationship on

Instrumentality and e-agriculture. While Gender and Age have no influence on Instrumentality and e-agriculture. Further, Instrumentality has a significant relationship with e-agriculture (Beta=. . 330 **) this implies that an increase in Instrumentality increases e-agriculture usage of farmers. The total contribution of control variables with Expectancy and Instrumentality towards e-agriculture is 33.9% (Adj R^2= .339). Instrumentality alone explains 4.1 % of variance in e-agriculture (R^2 Change= .041). This finding indicates that H2 stating that Instrumentality has a positive influences usability of e-Agriculture by farmers in Uganda was also accepted.

Model 4

Results in Model 4 reveal that among control variables, Age, Region , land size and Education significantly controls Usability Measures and e-agriculture (Beta= 0 -.089*), (Beta= .144**), (Beta = -..145**), (Beta = -.246**) respectively. These results imply that while Region and Education have a positive relationship on Usability Measures and e-agriculture, Age and Land size have a negative relationship on Usability Measures and e-agriculture, while Gender does not have an influence on Usability Measures and e-agriculture.

Further, Usability Measures has a significant relationship with e-agriculture (Beta=. 366 **), this implies that an increase in Usability Measures increases e-agriculture usage of farmers. The total contribution of Usability Measures and Instrumentality towards e-agriculture is 43.8% (Adj R^2= .438). Instrumentality alone explains 9.9 % of variance in e-agriculture (R^2 Change= .099).

Model 5

Results in Model 5 reveal that among control variables, Region , land size and Education significantly controls Context of Use and e-agriculture (Beta= 0.141**), (Beta= - 0.179**), (Beta = 0.226) respectively. These results imply that while Region and Education have a positive relationship on Context of Use and e-agriculture, Land size has a negative relationship on Context of Use and e-agriculture, while Gender and Age does not have an influence on Context of Use and e-agriculture. Further, Context of Use has a significant relationship with e-agriculture

(Beta=.340 **). This implies that an increase in Context of Use increases e-agriculture usage of farmers. The total contribution of Context of Use towards e-agriculture is 49% (Adj R^2= .490). Context of Use alone explains 5.3% of variance in e-agriculture (R^2 Change= .053).

Model 6

Results in Model 6 reveal that among control variables, Region, land size and Education significantly controls Intrinsic Motivation and e-agriculture (Beta= 0.143**), (Beta= - 0.147**), (Beta = 0.204) respectively. These results imply that while Region and Education have a positive relationship on Intrinsic Motivation and e-agriculture, Land size has a negative relationship on Context of Use and e-agriculture, while Gender and Age does not have an influence on Intrinsic Motivation and e-agriculture.

Further, Intrinsic Motivation has a significant relationship with e-agriculture (Beta=. . 260 **). This implies that an increase in Intrinsic Motivation increases e-agriculture usage of farmers. The total contribution of Intrinsic Motivation towards e-agriculture is 51.5% (Adj R^2= .515). Intrinsic Motivation alone explains 2.5 % of variance in e-agriculture (R^2 Change= .025). This finding supports H6 that Intrinsic Motivation has a positive influences usability of e-Agriculture by farmers in Uganda.

Model 7

Results in Model 7 reveal that among control variables, Region, land size and Education significantly controls Extrinsic Motivation and e-agriculture (Beta= 0.143**), (Beta= - 0.147**), (Beta = 0.206) respectively. These results imply that while Region and Education have a positive relationship on Extrinsic Motivation and e-agriculture, Land size has a negative relationship on Extrinsic Motivation and e-agriculture, while Gender and Age does not have an influence on Extrinsic Motivation and e-agriculture.

Further, Extrinsic Motivation does not have a significant relationship with e-agriculture (Beta=. 010). This implies that an increase or decrease in Extrinsic Motivation has no significant effect on e-agriculture usage of farmers. The total contribution of control variables, Expectancy, Instrumentality, Usability Measures, Context of Use, Intrinsic Motivation and Extrinsic Motivation towards e-agriculture is 51.4% (Adj R^2= .514). Extrinsic Motivation alone zero contribution on of variance in e-agriculture (R^2 Change= .000). This finding rejected H7 that Extrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.

4.4.5 Answering research questions 1 and 2

Qtn 1: *What is the relationship between Expectancy, Instrumentality, Intrinsic Motivation, Extrinsic Motivation and e-Agriculture usability of farmers in using e-Agriculture in Uganda?*

Table 48: Regression results for research question 1

	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Variable	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**
(Constant)	2.965**		1.705**		1.409**		.555**		.529**	
Gender	.101*	.106*	0.064	0.067	0.059	0.062	0.039	0.041	0.039	0.041
Age	0.000	0.000	-0.026	-0.044	-0.051	-0.087	-0.041	-0.069	-0.043	-0.073
Region	.045*	.109*	.060**	.147**	.061**	.149**	.061**	.148**	.061**	.148**
Land Size	-.074**	-.156**	-.097**	-.204**	-.079**	-.167**	-.052**	-.109**	-.052**	-.110**
Education	.077**	.199**	.072**	.185**	.084**	.216**	.073**	.189**	.075**	.194**
Expectancy			.379**	.467**	.171**	.211**	.114*	.140*	.111*	.137*
Instrumentality					.286**	.330**	0.083	0.096	0.068	0.079
Intrinsic Motivation							.474**	.465**	.478**	.469**
Extrinsic Motivation									0.038	0.035
R	0.321		0.557		0.592		0.693		0.694	
R^2	0.103		0.310		0.351		0.480		0.481	
Adj R^2	0.091		0.299		0.339		0.469		0.468	
R^2 Change	0.103		0.207		0.041		0.129		0.001	
F Change	8.548		111.542		23.126		91.876		0.597	
Sig. F	0.000		0.000		0.000		0.000		0.440	

F	8.548	27.831	28.581	42.636	37.923
Sig.	0.000	0.000	0.000	0.000	0.000

****.Significant at 0.01**

***. Significant at 0.05**

Model 1

Results on control variables in Table 48 above show that Gender, Region, land size,, and Education, respectively have a significant relationship with e-agriculture (Beta=0 .101*), (Beta=0.045 *), (Beta=-0.074**) and (Beta= - 0.077**) respectively. These results imply that e-agriculture is positively influenced by Gender, Region, and Education. Whereas an increase in land size negatively influenced e-agriculture usage. Age does not significantly influences e-agriculture (Beta=0.000). The total contribution of control variables on e-agriculture is 9.1 % and is not significant (Adj R^2=.091, Sig. = .000).

Model 2

Results in Model 2 reveal that it is Region, land size and Education that significantly controls expectancy and e-agriculture (Beta= 0 .147*), (Beta= - 0.204**), (Beta = 0.185), respectively. These results imply that while Region and Education have a positive relationship on expectance and e-agriculture, Land size has a negative relationship on expectance and e-agriculture. While Age and Gender have no influence on expectance and e-agriculture.

Further, Expectancy has a significant relationship with e-agriculture (Beta=.476**). This implies that an increase in expectancy increases e-agriculture usage of farmers. The total contribution of control variables and expectancy towards e-agriculture is 29.9 % (Adj R^2= .299). Expectancy alone explains 20.7 % of variance in intrinsic motivation (R^2 Change= .207).

Model 3

Results in Model 3 reveal that it is Region, land size and Education that significantly controls Instrumentality and e-agriculture (Beta= 0 .149*), (Beta= - 0.167**), (Beta = 0.216), respectively. These results imply that while Region and Education have a positive relationship on Instrumentality and e-agriculture, Land size has a negative relationship on Instrumentality and e-agriculture. While Age and Gender have no influence on expectance and e-agriculture.

Further, Instrumentality has a significant relationship with e-agriculture (Beta=.330**). This implies that an increase in Instrumentality increases e-agriculture usage of farmers. The total contribution of control variables, Expectancy, and Instrumentality towards e-agriculture is 33.9 % (Adj R^2= .339). Instrumentality alone explains 4.1 % of variance in e-agriculture (R^2 Change= .041).

Model 4

Results in Model 4 reveal that it is Region , land size and Education that significantly controls Intrinsic Motivation and e-agriculture (Beta= 0 .148*), (Beta= - 0.109**), (Beta = 0.189**) respectively. These results imply that while Region and Education have a positive relationship on Intrinsic Motivation and e-agriculture, Land size has a negative relationship on Intrinsic Motivation and e-agriculture. While Age and Gender have no influence on Intrinsic Motivation and e-agriculture.

Further, Intrinsic Motivation has a significant relationship with e-agriculture (Beta=.465**). This implies that an increase in Intrinsic Motivation increases e-agriculture usage of farmers. The total contribution of control variables, Expectancy, and Instrumentality, and Intrinsic Motivation towards e-agriculture is 46.9 % (Adj R^2= .469). Instrumentality alone explains 12.9 % of variance in e-agriculture (R^2 Change= 0.129).

Model 5

Results in Model 5 reveal that it is Region , land size and Education that significantly controls Extrinsic Motivation and e-agriculture (Beta= 0 .148**), (Beta= - 0.110**), (Beta = 0.194**) respectively. These results imply that while Region and Education have a positive relationship on Extrinsic Motivation and e-agriculture, Land size has a negative relationship on Extrinsic Motivation and e-agriculture. While Age and Gender have no influence on Extrinsic Motivation and e-agriculture.

Further, Extrinsic Motivation has no significant relationship with e-agriculture (Beta=.035). This implies that Extrinsic Motivation does not influence e-agriculture usage of farmers. The total contribution of control variables, Expectancy, and Instrumentality, Intrinsic Motivation, and Extrinsic Motivation towards e-agriculture is 46.8 % (Adj R^2= .468). Extrinsic Motivation alone explains only 0.1 % of variance in e-agriculture (R^2 Change= 0.001).

In summary – trying to answer research question 1, Expectancy has a positive significant relationship with e-agriculture usability; Instrumentality also has a positive significant relationship with e-agriculture usability; Intrinsic Motivation has a positive significant relationship with e-agriculture usability; while Extrinsic has no significant relationship with e-agriculture usability. Expectancy explains 20.7% of e-agriculture usability, Instrumentality explains 4.1%, and Intrinsic Motivation explains 12.9% while Extrinsic Motivation explains a minute 0.1% of e-agriculture usability.

Qtn 2: *To analyze the relationship between Context of Use, Usability Measures and Intrinsic Motivation of farmers using e-agriculture platforms in Uganda?*

Table 49: Regression results for research question 2

	Model 1		**Model 2**		**Model 3**		**Model 4**	
Variable	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**	**B**	**Beta**
(Constant)	2.965**		1.504**		.577**		.371*	

Gender	.101*	.106*	0.058	0.061	0.026	0.027	0.026	0.028
Age	0.000	0.000	0.011	0.018	-0.007	-0.013	-0.016	-0.027
Region	.045*	.109*	.055**	.134**	.056**	.137**	.057**	.140**
Land Size	-.074**	-.156**	-.096**	-.202**	-.086**	-.181**	-.068**	-.142**
Education	.077**	.199**	.075**	.194**	.087**	.224**	.080**	.207**
Context of Use			.512**	.545**	.377**	.402**	.274**	.292**
Usability Measures					.345**	.355**	.215**	.221**
Intrinsic Motivation							.271**	.266**
R	0.321		0.629		0.706		0.725	
R^2	0.103		0.396		0.498		0.526	
Adj R^2	0.091		0.386		0.489		0.516	
R^2 Change	0.103		0.293		0.103		0.028	
F Change	8.548		179.548		75.750		21.409	
Sig. F	0.000		0.000		0.000		0.000	
F	8.548		40.467		52.496		51.144	
Sig.	0.000		0.000		0.000		0.000	

****.Significant at 0.01**

***. Significant at 0.05**

Model 1

Results on control variables in Table 49 above show that Gender has a significant relationship with usage of e-agriculture platforms (Beta=0.106*). This implies usage of e-agriculture platforms is influenced by the gender of the farmer. Age does not significantly influences on the usage of e-agriculture platforms (Beta=0.000), this implies that usage of e-agriculture platforms does not depend on the age of the farmer. Region has a significant relationship with usage of e-agriculture platforms (Beta=-0.109*), this indicates that usage of e-agriculture platforms is influenced by the region where the farmer comes from. Land Size significantly influences usage of e-agriculture platforms (Beta= -0.156**), this shows that land size influence the usage of e-agriculture platform and Education also has a significant relationship with usage of e-agriculture platforms (Beta=0.199**). This indicates that the more educated a farmers is the more likely to use e-agriculture platforms. The total contribution of control variables on usage of e-agriculture platforms is 9.1% and is significant (Adj R^2=0.091, Sig. = .000).

Model 2

Results in Model 2 reveal that region significantly controls context of use and e-agriculture usage (Beta= 0.134**) and education also significantly controls on context of use and e-agriculture usage (Beta= 0.194**). This implies that usage of e-agriculture platforms is influenced by the region where the farmers come and the level of education of the farmer. On the other hand, land size also significantly controls context of use and e-agriculture usage (Beta=-0.202**). . The rest of other control variables (gender and age) have no control on context of use and e-agriculture usage.

Further, Context of Use has a significant relationship with farmers usage of e-agriculture platforms (Beta= 0.545**) this implies that context of use increases farmers usage of e-agriculture platforms. The total contribution of control variables and context of use towards e-agriculture usage by farmers 38.6% (Adj R^2= 0.386). Context of use alone explains 29.3 % of variance in e-agriculture usage by farmers (R^2 Change= 0.293).

Model 3

In model 3, results reveal that Region has a significant control on Usability Measures with e-agriculture usage among farmers (Beta = 0 .137**), similarly, land size also has a significant control on Usability Measures and usage of e-agriculture usage by farmers (Beta = -0.181**) and education has a significant control on Usability Measures with e-agriculture usage by farmers (Beta = 0 .224**) and lastly gender and age do not have a significant influence on Usability Measures and E-agriculture platform usage . Further usability Measures have a positive significant relationship with e-agriculture usage (Beta = .355**). This implies that the better the results of the usability measures the more usage of e-agriculture platforms by farmers. The total contribution of control variables and usability measures towards e-agriculture usage by farmers is 48.9 % (Adj R^2= 0.489). Usability Measures alone explains 10.3 % of variance in e-agriculture usage by farmers (R^2 Change= 0.103).

Model 4

Results reveal that Region and education have a positive significant control on intrinsic motivation and e-agriculture usage (Beta = .140**) and (Beta = 0.207**) respectively, while Land size have a negative control on intrinsic motivation and e-agriculture usage (Beta = -0.142). Further intrinsic motivation have a positive significant relationship with e-agriculture usage (Beta = .266**). This implies that the more intrinsically motivated a farmer is the more he/she will use e-agriculture platform. The total contribution of control variables and intrinsic motivation towards e-agriculture usage by farmers is 51.6% (Adj R^2= 0.516). Intrinsic motivation alone explains 2.8 % of variance in e-agriculture usage by farmers (R^2 Change= 0.028).

In respect to research question 2, Context of Use has a significant positive relationship with e-agriculture usability, Usability Measures has a significant positive relationship with e-agriculture usability and also Intrinsic Motivation has a significant positive relationship with e-agriculture usability. Context of Use contributes 29.3% towards e-agriculture usability; Usability Measures contribute 10.3%, while Intrinsic Motivation contributes 2.8% of e-agriculture usability.

4.5 Structural Equation Modeling

Structural Equation Modelling (SEM) is multivariate statistical technique, which is used in measuring data about human perceptions, beliefs, behaviours etc. It is used to determine the direct causal influence of one variable to another (Babin & Svensson, 2012; Hoe, 2008). It is a combination of both confirmatory factor analysis and multiple regressions analysis, which can be used to ascertain the dependent interrelationships. Therefore it is assumed to be a better multivariate procedure that can test construct validity with theoretical relationships within a given concepts measured by multiple variables. It integrates the measurement errors in the measurements of the dependent relationships (Hair et al., 2010).

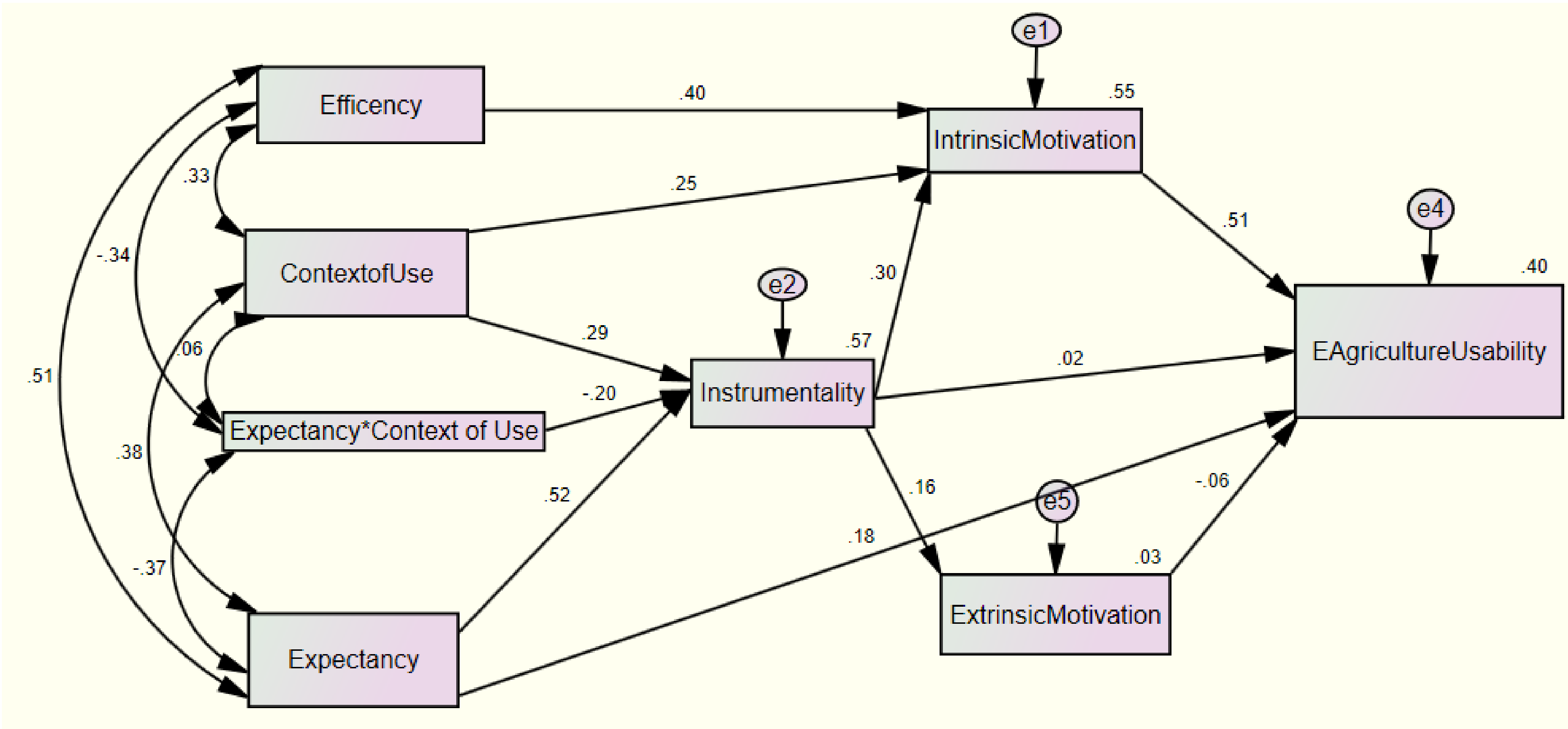

Figure 11: Original SEM (Hypothesized model)

Table 50: Summary and estimates of the Hypothesized Model

Model	**X^2**	**X^2/DF**	**P**	**GFI**	**AGFI**	**TLI**	**RMSEA**
	145.460	13.224	.000	.923	.749	.721	.180

			Estimate	**S.E.**	**Beta**	**C.R.**	**P**	**Hypothesis**
Instrumentality	<---	Expectancy	.469	.036	.519	12.870	***	H1

E-Agriculture Usability	<---	Instrumentality	.025	.061	.025	.404	.686	H2
E-Agriculture Usability	<---	Expectancy	.167	.052	.183	3.226	.001	H3
Intrinsic Motivation	<---	Instrumentality	.282	.039	.304	7.300	***	H4
Extrinsic Motivation	<---	Instrumentality	.163	.052	.160	3.151	.002	H5
E-Agriculture Usability	<---	Intrinsic Motivation	.547	.054	.505	10.091	***	H6
E-Agriculture Usability	<---	Extrinsic Motivation	-.062	.040	-.063	-1.562	.118	H7
Intrinsic Motivation	<---	Context of Use	.204	.033	.245	6.160	***	H8
Intrinsic Motivation	<---	Efficiency	.358	.035	.396	10.181	***	H9
Instrumentality	<---	Expectancy	.469	.036	.519	12.870	***	H10
Instrumentality	<---	Expectancy x Context of Use	-.076	.014	-.198	-5.313	***	
Instrumentality	<---	Context of Use	.255	.034	.285	7.595	***	

Table 17: Squared Multiple Correlations

	Estimate
Instrumentality	.571
Extrinsic Motivation	.026
Intrinsic Motivation	.545
E-Agriculture Usability	.399

The hypothesised structural model was estimated for predictive potential on the dependent variables by the direct and indirect paths as seen in Table 51 above. The results show that Instrumentality had a multiple squared correlation of .571, meaning that the combined effect on instrumentality by expectancy, context of use and the interaction of expectancy and context of use was approximately 57%. Extrinsic motivation was found to have one predictor, that is; instrumentality with a squared multiple correlation coefficient of 0.026, implying that instrumentality predicts Extrinsic motivation by up to 2.6%. Intrinsic motivation was also found to have three direct predictors which include; Efficiency, instrumentality and context of Use and all of these variables predict the variation in intrinsic motivation by up to 54.5%. Lastly all independent variables and mediating variables had either a direct or indirect effect and both categories of variables have a 39.9% predictive power.

The results in Table 50 above regarding the specification of the hypothesized model show that the model did not fit the data well. This is so because all model fit statistics and indices were found to be in unacceptable range compared to the thresholds of a well-fitting model. These indices include; X^2 of 145.460, X^2 /DF11 of 13.224, 11 degrees of freedom at P=.000 which is less than the mandatory 0.05 value, RMSEA is .180 which is above 0.08. GFI is .923, AGFI is .749 and TLI is .721, which are lower than 0.90.

H_1: Expectancy has a positive effect on instrumentality of farmers' usage of e-Agriculture.

Results in Table 50 above reveal that there is a positive and significant relationship between Expectancy and Instrumentality (Beta=.519, P=<.001). This means that a positive change in

Expectancy causes a positive change in the instrumentality of farmers in Uganda. Therefore H1 was supported by the data. Hence Expectancy has a positive effect on instrumentality of farmers' usage of e-Agriculture.

H_2: Instrumentality has a positive influence on usability of e-Agriculture by farmers in Uganda.

Results in Table 50 indicate that there is no significant relationship between Instrumentality and usability of e-agriculture (Beta=.025, P=.686). This implies that a change in Instrumentality does not lead to any changes in the e-agriculture usability by farmers in Uganda. Therefore H2 was not supported by the data. Hence Instrumentality has no influence on e-agriculture usability by farmers in Uganda.

H_3: Expectancy positively influences usability of e-Agriculture by farmers in Uganda.

Further, the results in Table 50 reveal that there is a significant positive relationship between Expectancy and e-agriculture usability (Beta=.183, P=.001), implying that a change in expectancy leads to a corresponding/same directional change in e-agriculture usability. This finding is in agreement with H3 that Expectancy positively influences usability of e-Agriculture by farmers in Uganda.

H_4: Instrumentality has a positive effect on the Intrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.

Further, the results in Table 50 show that there is a positive significant relationship between Instrumentality and Intrinsic motivation (Beta=.304, P=.001), implying that a change in Instrumentality leads to a corresponding change in Intrinsic motivation. This finding is in agreement with H4 that Instrumentality has a positive effect on the Intrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.

H_5: Instrumentality has a positive effect on the Extrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.

Further, the results in Table 50 reveal that there is a positive significant relationship between Instrumentality and Extrinsic motivation (Beta=.160, P=.002), implying that a change in

Instrumentality leads to a corresponding change in Extrinsic motivation. This finding is in agreement with H5 that Instrumentality has a positive effect on the Extrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.

H_6: Intrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.

Results in Table 50 reveal that intrinsic motivation has a positive significant relationship with E-Agriculture Usability (Beta=.505, P=.001), implying that a positive change in intrinsic motivation leads to a positive change in E-Agriculture Usability. This finding is in agreement with H6 that intrinsic motivation has a positive effect on the E-Agriculture Usability of farmers' usage of e-Agriculture platforms in Uganda.

H_7: Extrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.

Results in Table 50 reveal that Extrinsic Motivation has no significant relationship with E-Agriculture Usability (Beta= -0.062, P=.118), implying that a change in Extrinsic Motivation leads to no change in E-Agriculture Usability. This finding is in disagreement with H_7 that Extrinsic Motivation has a positive effect on the E-Agriculture Usability in Uganda.

H_8: Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda

Results in Table 50 reveal that Context of Use has a positive significant relationship with Intrinsic Motivation (Beta= 0.245, P=.001), implying that a positive change in Context of Use leads to a positive change in Intrinsic Motivation. This finding is in agreement with H_8 that Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda.

H_9: Efficiency has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda

Results in Table 50 reveal that Efficiency has a positive significant relationship with Intrinsic Motivation (Beta=.396, P=.001), implying that a positive change in Efficiency leads to a positive change in Intrinsic Motivation. This finding is in agreement with H_9 that Efficiency has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platform in Uganda.

H_{10}: Context of use positively moderates the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda

Results in Table 50 reveal that Expectancy*Context of Use has a significant negative relationship with instrumentality (Beta= -0.198, P=.001). Expectancy has a positive significant relationship with Instrumentality (Beta=.519, P<.001). Context of Use has a positive significant relationship with Instrumentality (Beta=.285, P<.001). This finding reveals that Context of use has a significant negative moderation effect on the relationship between expectancy and instrumentality. Therefore H_{10} stating that Context of use positively moderates the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda was not supported.

Table 52: Bootstrap Indirect effects and mediation effects for hypothesized model

Dependent variable		Mediating variable		Independent variable	Direct Effect		Indirect Effect		Hypothesis	Mediation
					B	**Sig.**	**B**	**Sig.**		
E-agriculture Usability	<---	Instrumentality	<---	Expectancy	.165	.020	.012	.006	$\mathbf{H_{11}}$	Partial mediation
E-agriculture Usability	<---	Intrinsic Motivation	<---	Instrumentality	.167	.020	.084	.006	$\mathbf{H_{12}}$	Partial mediation
E-agriculture Usability	<---	Extrinsic Motivation	<---	Instrumentality	.142	.020	.010	.046	$\mathbf{H_{13}}$	Partial mediation
Intrinsic Motivation		Instrumentality		Context of Use	.240	.008	.189	.006	$\mathbf{H_{14}}$	Partial mediation
E-agriculture Usability		Instrumentality & Intrinsic Motivation		Expectancy	.178	.012	.203	.016	$\mathbf{H_{15}}$	Partial mediation

A mediation model tries to recognise and describe the mechanism that underlies the relationships between an independent variable and a dependent variable via another variable called the mediating variable or intervening variable. A mediation model proposes that the independent variable influences the mediator variable, which in turn influences the dependent variable. Thus, the mediator variable serves to clarify the nature of the relationship between the independent and dependent variables. Mediation is used to understand a known relationship by examining the underlying processes, where one variable influences another variable through a mediator variable. This leads to a better understanding of the relationship between the independent and dependent variable when the variables appear not to have a defined connection, thus table 52 was used to understand the mediation effects of the hypothesised model. On the other hand full mediation would arise when the presence of a mediation variable drops the relationship between the independent and dependent variable (Preacher & Hayes, 2004).

H_{11}: Instrumentality positively mediates the relationship between Expectancy and e-agriculture usability by farmers in Uganda.

Results in Table 52 show that the direct effect of arrow from Expectancy to E-agriculture Usability is significant (Beta=.165, P=.020). Further the indirect effect of the arrow from Expectancy to E-agriculture Usability through Instrumentality is also significant (Beta=.012, P=.006). These results indicate that Instrumentality partially mediates the relationship between Expectancy and E-agriculture usability - hence the partial mediation effect. Therefore H_{11} was accepted.

H_{12}: Intrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.

Results in Table 52 show that the direct effect of arrow from Instrumentality to E-agriculture Usability is significant (Beta=.167, P=.020). The indirect effect of the arrow from Instrumentality to E-agriculture Usability through Intrinsic Motivation is also significant (Beta=.084, P=.006). These results indicate that Intrinsic Motivation partially mediates the relationship between Instrumentality and E-agriculture usability. Therefore H_{12} was also accepted.

H_{13}: Extrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.

Results in Table 52 show that the direct effect of arrow from Instrumentality to E-agriculture Usability is significant (Beta=.142, P=.020). The indirect effect of the arrow from Instrumentality to E-agriculture Usability through Extrinsic Motivation is also significant (Beta=-.010, P=.046). These results indicate that Extrinsic Motivation partially mediates the relationship between Instrumentality and E-agriculture usability. Therefore H_{13} was also accepted.

H_{14}: Instrumentality has a positive mediation effect in the relationship Context of Use and Intrinsic Motivation of farmers in Uganda.

Results in Table 52 show that the direct effect of arrow from Context of Use to Intrinsic Motivation is significant (Beta=.240, P=.008). The indirect effect of the arrow from Context of Use to Intrinsic Motivation through Instrumentality is also significant (Beta=-.189, P=.006). These results indicate that Instrumentality partially mediates the relationship between Context of Use to Intrinsic Motivation. Therefore H_{14} was also accepted.

H_{15}: Instrumentality and Intrinsic Motivation have a positive mediation effect in the relationship Expectancy and e-agriculture usability by farmers in Uganda.

Results in Table 52 show that the direct effect of arrow from Expectancy to E-agriculture Usability is significant (Beta=.178, P=.012). The indirect effect of the arrow from Expectancy to E-agriculture Usability through Instrumentality and Intrinsic Motivation is also significant (Beta=.203, P=.016). These results indicate that Instrumentality and Intrinsic Motivation partially mediate the relationship between Expectancy and E-agriculture usability. Therefore H_{15} was also accepted.

Table 53: Summary of the hypotheses from the hypothesized SEM

Objectives	Research questions	Hypotheses	Status
		H_1: Expectancy has a positive effect on instrumentality of	Supported

1: To examine the relationship between Expectancy, Instrumentality, Intrinsic Motivation, Extrinsic Motivation and e-Agriculture usability of farmers in using e-Agriculture in Uganda	**1:** What is the relationship between Expectancy, Instrumentality, Intrinsic Motivation, Extrinsic Motivation and e-Agriculture usability of farmers in using e-Agriculture in Uganda?	farmers' usage of e-Agriculture.	
		H_2: Instrumentality has a positive influences usability of e-Agriculture by farmers in Uganda.	Not Supported
		H_3: Expectancy positively influences usability of e-Agriculture by farmers in Uganda.	Supported
		H_4: Instrumentality has a positive effect on the Intrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.	Supported
		H_5: Instrumentality has a positive effect on the Extrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.	Supported
		H_6: Intrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.	Supported

		H_7: Extrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.	Not Supported
2: To analyze the relationship between Context of Use, Efficiency and Intrinsic Motivation of farmers using e-agriculture platforms in Uganda	**2:** What is the relationship between Context of Use, Efficiency and Intrinsic Motivation of farmers using e-agriculture platforms in Uganda?	**H_8:** Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda	Supported
		H_9: Efficiency has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda	Supported
3: To analyze the moderation effect of Context of Use in the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda	**3:** What is the moderation effect of Context of Use in the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda?	**H_{10}:** Context of use positively moderates the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda;	Supported
4: To examine the mediation effect of	**4:** What is the mediation effect of Instrumentality in	**H_{11}:** Instrumentality and Intrinsic	Supported

Instrumentality in the relationship between Expectancy and e-agriculture usability by farmers in Uganda.	the relationship between Expectancy and e-agriculture usability by farmers in Uganda?	Motivation positively mediate the relationship between Expectancy and e-agriculture usability by farmers in Uganda.	
5: To examine the mediation effect of Intrinsic Motivation and Extrinsic motivation, Instrumentality in the relationship Context and Extrinsic Motivation, Expectancy, Instrumentality and e-agriculture usability by farmers in Uganda.	**5:** What is the mediation effect of Intrinsic Motivation and Extrinsic motivation, Instrumentality in the relationship Context and Extrinsic Motivation, Expectancy, Instrumentality and e-agriculture usability by farmers in Uganda?	**H_{12}:** Intrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.	Supported
		H_{13}: Extrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.	Supported
		H_{14}: Instrumentality has a positive mediation effect in the relationship Context of Use and Intrinsic Motivation of farmers in Uganda.	Supported
		H_{15}: Instrumentality	Supported

		and Intrinsic Motivation have a positive mediation effect in the relationship Expectancy and e-agriculture usability by farmers in Uganda.	

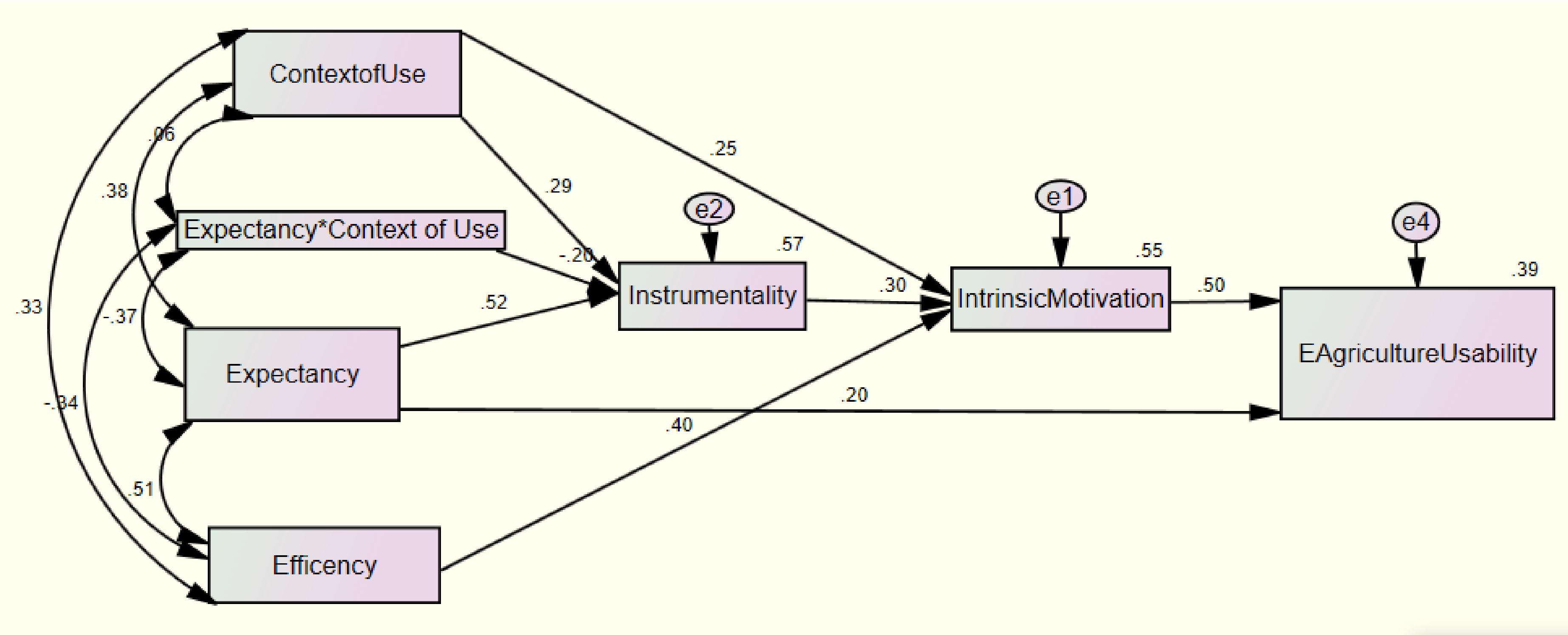

Figure 12: Model for e-agriculture usability

Results in figure 12 reveal the proposed model for usability of e-agriculture in Uganda. This model was arrived at after deleting non-significant relationships from the hypothesized model seen in figure 11. During this process some constructs and their resultant relationships were dropped from the model. Dropped variables were; Extrinsic Motivation which was removed because it had no significant mediation effect in the relationship between Instrumentality and e-agriculture. The arrows from efficiency to instrumentality; from instrumentality to extrinsic motivation; from extrinsic motivation to e-agriculture usability were also removed due to weak relationships. Consequently, some hypotheses were dropped in this process. The dropped hypotheses were H2, H5, H7, H11, H12, and H13. Table 73 presents the model statistics.

Table 54: Model fit indices for the final model

Absolute indices					**Relative indices**			**Parsimonious Fit Indices**				**Noncentrality-based Indices**	
X^2	**X^2/DF**	**P**	**GFI**	**AGFI**	**IFI**	**TLI**	**NFI**	**PGFI**	**PNFI**	**PRATIO**	**PCFI**	**CFI**	**RMSEA**
11.731	1.676	.110	.991	.965	.996	.987	.989	.248	.330	.333	.332	.996	.042

			Estimate	**S.E.**	**C.R.**	**Beta**	**P**	**Hypothesis**
Instrumentality	<---	Expectancy	.469	.036	12.870	.519	***	H1
E-Agriculture Usability	<---	Expectancy	.178	.042	4.198	.196	***	H3
Intrinsic Motivation	<---	Instrumentality	.282	.039	7.300	.304	***	H4
E-Agriculture Usability	<---	Intrinsic Motivation	.546	.050	10.837	.505	***	H6
Intrinsic Motivation	<---	Context of Use	.204	.033	6.160	.245	***	H8
Intrinsic Motivation	<---	Efficiency	.358	.03	10.181	.396	***	H9

				5				
Instrumentality	<---	Expectancy	.469	.03 6	12.870	.519	***	H10
Instrumentality	<---	Expectancy x Context of Use	-.076	.01 4	-5.313	-.198	***	
Instrumentality	<---	Context of Use	.255	.03 4	7.595	.285	***	

The results in Table 54 regarding the specification of the hypothesized model show that the proposed model was fit and explained usability of e-agriculture by Ugandan farmers. This is so because all model fit statistics and indices were found to be within the acceptable goodness-of-fit indices. These indices include; X^2 of 11.731, with 7 degrees of freedom at P=.110 which is above the recommended minimum of P of 0.05. Further, the RMSEA is .042, indicating good model fit given that it was below the recommended maximum RMSEA is 0.08. Model GFI =.991, AGFI = .965, IFI=.996, TLI =.987, NFI=.989, and CFI=.996 are all above the recommended minimum of 0.9.

4.5.1 Predictive power

Table 18: Squared Multiple Correlations

	R^2
Instrumentality	.571
Intrinsic Motivation	.545
E-Agriculture Usability	.394

The structural model was also estimated for predictive potential on the dependent variables by the direct and indirect paths as seen in Table 55. The results show that Instrumentality had a multiple squared correlation of .571, meaning that the combined effect on instrumentality by all of expectancy, context of use and the interaction of expectancy and context of use was approximately 57%. Intrinsic motivation was also found to have three direct and predictors which include; context of use, Efficiency, and instrumentality and indirect predictors including expectancy and the interaction term of context of use and expectancy and all of these variables predict the variation in intrinsic motivation by up to 55%. Lastly all independent variables and mediating variables had either a direct or indirect effect and both categories of variables have a 39% predictive power. This percentage is also pertinent in the sense that it is the predictive potential for the entire Structural model for E- Agriculture model.

H_1: Expectancy has a positive effect on instrumentality of farmers' usage of e-Agriculture.

The results in Table 54 show that there is a positive significant relationship between Expectancy and Instrumentality (Beta=.519, $P<0.001$). This implies that an improvement in the expectancy of farmers will improve their instrumentality towards using e-agriculture platforms. Therefor H_1 was accepted since data supported it.

H_3: Expectancy positively influences e-Agriculture usability by farmers in Uganda.

The results Table 54 show that there is a positive significant relationship between Expectancy and e-agriculture usability in Uganda (Beta=.196, $P<0.001$). This implies that a positive change in the expectancy of farmers will improve e-agriculture usability in Uganda. Therefor H_3 was accepted since data supported it.

H_4: Instrumentality has a positive effect on the Intrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.

The results in Table 54 show that there is a positive significant relationship between Instrumentality and Intrinsic Motivation of farmers in Uganda (Beta=.304, $P<0.001$). This implies that a positive change in the Instrumentality will improve Intrinsic Motivation of farmers in Uganda. Therefor H_4 was accepted since data supported it.

H_6: Intrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.

The results in Table 54 show that there is a positive significant relationship between Intrinsic Motivation and e-agriculture usability in Uganda (Beta=.505, $P<0.001$). This implies that a positive change in the Intrinsic Motivation of farmers will improve e-agriculture usability in Uganda. Therefor H_6 was accepted since data supported it.

H_8: Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda

The results in Table 54 show that there is a positive significant relationship between Context of Use and Intrinsic Motivation of farmers in Uganda (Beta=.245, $P<0.001$). This implies that a positive change in Context of Use will lead to positive change in the Intrinsic Motivation of farmers in Uganda. Therefor H_8 was accepted since data supported it.

H_9: Efficiency has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda

The results in Table 54 show that there is a positive significant relationship between Efficiency and Intrinsic Motivation of farmers in Uganda (Beta=.396, $P<0.001$). This implies that a positive change in the Efficiency will lead to positive change in the Intrinsic Motivation of farmers in Uganda. Therefor H_9 was accepted since data supported it.

H_{10}: Context of use positively moderates the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda

Results in Table 54 also show that there is a positive relationship between Expectancy and Instrumentality (Beta=.519, $P<0.001$). There is also a significant negative relationship between the interaction term of Expectancy and Context of Use and Instrumentality (Beta=-.198, $P<0.001$). There is also a significant positive relationship between Context of use and

Instrumentality (Beta=.285, P<0.001). These results show that Context of Use inversely moderates the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda. In essence Context of Use diminishes the relationship between Expectancy and Instrumentality in the sense that at low levels of Context of Use the relationship between Expectancy and Instrumentality is weaker and at high levels context of use, the relationship between Expectancy and Instrumentality is stronger. For instance, at high levels of technology, the influence of the farmers' expectations on their belief in the instrumentality of e-agriculture usage is low. Therefore H_{10} was accepted. This moderation effect was mapped in figure 13 below.

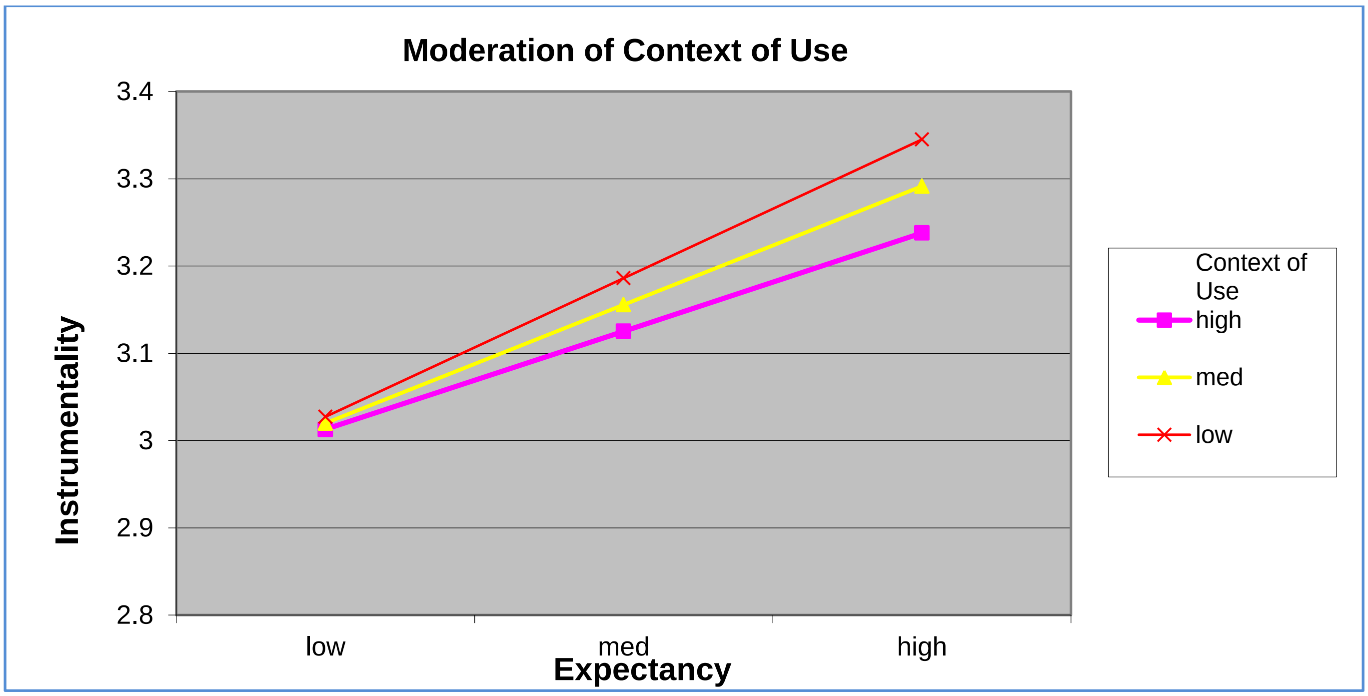

Figure 13: Moderation effect

The lines of the Modgraph for expectancy and instrumentality by context of use are not parallel meaning that there is a moderation effect of context of use on the relationship between expectancy and instrumentality. The modgraph lines show that the slope for the regression lines for instrumentality on expectancy is higher at lower levels of context of use than at higher levels of context of use. In other words, the incremental effect of expectancy on instrumentality is more intense at lower levels of context of use than at higher levels.

The more the farmers expect E-Agriculture to improve their agricultural performance the higher their instrumentality to engage E-Agriculture. However this effect is subject to the context of use of the E-Agriculture in terms of the social, economic and technological environment, as well as the farmer's individual characteristic. Further this relationship is stronger at lower levels than at higher levels of Context of Use.

Table 19: Mediation results for the final model

Independent variable		**Mediating variable**		**Independent variable**	**Direct Effect**		**Indirect Effect**		**Hypothesis**	**Mediation**
					B	**Sig.**	**B**	**Sig.**		
Intrinsic Motivation	<---	Instrumentality	<---	Context of Use	.240	.008	.189	.006	H14	Partial mediation
E-Agriculture Usability	<---	Instrumentality & Intrinsic Motivation	<---	Expectancy	.178	.008	.200	.014	H15	Partial mediation

H_{14}: Instrumentality has a positive mediation effect in the relationship Context of Use and Intrinsic Motivation of farmers in Uganda.

The results in Table 56 above indicate that, the direct effect of the relationship between Context of Use and Intrinsic Motivation is significant (Beta=.240, P=.008). The indirect effect of the relationship between Context of Use and Intrinsic Motivation via Instrumentality is also significant (Beta=.189, P=.006). This means that Instrumentality partially mediates the relationship between Context of Use and Intrinsic Motivation. Hence M_{14} was accepted.

H_{15}: Instrumentality and Intrinsic Motivation have a positive mediation effect in the relationship Expectancy and e-agriculture usability by farmers in Uganda.

The results in Table 56 above also show that the direct effect of the relationship between Expectancy and E-Agriculture Usability is significant (Beta=.178, P=.012). The indirect effect of the relationship between Expectancy and E-Agriculture Usability via Instrumentality & Intrinsic Motivation is also significant (Beta=.203, P=.016). This means that Instrumentality & Intrinsic Motivation partially mediates the relationship between Expectancy and E-Agriculture Usability. Hence M_{15} was accepted.

Table 57: Summary of the hypotheses from the proposed model

Hypothesis	**Confirmed / Not confirmed**
H_1: Expectancy has a positive effect on instrumentality of farmers' usage of e-Agriculture.	Confirmed
H_3: Expectancy positively influences usability of e-Agriculture by farmers in Uganda.	Confirmed
H_4: Instrumentality has a positive effect on the Intrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.	Confirmed
H_6: Intrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.	Confirmed
H_8: Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda	Confirmed
H_9: Usability Measures has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda	Confirmed
H_{10}: Context of use positively moderates the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda;	Confirmed
H_{14}: Instrumentality has a positive mediation effect in the relationship Context of Use and Intrinsic Motivation of farmers in Uganda.	Confirmed
H_{15}: Instrumentality and Intrinsic Motivation have a positive mediation effect in the relationship Expectancy and e-agriculture usability by farmers in Uganda.	Confirmed

CHAPTER FIVE

Discussion of Findings, Conclusion and Recommendations

5.0 Introduction

This chapter presents the results obtained in Chapter Four. The general objective of this study was to develop and test a model for e-Agriculture usability in Uganda. These results are accordingly discussed in relation to the research questions and hypotheses. The discussion further emphasizes the underlying theoretical and empirical explanations and justifications for the findings. The chapter also comes up with some Implications and recommendations to practice, plus the limitations of this study and finally proposes areas of future research. Table 53 presents a summary of findings.

Table 20: Summary of findings

Hypothesis	**Beta**	**P**	**Confirmed / Not confirmed**
H1: Expectancy has a positive effect on instrumentality of farmers' usage of e-Agriculture.	.519	***	Confirmed
H2: Instrumentality has a positive influences usability of e-Agriculture by farmers in Uganda.	.025	.686	Not Confirmed
H3: Expectancy positively influences usability of e-Agriculture by farmers in Uganda.	.196	***	Confirmed
H4: Instrumentality has a positive effect on the Intrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.	304	***	Confirmed
H5: Instrumentality has a positive effect on the Extrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.	.160	.002	Confirmed

H6: Intrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.	.505	***	Confirmed
H7: Extrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.	-.063	.118	Not Confirmed
H8: Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda	.245	***	Confirmed
H9: Efficiency has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda	.396	***	Confirmed
H10: Context of use positively moderates the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda;	.519, -.198, .285	***	Confirmed
H11: Instrumentality and Intrinsic Motivation positively mediate the relationship between Expectancy and e-agriculture usability by farmers in Uganda.	.167, .012	.020, .006	Confirmed
H12: Intrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.	167, .084	.020, .006	Confirmed
H13: Extrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.	167, -.010	.020, .046	Confirmed
H14: Instrumentality has a positive mediation effect in the relationship Context of Use and Intrinsic Motivation of farmers in Uganda.	.240, .189	.008, .006	Confirmed
H15: Instrumentality and Intrinsic Motivation have a positive mediation effect in the relationship Expectancy and e-agriculture usability by farmers in Uganda.	.178, .200	.008, .014	Confirmed

5.1 Discussion of findings

H1: Expectancy has a positive effect on instrumentality of farmers' usage of e-Agriculture.

Results revealed that there is a positive significant relationship between expectancy and instrumentality of farmers using e-agriculture platforms in Uganda. This finding is in agreement with literature that argued that high expectations increased farmers' instrumentality (Robbins, 2008; Porter & Lawler, 1969). The farmers' expectancy is manifested in terms of better farm yields, good prices for their agricultural products, better farm breads, access better pesticides, food security. On the other hand, instrumentality entails the farmers' confidence that using e-agriculture will help satisfy their needs (Vroom, 1964). According to Anderson and Gaile-Sarkane (2010), the underlying motivating factors for individuals to do certain things he needs to satisfy their needs. Once given actions are expected to bring gratification to the individual, then such a person will carry out the actions, otherwise they will be reluctant to execute. In this case, high expectations also increase the confidence of satisfying need through taking actions (Kreitner & Kimicki, 1998).

Therefore, with high expectancy, farmers' confidence in use of e-agriculture will increase with the hope that there will be benefits in yields, quality of breeds, better seeds, good prices, among others. However, where the expectancy is low i.e. the anticipated benefits of using e-agriculture is low; the farmers will lose confidence in satisfying their needs through taking action by way of using e-agriculture. Hence e-agriculture usage will be low where expectancy is low and high where expectancy is high.

H2: Instrumentality has a positive influence on usability of e-Agriculture by farmers in Uganda.

Results revealed that there is no significant relationship between Instrumentality and usability of e-agriculture. This finding is in disagreement with the literature which reasons that, Instrumentality is the confidence that one's good performance will lead to rewards (Porter & Lawler, 1969). Instrumentality shows the probabilistic estimation of the outcome due to good performance, and it ranges from 0 to 1, where an instrumentality leaning towards 0 indicates negative outcome and when it is leaning to 1 it indicates a positive outcome (Chaudhary, 2014). The results show that Ugandan farmers are not inclined to use e-agriculture because they have no confidence that once they use e-agriculture, their outcomes in terms of yields, market prices, knowledge sharing, better farm practices, access to extension workers etc. will be improved.

H3: Expectancy positively influences usability of e-Agriculture by farmers in Uganda.

Results revealed that there is a positive significant relationship between expectancy and usability of e-agriculture by farmers in Uganda. This finding is in line with literature that argued that Expectancy is the degree of certainty that one's effort will lead to excellent performance (Robbins, 2008). It refers to an individual's probabilistic estimation of a performance outcome due to their efforts. This outcome ranges from 0 to 1 - where 0 means there is no performance outcome while 1 indicates 100% outcome (Chaudhary, 2014). Where the expected performance outcome is high (leaning towards 1) individuals are motivated to put in efforts. However, if individuals perceive the expected outcome to be low i.e. leaning towards 0, they will not put in effort (Simone, 2015; Vroom, 1964).

The Ugandan farmers' are certain that with the use of e-agriculture, it will result in better farm yields, good prices for their agricultural products, better farm breads, access better pesticides, food security etc. On the other hand, if they perceive that the outcomes will be low, they will not embrace e-agriculture.

Therefore, with high expectancy, farmers' usage of e-agriculture will increase with the hope that there will be accrued benefits. Similarly, where the expectancy is low i.e. the anticipated benefits of using e-agriculture is low; the farmers will lose confidence in using e-agricultures. Consequently e-agriculture utilization will be low where expectancy is low and high, where expectancy is high.

H4: Instrumentality has a positive effect on the Intrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.

Results revealed that there is a positive significant relationship between Instrumentality and Intrinsic motivation for the usability of e-agriculture by farmers in Uganda. These results were in conformity with Porter & Lawer (1969) argument that Instrumentality shows the probabilistic estimation of the outcome due to good performance, on the other hand Munk ,2011 argued that Intrinsic motivation is where individuals do certain activities "for which there are no obvious or appreciable external rewards" but rather "the rewards are inherent in the activity". Further Deci and Ryan (1985), argued that intrinsic motivation is "the innate, natural propensity to engage one's interests and exercise one's capacities, and in so doing, to seek and conquer optimal challenges". It is a form of self-motivation of a farmer towards his work, peers, family members and the community at large (Brooks 2009). Munk (2011) argues that it is almost impossible to motivate individuals to perform where there is no intrinsic motivation.

Consequently it can be argued that majority of Ugandan farmers who are engaged in e-agriculture do it, not only because it will lead to external rewards, but that the rewards are inherent in the activity itself , like acquiring new knowledge, recognition from peers that they are using e-agriculture, knowledge that they are in control when using e-agriculture etc. These results may point to another fact that Ugandan farmers engaged in e-agriculture are the more affluent ones, who happen to have other sources of income apart from relying on agriculture activity itself.

H5: Instrumentality has a positive effect on the Extrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.

Results revealed that there is a positive significant relationship between Instrumentality and Extrinsic motivation for the usability of e-agriculture by farmers in Uganda. These results were in conformity with Porter & Lawer (1969) argument that, while Instrumentality is the confidence that one's good performance will lead to rewards, Osterloh and Frey (2007) observed that it is the things that monetary rewards can do for a farmer that will influence their behaviour towards work and not the nominal value of the financial rewards. Hence, if an individuals' monetary reward is not sufficient to purchase his needs, he may not be motivated.

Therefore, while Instrumentality is demonstrated in terms of attraction of good prices for agricultural products, leading to better yields, access to better farming breeds, improvement of the quality of farm produce etc., Extrinsic Motivation is exhibited in relation to incentives obtained for using e-agriculture, financial rewards etc. Hence, a high level of farmers' instrumentality translates to high extrinsic motivation in terms of using e-agriculture platforms in Uganda.

H6: Intrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.

Findings indicated that intrinsic motivation had a positive significant relationship with e-agriculture usability. This finding is in agreement with arguments posited in Vockell (2011) that intrinsic motivation improves performance. Where intrinsic motivation is high, farmers will be encouraged to use e-agriculture platforms (Ryan & Deci, 2000; Deci & Ryan, 1985).

Therefore, where farmers get manageable challenges when using e-agricultural platforms to achieve their goals, acquire some new knowledge by using e-agriculture platforms, and are in in control when using e-agriculture platforms, there will improved usability of e-agriculture platforms. However, where farmers do not get manageable challenges when using e-agricultural platforms to achieve their goals, do not acquire new knowledge by using e-agriculture platforms, and are not in in control when using e-agriculture platforms, there will be less usability of e-agriculture platforms.

H7: Extrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.

Results showed that extrinsic motivation had no significant relationship with e-agriculture usability in Uganda. This finding disagrees with Porter and Lawler (1969) who argue that extrinsic motivation improves performance. Hence, where the perceived rewards from using e-agriculture platforms are satisfactory to the farmers, there will be improved usability.

Inversely, where the perceived rewards from using e-agriculture platforms are low, farmers will use e-agriculture less.

Therefore, giving farmers financial rewards gifts, other incentives and better market prices for agricultural produce, does not necessarily motivate farmers to use e-agriculture platforms.

H8: Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda

Findings showed that there was a positive significant relationship between context of use and intrinsic motivation of farmers. This finding agrees with ISO 9241-11 (1998) that user characteristics, technological attributes, organizational environment, social environment, economic environment greatly influences system usability. Where context of use is high, farmers are intrinsically motivated to use e-agriculture platforms. On the other hand, where user characteristics, technological attributes, organizational environment, social environment, economic environment of the farmers' intrinsic motivation to use e-agriculture platforms will be low.

H9: Efficiency has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda

Results revealed a positive and significant relationship between efficiency and intrinsic motivation of farmers using e-agricultural platforms in Uganda. This finding agrees with ISO 9241-11 (1998) that efficiency, being one of the dimensions under usability measures influenced usability. Although two dimensions were hypothesized to measure usability measure i.e. efficiency and usefulness, only efficiency was confirmed by the confirmatory factors analysis. Therefore where the e-agriculture platforms allows farmers to accomplish tasks in the shortest time possible, helps them save costs, and also enables them to achieve tasks well, farmers will be intrinsically motivated to use e-agriculture platforms.

On the other hand, where the e-agriculture platforms do not allow farmers to accomplish tasks in the shortest time possible, do not save costs, and also do not enable them to achieve tasks well, farmers will not be intrinsically motivated to use such e-agriculture platforms.

H10: Context of use positively moderates the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda

Findings revealed that the relationship between Expectancy and Instrumentality was positive and significant. Findings also revealed that the relationship between context of use and instrumentality was positive and significant. Further, the relationship between interaction term expectancy * context of use was negative and significant. Whereas an increase in the interaction term expectancy * context of use reduced instrumentality, the relationship between expectancy and instrumentality as well as that between context of use and instrumentality increased.

Further, the results in the modgraph revealed that when context of use was high, the moderation effect reduced. And at low context of use, moderation effect was high.

Therefore context of use moderated the relationship between expectancy and instrumentality. This result was in agreement with ISO usability standards model that posts that context of use was a key consideration for usability of technology (ISO 9241-11, 1998). Further, the findings agree with the propositions by Vroom (1964) and Lunenburg (2011) that expectancy improved instrumentality.

Therefore anticipation of better yields, good prices, better farm breads, better pesticides, food security among others improved the farmers' confidence in using e-agriculture platforms in Uganda.

H11: Instrumentality and Intrinsic Motivation positively mediate the relationship between Expectancy and e-agriculture usability by farmers in Uganda.

Results revealed that the both the direct and indirect mediation effects of the relationship between expectancy and e-agriculture usability and the relationship between expectancy and e-agriculture usability via instrumentality and intrinsic motivation were significant. This meant that Instrumentality and Intrinsic Motivation partially mediated the relationship between Expectancy and e-agriculture usability by farmers in Uganda. The finding agreed with literature that argued that instrumentality and intrinsic motivation enhanced performance (Vroom, 1964; Lunenburg, 2011).

H12: Intrinsic Motivation has a positive mediation effect in the relationship between Instrumentality and e-agriculture usability by farmers in Uganda.

Findings revealed that the direct effect for relationship between instrumentality and e-agriculture usability was significant. Further, the indirect effect of the relationship between instrumentality and e-agriculture usability through intrinsic motivation was significant. These findings showed that intrinsic motivation partially mediated the relationship between instrumentality and e-agriculture usability in Uganda. The findings are in agreement with Vroom (1964) theory of expectancy that argues that instrumentality improved performance. The findings also agree with Vockell (2011) and Porter and Lawler (1969) who argue that intrinsic motivation influences performance.

Therefore, where farmers get manageable challenges when using e-agricultural platforms, acquire new knowledge by using e-agriculture platforms, and are recognized by their peers for using e-agriculture, their instrumentality will improve e-agriculture usability.

H13: Extrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.

Both direct and indirect effects were significant, implying that extrinsic motivation partially mediated the relationship between instrumentality and e-agriculture usability. A further examination reveals that whereas the direct mediation effect of the relationship between instrumentality and e-agriculture was positive and significant. However, the relationship between instrumentality and e-agriculture usability mediated by extrinsic motivation was negative and significant. This finding suggests that whereas the relationship between instrumentality and e-agriculture usability was positive, the introduction of extrinsic motivation makes it negative.

The above finding contravenes the earlier hypothesis that extrinsic motivation positively mediated instrumentality and e-agriculture usability as had been suggested by Porter and Lawler model (1969). Therefore it was in disagreement with literature.

H14: Instrumentality has a positive mediation effect in the relationship between Context of Use and Intrinsic Motivation of farmers in Uganda.

Findings indicated that the direct effect for the relationship between context of use and intrinsic motivation was positive and significant. Further, the indirect effect of the relationship between context of use and intrinsic motivation through instrumentality was significant. This implied that instrumentality partially mediated the relationship between context of use and intrinsic motivation.

The above finding is in line with literature that instrumentality facilitates performance (Vroom, 1964), and also that context of use enhances the relationship between instrumentality and system usability (ISO, 1998)

H15: Instrumentality and Intrinsic Motivation have a positive mediation effect in the relationship Expectancy and e-agriculture usability by farmers in Uganda.

Findings showed that both direct and indirect effects for the relationship between expectancy and e-agriculture usability and the relationship between expectancy and e-agriculture usability through instrumentality respectively were significant. This means that instrumentality partially mediates the relationship between expectancy and e-agriculture usability.

The above findings are supported by literature of Vroom (1964) and Lunenburg (2011) who argue the case for expectancy as an important influencing factor for greater performance and

Vockell (2011) about the role of intrinsic motivation in influencing performance. Hence, with increased instrumentality and expectancy, e-agriculture usability is bound to increase.

5.3 Conclusions

This study commenced with the aim of investing five objectives. The first objective was to examine the relationship between Expectancy, Instrumentality, Intrinsic Motivation, Extrinsic Motivation and e-Agriculture usability of farmers in using e-Agriculture in Uganda. In order to exhaustively investigate this objective, seven hypotheses were formulated. These were H_1 to H_7 listed below:

H_1: *Expectancy has a positive effect on instrumentality of farmers' usage of e-Agriculture;*

H_2: *Instrumentality has a positive influence on usability of e-Agriculture by farmers in Uganda.*

H_3: *Expectancy positively influences usability of e-Agriculture by farmers in Uganda.*

H_4: *Instrumentality has a positive effect on the Intrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.*

H_5: *Instrumentality has a positive effect on the Extrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda.*

H_6: *Intrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.*

H_7: *Extrinsic Motivation has a positive effect on the usability of e-Agriculture platforms in Uganda.*

Although many of the above hypotheses were significant, except for H_2 and H_7, only H_1, H_3, H_4 and H_6, were retained in the final structural equation model.

For H_2, the findings revealed that the relationship between Instrumentality and usability of e-Agriculture was insignificant. This meant that the causal effect of instrumentality on e-agriculture usability had no role in the model explaining usability of e-agriculture platforms in Uganda. Therefore this hypothesis was dropped from the model. Hence, we can conclude that instrumentality had no causal effect on the usability of e-agriculture by Ugandan farmers.

The results also revealed that the relationship between Extrinsic Motivation and e-Agriculture usability was not significant. This implied that a change in Extrinsic Motivation caused no changes whatsoever in the usability of e-agriculture. Therefore, we conclude that Extrinsic Motivation had no causal effect in the model explaining usability of e-agriculture platforms by farmers in Uganda.

Further, for H_5, although it was established that Instrumentality had a positive significant relationship with Extrinsic Motivation, this hypothesis did not fit in the model due to its low path coefficients compared to others in the final model. Therefore it was dropped. Hence, whereas instrumentality significantly explained the extrinsic motivation, it is not useful to say that it supported usability of e-agriculture platforms by farmers in Uganda.

Hypotheses H_1, H_3, H_4 and H_6 were all found to be positive and significant and were confirmed by both the hypothetical and the final structural equation models.

For H_1, it was confirmed that Expectancy had a positive effect on instrumentality of farmers' usage of e-Agriculture. Therefore, with a path coefficient of .519, we can conclude that H_1 plays a significant role in enhancing usability of e-agricultural platforms in Uganda.

Similarly, H_3 stating that Expectancy positively influences usability of e-Agriculture by farmers in Uganda was found to be significant and confirmed both in the hypothesized model as well as the final structural equation model explain usability of e-agricultural platforms by Ugandan farmers. With a path coefficient of .196, we conclude that H_3 helps to explain e-agriculture usability in Uganda.

Further, H_4 stating that Instrumentality has a positive effect on the Intrinsic Motivation of farmers' usage of e-Agriculture platforms in Uganda was found to be significant. It was retained and confirmed by both in the hypothesized model as well as the final structural equation model explaining usability of e-agricultural platforms by Ugandan farmers. With a path coefficient of .304, we conclude that H_4 helps to explain e-agriculture usability in Uganda

The findings also indicated that H_6 was confirmed by both the hypothesized model and the final e-agriculture usability model. This implies that Intrinsic Motivation significantly explains the usability of e-Agriculture platforms in Uganda, thereby providing empirical support for the research hypothesis.

The second objective of the study was to analyze the relationship between Context of Use, Efficiency and Intrinsic Motivation of farmers using e-agriculture platforms in Uganda. Two hypotheses listed below were used to investigate this objective:

***H_8*:** *Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda*

***H_9*:** *Efficiency has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda*

Context of Use was found to have a positive significant relationship with Intrinsic Motivation. This therefore meant that H_8 stating that Context of Use has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda was accepted. Further, H_9 which postulated that Efficiency has a positive effect on the Intrinsic Motivation of farmers using e-agriculture platforms in Uganda was accepted since the relationship was positive and significant. We can therefore conclude that context of use and Efficiency played a significant role in the model explaining usability of e-agriculture platforms in Uganda.

The third objective of this study was to analyze the moderation effect of Context of Use in the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda. This was investigated through H_{10} that postulated that Context of use positively moderates the relationship between Expectancy and Instrumentality of farmers' usage of e-Agriculture in Uganda. The findings revealed that indeed Context of Use moderated the relationship between Expectancy and Instrumentality – thereby leading us to a conclusion that farmers' Expectancy and Instrumentality towards using e-Agriculture platforms in Uganda is moderated by Context of Use.

Objective number four was to examine the mediation effect of Instrumentality in the relationship between Expectancy and e-agriculture usability by farmers in Uganda. This was completed through H_{11} that Instrumentality positively mediates the relationship between Expectancy and e-agriculture usability by farmers in Uganda. The findings revealed that Instrumentality and Intrinsic Motivation partially mediated the relationship between Expectancy and e-agriculture usability. Therefore we conclude that instrumentality played an important mediation role in causing the two relationships explaining e-agriculture usability by farmers in Uganda.

The last objective was to examine the mediation effect of Intrinsic Motivation and Extrinsic motivation in the relationship between Instrumentality and e-agriculture usability by farmers in Uganda. To investigate this objective, the following four hypotheses were used:

***H_{12}*:** *Intrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.*

***H_{13}*:** *Extrinsic Motivation has a positive mediation effect in the relationship Instrumentality and e-agriculture usability by farmers in Uganda.*

***H_{14}*:** *Instrumentality has a positive mediation effect in the relationship Context of Use and Intrinsic Motivation of farmers in Uganda.*

***H_{15}*:** *Instrumentality and Intrinsic Motivation have a positive mediation effect in the relationship between Expectancy and e-agriculture usability by farmers in Uganda.*

Results revealed a full mediation effect of Intrinsic Motivation in the relationship between Instrumentality and e-agriculture usability. Results also revealed a partial mediation effect of Extrinsic Motivation in the relationship Instrumentality and e-agriculture usability. Further, the results indicated that Instrumentality had a full mediation effect in the relationship Context of Use and Intrinsic Motivation. Finally, the findings indicated that Instrumentality and Intrinsic Motivation fully mediated the relationship between Expectancy and e-agriculture usability by farmers in Uganda.

Therefore, given the above findings, we conclude that Intrinsic Motivation, Extrinsic Motivation, Instrumentality and Intrinsic Motivation played significant mediation roles in the relationships leading to usability of e-agriculture platforms by farmers in Uganda.
Notwithstanding the above findings, H_2, H_5, H_7, H_{11}, H_{12} and H_{13} were all dropped by the final structural equation model. Therefore, only the H_1, H_3, H_4, H_6, H_8, H_9, H_{10}, H_{14} and H_{15} explained e-agriculture usability by farmers in Uganda. Therefore, for increased usability of e-agriculture platforms there is need to increase Expectancy, Instrumentality, Intrinsic Motivation, Context of Use, Efficiency, and Expectancy since all these variables were found to have a positive effect on their dependent variables in the final model explaining usability of e-agriculture by Ugandan farmers.

Further, there is need to increase Instrumentality and Intrinsic Motivation since both of them positively and significantly mediated two relationship in the final structural equation model.

5.4 Implications to theory

The study adopted a triangulation of three theories of motivation including the Expectancy theory by Vroom (1964) and Porter and Lawler model of motivation (Porter & Lawler, 1969) together with ISO usability model (ISO 9241-11, 1998). This was necessary because none of these theories independently explained usability of e-agriculture platforms by farmers in Uganda. Whereas the Vroom (1964) adequately handled the expectancy aspect which helped to show why farmers would use e-agriculture in anticipation of some desired expectations, this theory did not address issues concerning technological issues such as efficiency, Context of use. It did not also address Intrinsic and Extrinsic motivation factors that explained why individuals acted the way they did. Similarly, whereas the ISO usability model addressed technological issues, it did not cover motivational factors (ISO 9241-11, 1998). Therefore triangulating these three theories went a long way in checking and eliminating the weaknesses presented by either one of the theories.

The final model presented in this study retained at least one construct out of the three. Context of Use and efficiency address technological issues for usability (ISO 9241-11, 1998), while expectancy, instrumentality and intrinsic motivation address motivational factors influencing e-agriculture usability. Therefore, from this perspective, we argue that this model makes a significant contribution both to the theories of motivation and that of usability for improved usability of technologies.

5.4.1 Implications and recommendations to practice

E-agriculture developers have mainly relied upon technology factors with minimum consideration of the soft needs such as motivation. This study established that intrinsic motivation factors played a role in enhancing usability of e-agriculture. It was also observed that context, efficiency were the most important considerations for improved usability of e-agriculture platforms.

Therefore, it is recommended that stakeholders implementing e-agriculture try to enhance the expectancy of farmers as well as intrinsic motivation. This will encourage farmers use the technology in anticipation of better returns. Farmers need to know that using e-agriculture can help them increase their productivity in terms farm yields, get access to better markets for their produce, better prices, share agricultural knowledge among others so that they are motivated to use e-agriculture.

In addition, there is a need to address user characteristics, technology, organizational environment, social environment and economic environment pertinent for the technology to be accepted. Other, usability attributes important for farmers to understand and use e-agriculture.

Finally, there is need for system developers to address issues of efficiency since it was found to tremendously influence usability of e-agriculture. They need to ensure that e-agriculture platforms accomplish tasks in the shortest time possible, while at the same time helping farmers to save costs.

5.4.2 Implications and recommendations to Government

It has been a practice for government ministries and agencies to provide support to farmers in terms cash whenever they wanted to implement a given technology. Whereas this move appears to be attractive, the variable that explained such extrinsic motivational benefits was found to have no significant influence on e-agriculture platforms usability. Therefore monetary rewards per se do not promote usability of e-agriculture platforms. Instead, intrinsic motivational factors such as recognition, acquiring knowledge through training were found to significantly influence e-agriculture usability.

Therefore, given the above observations, government policy geared towards promoting usability of e-agriculture platforms should take into consideration intrinsic motivational factors that were found to enhance usability.

5.5 Limitations of the study

This study adopted a quantitative research approach which is faulted for handling subjective matters. Although it was necessary to use quantitative research given that the study sample was big, this method assumes that numerically quantifiable observations and assumptions can be tested in the study (Griffin, 2017). Moreover, certain important observations that cannot be quantified numerically may have a bearing on study findings.

Although Context of Use, Expectancy, Efficiency, Instrumentality and Intrinsic Motivation were predictors of e-Agriculture usability, they explained only 39% of total variance in e-Agriculture as per the R^2 of the final model. This finding reveals that over 60% of variance in e-Agriculture is explained by other factors which were not investigated in this study. Therefore, further research should be conducted to investigate the factors influencing e-Agriculture usability by farmers in Uganda other than Context of Use, Expectancy, Efficiency, Instrumentality and Intrinsic Motivation.

5.6 Areas for future research

Given the above limitation, future research can focus on studying e-agriculture usability using a qualitative approach. For example a case study can be conducted with a group of farmers using e-agriculture and those not using e-agriculture.

Further, since the variables in retained in final model explained only 39% of variance in e-Agriculture usability, there is need for future research to identify and examine the other unknown factors that could explain 60% of farmers' usability of e-Agriculture in Uganda.

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Appendix I- Research questionnaire

THE ICT UNIVERSITY

DATA COLLECTION QUESTIONNAIRE FOR E-AGRICULTURE USERS

Dear Respondent,

I am a doctoral student at The ICT University, Yaoundé, Cameroon. I am conducting a study on the "usability of e-agriculture services in Uganda". E-agriculture is a wide range of internet-based applications and mobile platforms that allow farmers to access, process, store and share information on agricultural services and products. The study aims to develop a model that will guide smooth usability of e-agriculture platforms by farmers in the Uganda.

You have been carefully selected to participate in this survey by filling in the survey form. Your responses will be treated with utmost confidentiality and shall be used for academic purposes only.We will be glad to share with our findings with interested participants. Please let us know by sending an e-mail to rkyeyune@mubs.ac.ug.

In case you have any questions, please contact the researcher on rkyeyune@mubs.ac.ug or Thesis Chair, Prof. Victor Mbarika on victor@mbarika.com or the PhD Program Coordinator, Dr. Clive Tsuma on ctsuma@ictuniversity.org. or the main supervisor of my work michael.kyobe@uct.ac.za

Kindly complete and submit the survey to the researcher as soon as possible. Thank you for accepting to participate in this survey.

SECTION A: BACKGROUND INFORMATION

Part I: Demographics

For questions under this section, please tick the choice(s) that apply to you.

1. What is y1our gender?

Female		Male	

2. What is your age group?

Below 20 years		20-29 years		30-39 years		40 and above	

3. What region of Uganda do you practice agriculture from?

Eastern Region	
Western Region	
Northern Region	
Central Region	

4. How big is your farm land in acres?

Less than 1 acre	
1-2 acres	
2-5 acres	
More than 5 acres	

5. What is your highest level of education?

Primary	
Secondary	
Certificate	
Diploma	

Bachelor	
Masters	
PhD	
Others (please specify)	

Part II: Information on e-agriculture

6. The following statements relate to the devices used to access e-agriculture. Please tick one option on each item to show your agreement or disagreement.

Strongly Disagree (1); Disagree (2), Not Sure (3); Agree (4); Strongly Agree (5)	**1**	**2**	**3**	**4**	**5**
I use a Smartphone to access e-agriculture					
I use a Laptop computer to access e-agriculture					
I use a Desktop computer to access e-agriculture					
I use an Ipad to access e-agriculture					
I use a Note pad to access e-agriculture					
I use a Tablet to access e-agriculture					

7. How would you rate your knowledge of the following e-agriculture platforms? Please tick one option on each platform.

E-agriculture platforms	**Not knowledgeable**	**Quite knowledgeable**	**Knowledge able**	**Very knowledgeable**
E-agriculture databases				
E-agriculture data warehouses				
E-agriculture via YouTube				
E-agriculture via Skype				
E-agriculture via Facebook				

E-agriculture via Wikipedia				
E-agriculture websites				
E-agriculture blogs				
Agricultural knowledge management systems				
Mobile agriculture applications				

8. For how long have you used the above e-agriculture platforms?

Less than 2 years	
2 to 4 years	
5 years and above	

9. How often do you use the following e-agriculture platforms? Please tick one option on each platform.

E-agriculture platforms	**Never used**	**Very Rarely**	**Rarely**	**Frequently**	**Very frequently**
E-agriculture databases					
E-agriculture data warehouses					
E-agriculture via YouTube					
E-agriculture via Skype					
E-agriculture via Facebook					
E-agriculture via Wikipedia					
E-agriculture websites					
E-agriculture blogs					
Agricultural knowledge management systems					
Mobile agriculture applications					

10. For what purpose do you use the above e-agriculture platforms? Please tick one option on each item.

Strongly Disagree (1); Disagree (2); Agree (3); Strongly Agree (4)	1	2	3	4
I use e-agriculture to access market information				
I use e-agriculture to connect with other farmers				
I use e-agriculture to access information on farm practices				
I use e-agriculture to access information on pesticides				
I use e-agriculture to access information on crop and animal breads				
I use e-agriculture to access expert information on farming				

SECTION B: E-AGRICULTURE USABILITY

11. Please indicate how much you agree or disagree with the following responses about **e-agriculture usability.** Tick an appropriate box against each item. The responses are arranged as follows; Strongly Disagree (1); Disagree (2), Not Sure (3); Agree (4); Strongly Agree (5).

Strongly Disagree (1); Disagree (2), Not Sure (3); Agree (4); Strongly Agree (5)						
NO	**EXPECTANCY**	**1**	**2**	**3**	**4**	**5**
E1	I am certain that my effort to use e-agriculture will lead to better yields					
E2	I am certain that my effort to use e-agriculture will attract good prices for my agricultural products					
E3	I am certain that my effort to use e-agriculture will provide access to expert agricultural information					

E4	I am certain that my effort to use e-agriculture will provide access to better farm breads					
E5	I am certain that my effort to use e-agriculture will provide access to access better pesticides					
E6	I am certain that my effort to use e-agriculture will enable me have enough food for my family					
E7	I am certain that my effort to use e-agriculture will make me more knowledgeable about good farming practices					
E8	I am certain that my effort to use e-agriculture will enable me have access to extension workers					
E9	I am certain that my effort to use e-agriculture will enable me improve the quality of my far produce					
E10	I am certain that my effort to use e-agriculture will enable me access to latest weather updates for planning purposes					
NO	**INSTRUMENTALITY**	**1**	**2**	**3**	**4**	**5**
I-1	I am confident that my effort to use e-agriculture will lead to better yields					
I-2	I am confident that my effort to use e-agriculture will attract good prices for my agricultural products					
I-3	I am confident that my effort to use e-agriculture will provide access to expert agricultural information					
I-4	I am confident that my effort to use e-agriculture will provide access to better farm breads					
I-5	I am confident that my effort to use e-agriculture will provide access to better pesticides					
I-6	I am confident that my effort to use e-agriculture will enable me have enough food for my family					
I-7	I am confident that my effort to use e-agriculture will make me more knowledgeable about good farming practices					

I-8	I am confident that my effort to use e-agriculture will enable me have access to extension workers					
I-9	I am confident that my effort to use e-agriculture will enable me improve the quality of my far produce					
I-10	I am confident that my effort to use e-agriculture will enable me access to latest weather updates for planning purposes					
NO	**CONTEXT OF USE**	**1**	**2**	**3**	**4**	**5**
	USER CHARACTERISTICS					
CUC-1	I possess the necessary skills for using the available e-agriculture platforms					
CUC-2	I possess the necessary experience in using the available e-agriculture platforms					
CUC-3	I possess the necessary knowledge for using the available e-agriculture platforms					
	TECHNOLOGY					
CT-1	I have access to the internet for using e-agriculture platforms					
CT-2	I have the required hardware for using e-agriculture platforms					
CT-3	I have the required software for using e-agriculture platforms					
CT-4	The hardware I that I have is compatible with the available e-agriculture platforms					
CT-5	The software I have is compatible with the available e-agriculture platforms					
CT-6	The available e-agriculture hardware facilities are easy to use					
CT-7	The available e-agriculture technology is user friendly					
CT-8	The available e-agriculture platforms have user manuals					
	ORGANIZATIONAL ENVIRONMENT					
COE-1	I receive e-agriculture trainings on how to use e-agriculture platforms from the service providers					
COE-2	I receive training on how to use e-agriculture platforms from agricultural extension workers					

COE-3	I receive e-agriculture user support from the service providers					
COE-4	I receive e-agriculture user support from agricultural extension workers					
COE-5	There is a national policy for using e-agriculture platforms					
COE-6	E-agriculture service providers provide user feedback to farmers concerning the available e-agriculture platform					
	SOCIAL ENVIRONMENT					
CSE-1	My peers encourage me to use e-agriculture platforms in accessing agricultural information					
CSE-2	My family members encourage me to use e-agriculture platforms to access agricultural information					
CSE-3	Members of the community encourage me to use e-agriculture platforms to access agricultural information					
CSE-4	My superiors encourage me to use e-agriculture platforms to access agricultural information					
CSE-5	My community's social norms allow me to use e-agriculture platforms to access agricultural information					
	ECONOMIC ENVIRONMENT					
CEE-1	I receive financial support from service providers to enable me use e-agriculture platforms					
CEE-2	I receive financial support from the government to enable me use e-agriculture platforms					
CEE-3	I receive financial support to enable me access the services of e-agriculture experts					
CEE-4	I receive financial support to enable me repair and maintain and use e-agriculture platforms					
CEE-5	I receive financial support to enable me procure the hardware for using e-agriculture platforms					
CEE-6	I receive financial support to enable me procure the software for using e-agriculture platforms					

NO	USABILITY MEASURES	1	2	3	4	5
	EFFICIENCY					
UME-1	The available e-agriculture platforms allow me to accomplish tasks in the shortest time possible					
UME-2	I save costs when I use e-agriculture platform					
UME-3	I achieve my tasks well when using the available e-agriculture platforms					
UME-4	I enjoy using e-agriculture platform to accomplish my tasks					
	USEFULNESS					
UMU-1	Using e-agriculture platforms helps me save time					
UMU-2	It is convenient for me to use e-agriculture platforms					
UMU-3	Using e-agriculture platforms provides me access to unlimited expert agricultural information					
UMU-4	Using e-agriculture platforms enables me to access better markets for my produce					
NO	**INTRINSIC MOTIVATION**	**1**	**2**	**3**	**4**	**5**
IM-1	I get manageable challenges when using e-agricultural platforms to achieve my goals					
IM-2	I am able to acquire some new knowledge by using e-agriculture platforms					
IM-3	I am always in control when using e-agriculture platforms					
IM-4	I intend to use my newly acquired knowledge from e-agriculture platforms for better future yields					
IM-5	I compare my performance in terms of using e-agriculture platforms to the performance of my peers					
IM-6	I get satisfied when I help my peers to use e-agriculture platforms					
IM-7	I get satisfied when people in my society recognize me for using e-agriculture					

	platforms					
NO	**EXTRINSIC MOTIVATION**	**1**	**2**	**3**	**4**	**5**
EM-1	I get financial rewards from government for using e-agriculture platforms					
EM-2	I get financial rewards from service providers for using e-agriculture platforms					
EM-3	I get gifts from government for using e-agriculture platforms					
EM-4	I get gifts from service providers for using e-agriculture platforms					
EM-5	I get other incentives from service providers for using e-agriculture platforms					
EM-6	I get incentives from government for using e-agriculture platforms					
EM-7	I get better market prices for my products when I use e-agriculture platforms					
NO	**E-AGRICULTURE USABILITY**	**1**	**2**	**3**	**4**	**5**
	PLATFORM USABILITY					
EUPU-1	The information provided by available e-agriculture platforms is clear					
EUPU-2	The information provided by available e-agriculture platforms is easy to read					
EUPU-3	The information I get from available e-agriculture platforms is easy to understand					
EUPU-4	The information provided by the e-agriculture platform is logically organized					
	CONTROL AND FLEXIBILITY					
EUCF-1	The available e-agriculture platforms allow me to exit when there is an error					
EUCF-2	The available e-agriculture platforms allow me to undo previous actions I do not want to save					
EUCF-3	The available e-agriculture platforms allow me to redo previous actions that I want to save					
EUCF-	The available e-agriculture platforms allow me to change my login details					

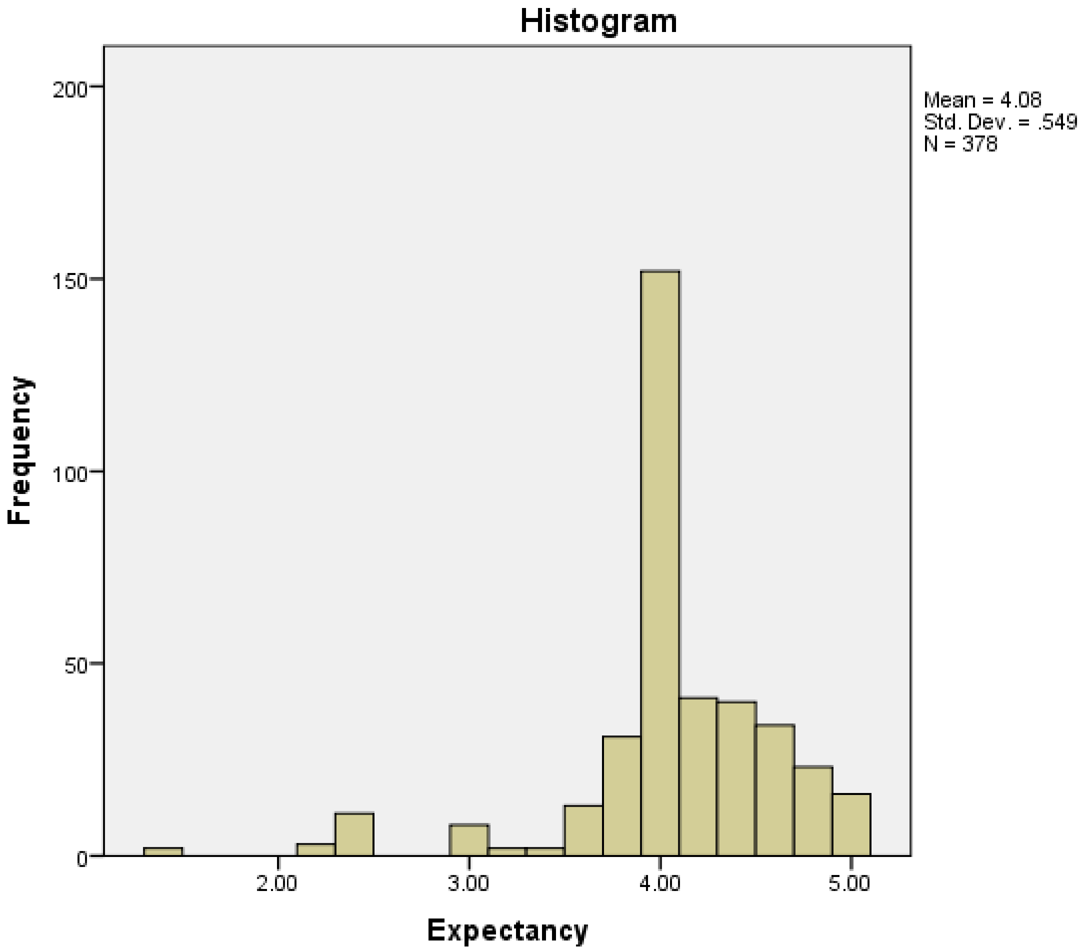
4						
EUCF-5	The available e-agriculture platforms allow me to update my user profile					
EUCF-6	The available e-agriculture platforms ask me to confirm my actions before saving them					
EUCF-7	The available e-agriculture platforms provide me with shortcuts tools for accomplishing tasks					
EUCF-8	The available e-agriculture platforms allow me to customize information held on them					
EUCF-9	The available e-agriculture platforms allow me to access information in different formats					
EUCF-10	The available e-agriculture platforms allow me to save information in different formats					
EUCF-11	The available e-agriculture platforms allow me to print information held on them					
	CONSISTENCY AND STANDARDIZATION					
EUCS-1	The available e-agriculture platforms have a consistent interface					
EUCS-2	The available e-agriculture platforms have uniform user menus					
EUCS-3	The available e-agriculture platforms have consistent colors					
EUCS-4	The available e-agriculture platforms have consistent text fonts and types					
	DOCUMENTATION AND USER SUPPORT					
EUDS-1	The available e-agriculture platforms have online help tools					
EUDS-2	The available e-agriculture platforms have offline user manuals					

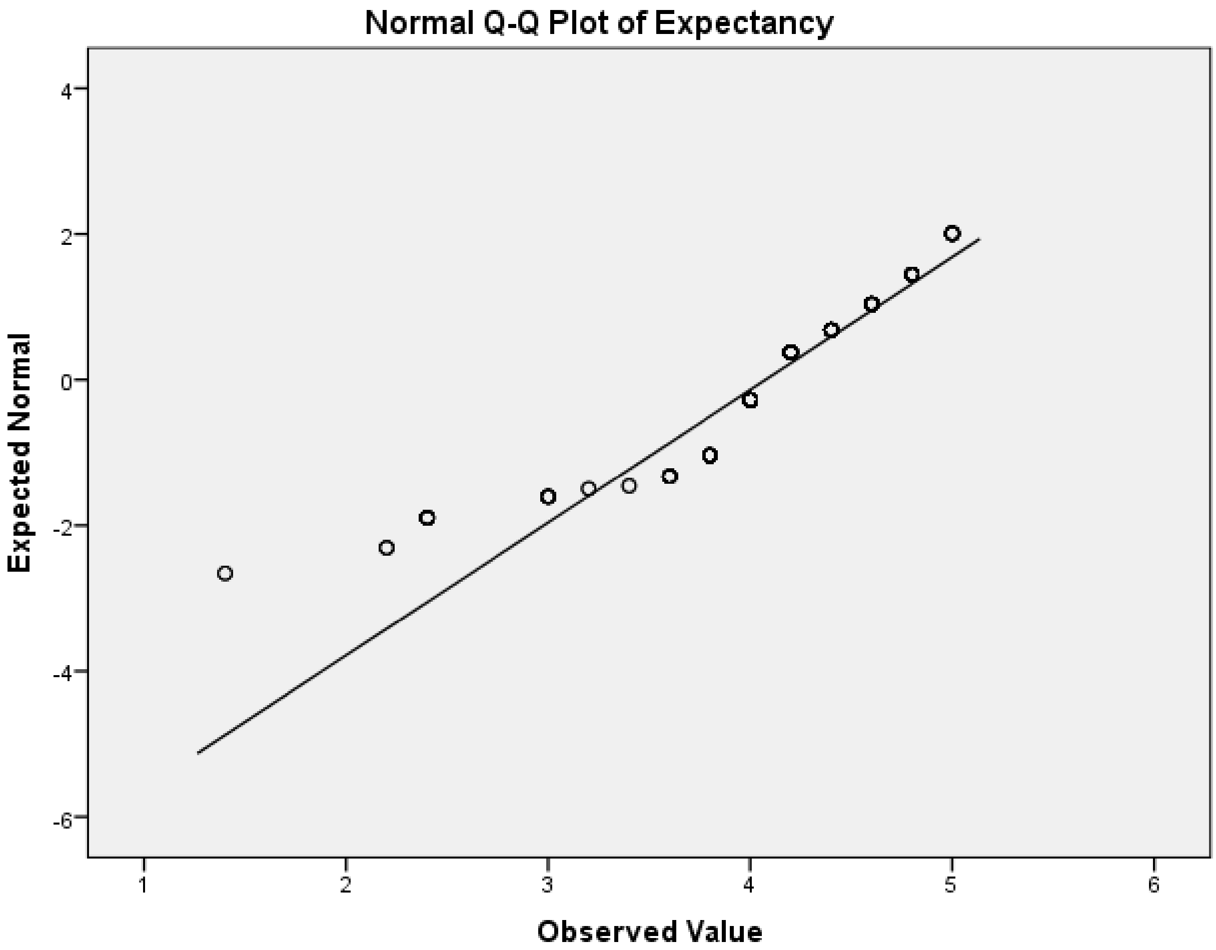
EUDS-3	The available e-agriculture platforms have training materials					
EUDS-4	The user manuals for e-agriculture platforms are easy to understand					
EUDS-5	The user manuals for e-agriculture platforms are written in my local language					
EUDS-6	The user manuals for e-agriculture platforms are written in a language that I understand					

Thank you.

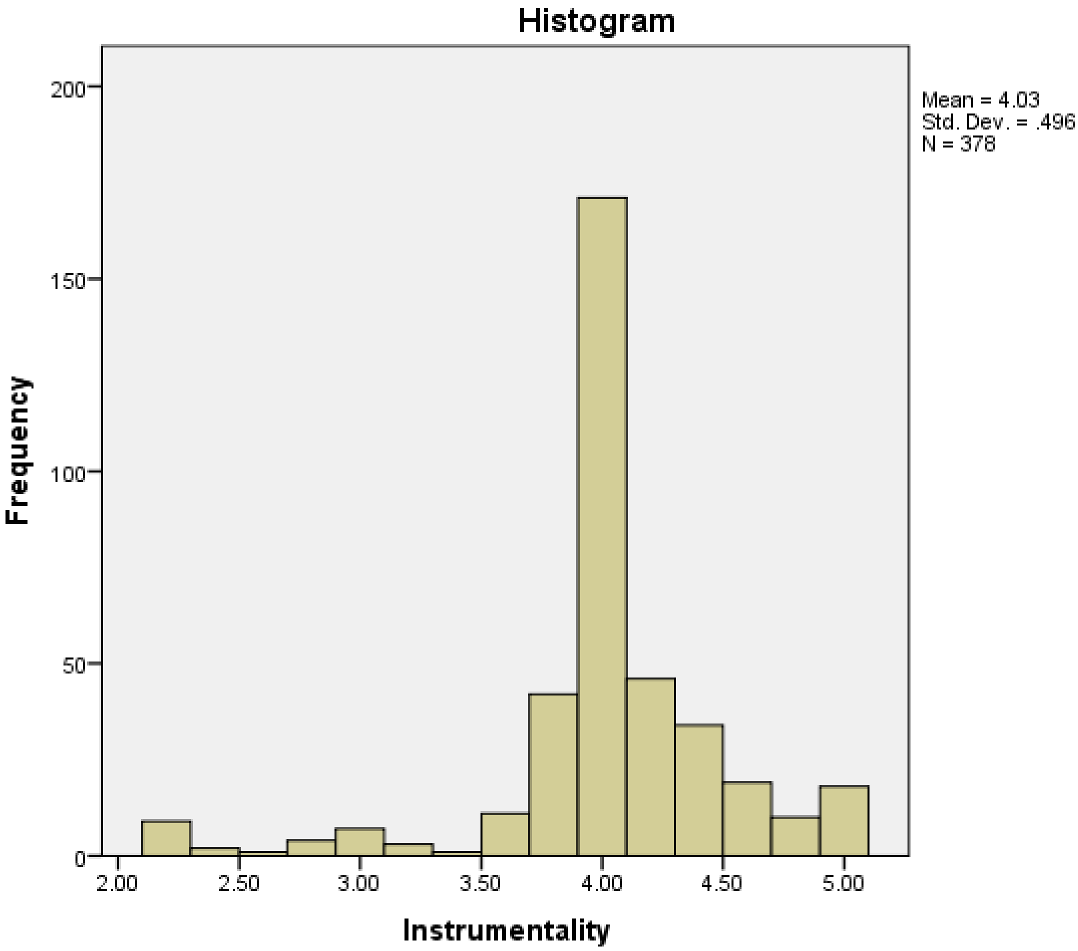
Appendix II – Normality test figures

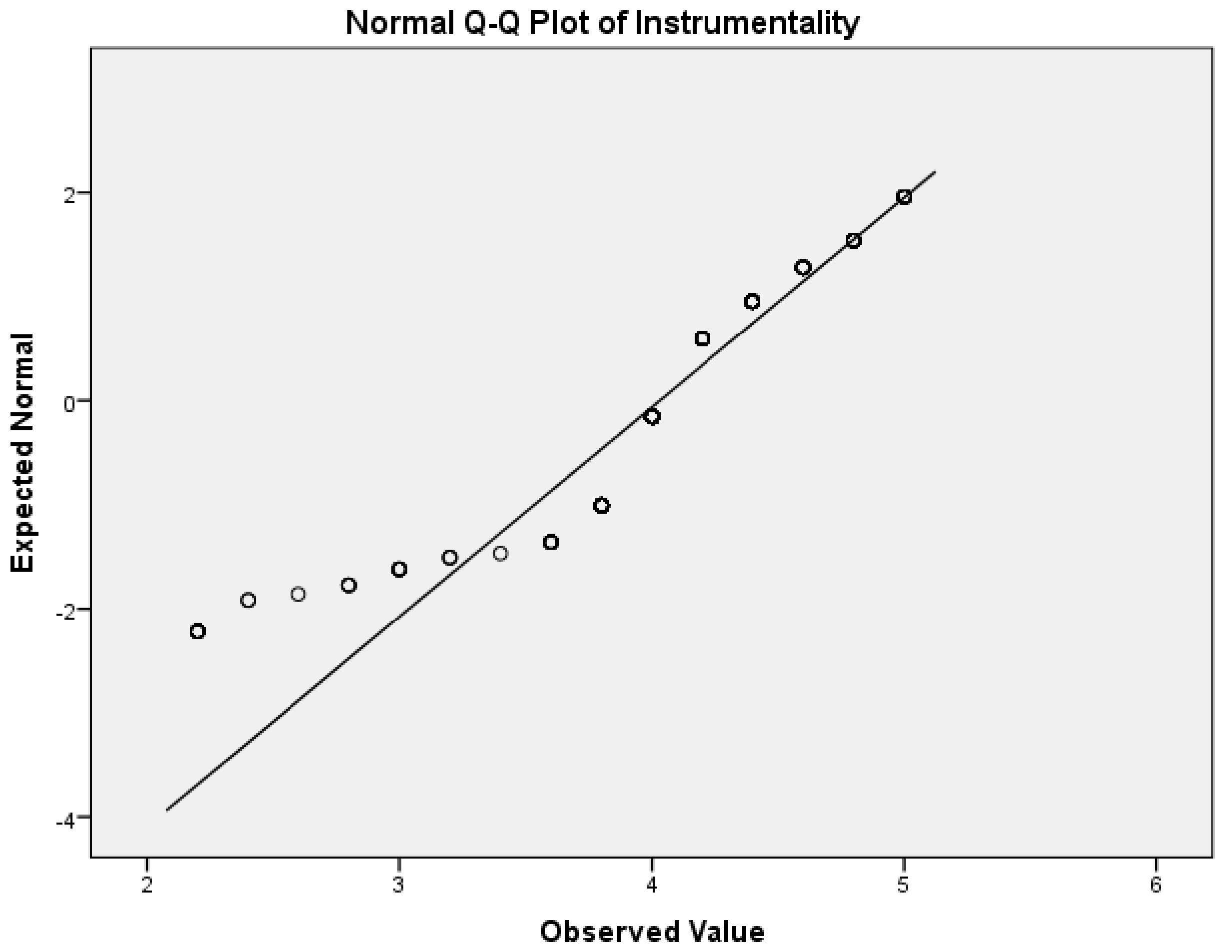
Expectancy



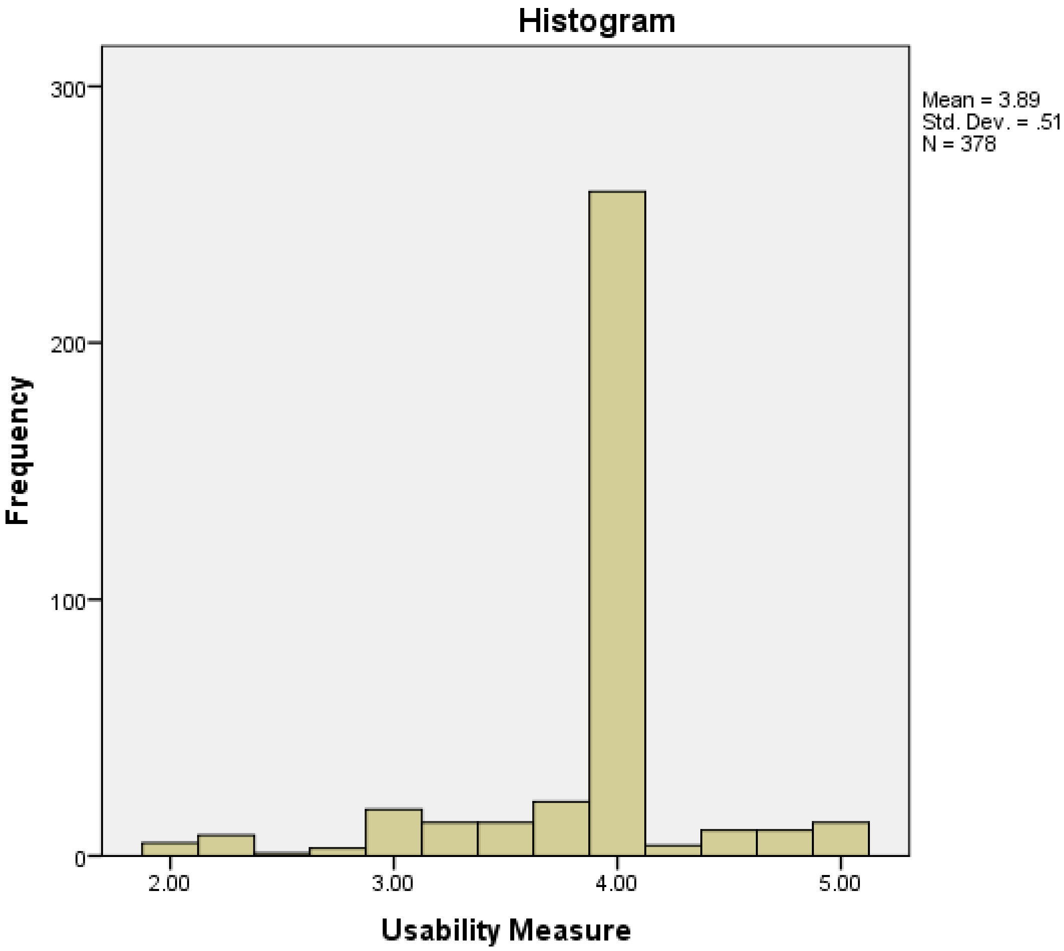


Instrumentality


Histogram
Mean = 4.03
Std. Dev. = .496
N = 378
Frequency
200
150
100
50
0
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Instrumentality


Normal Q-Q Plot of Instrumentality
Expected Normal
2
0
-2
-4
2
3
4
5
6
Observed Value

Effeciency


Histogram
Mean = 3.89
Std. Dev. = .51
N = 378
Frequency
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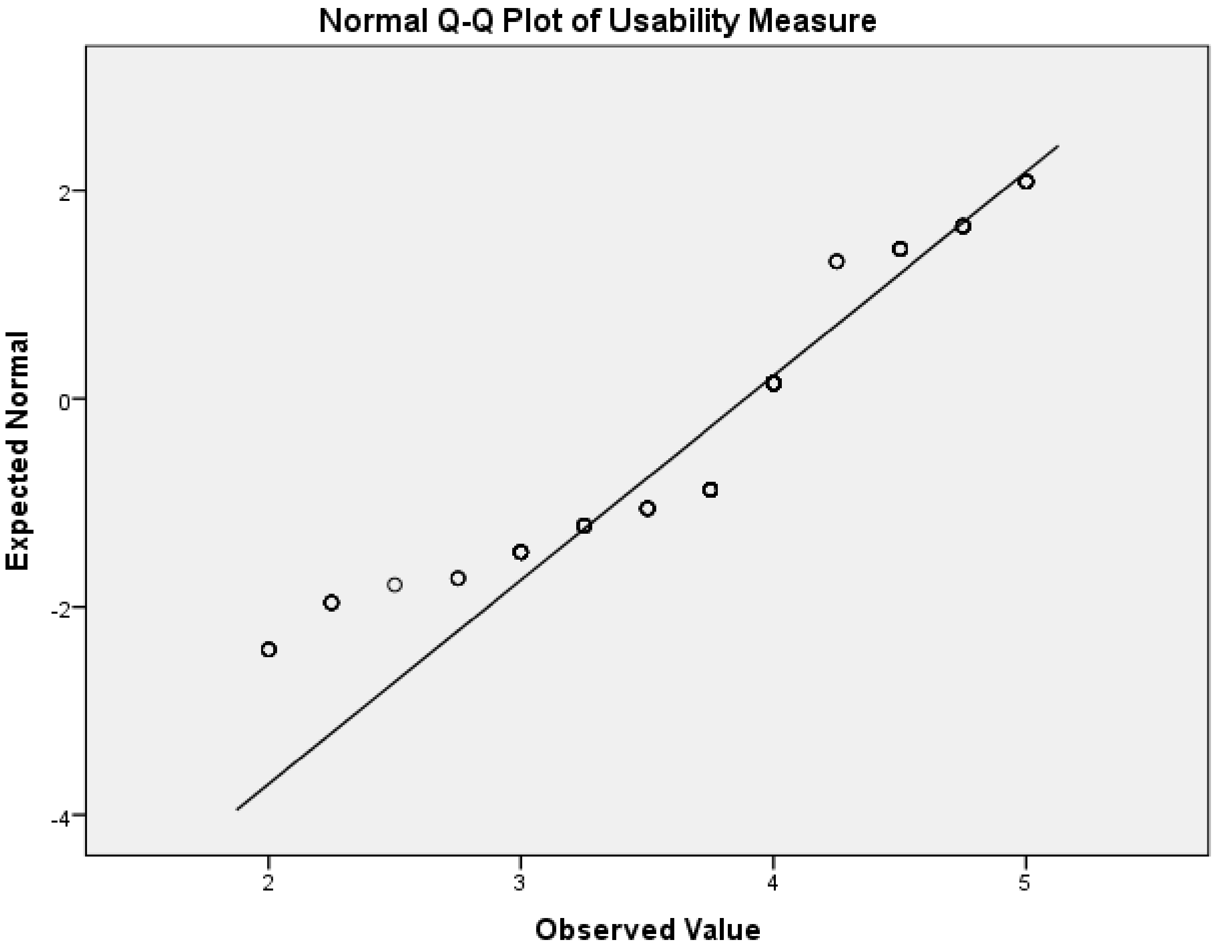
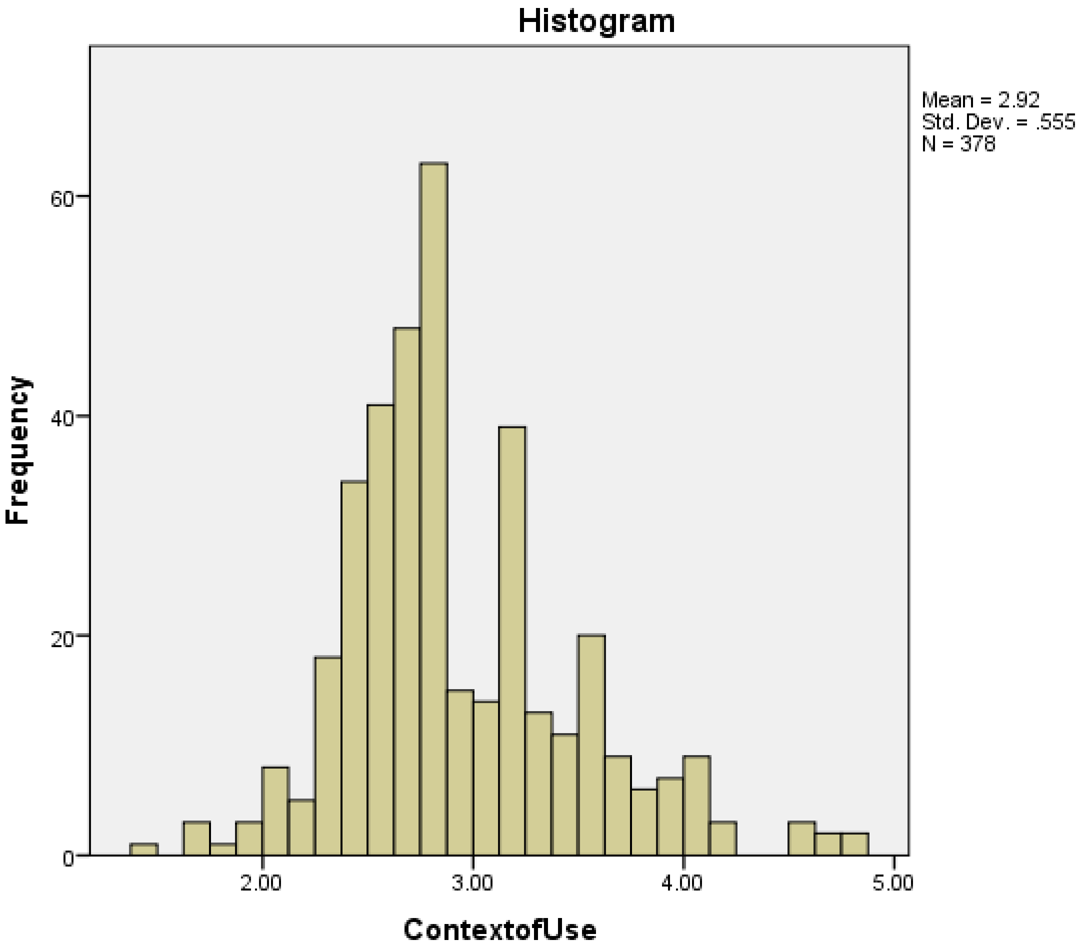
200
100
0
2.00
3.00
4.00
5.00
Usability Measure



Context of Use


Histogram
Mean = 2.92
Std. Dev. = .555
N = 378
Frequency
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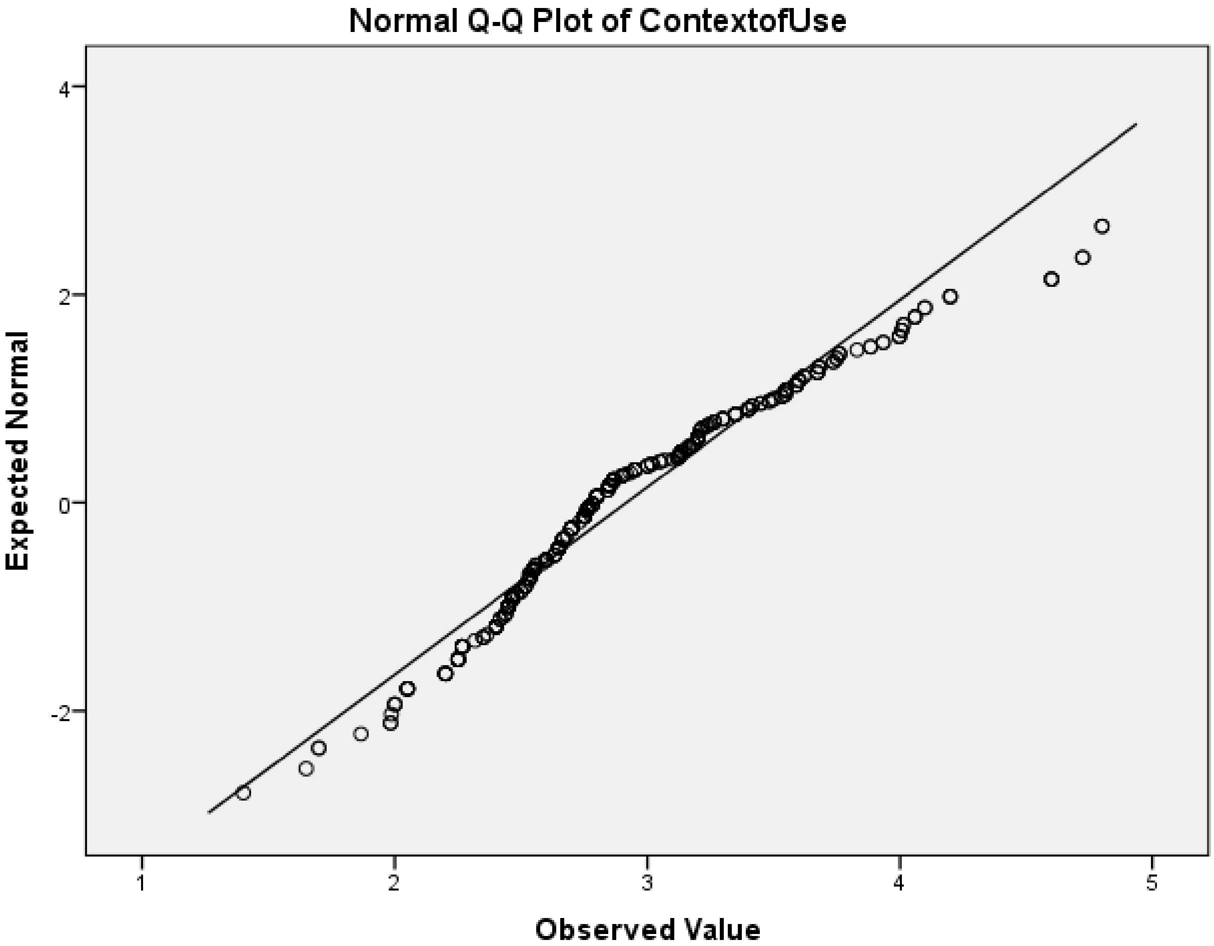
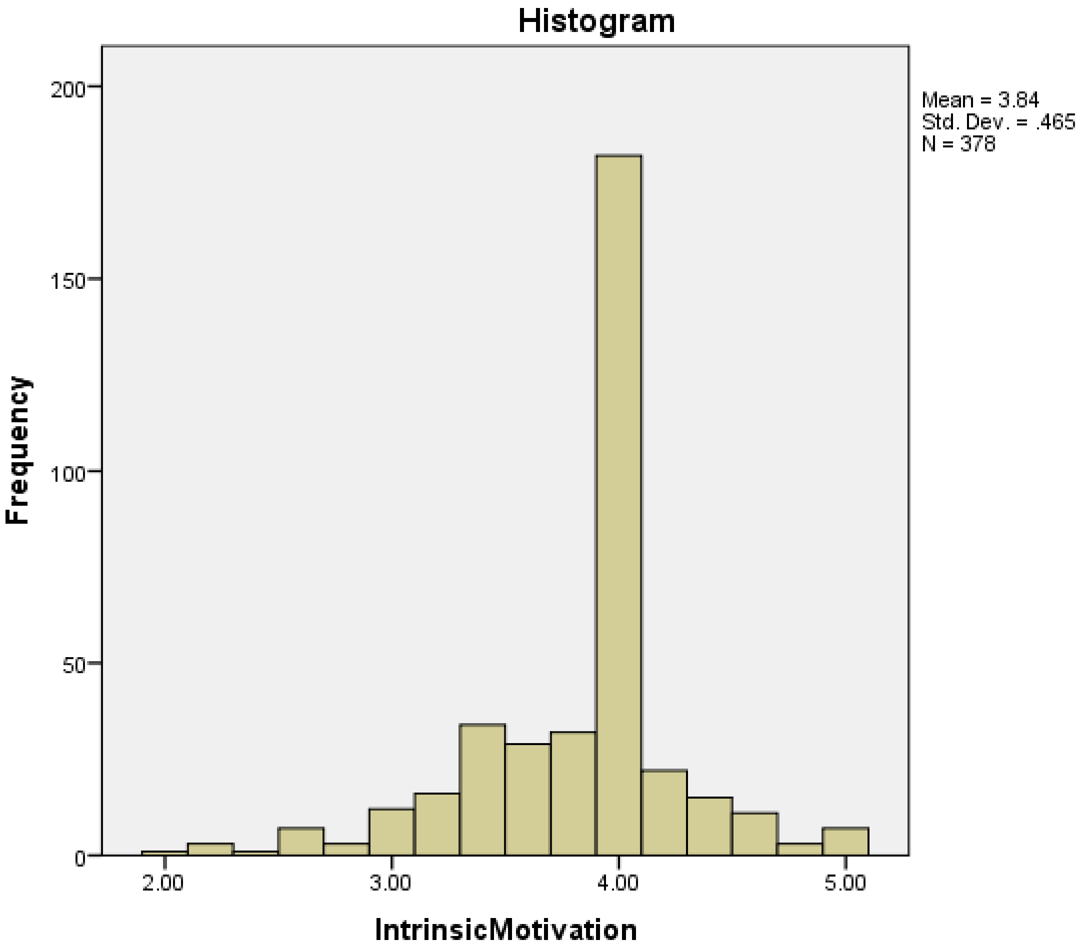
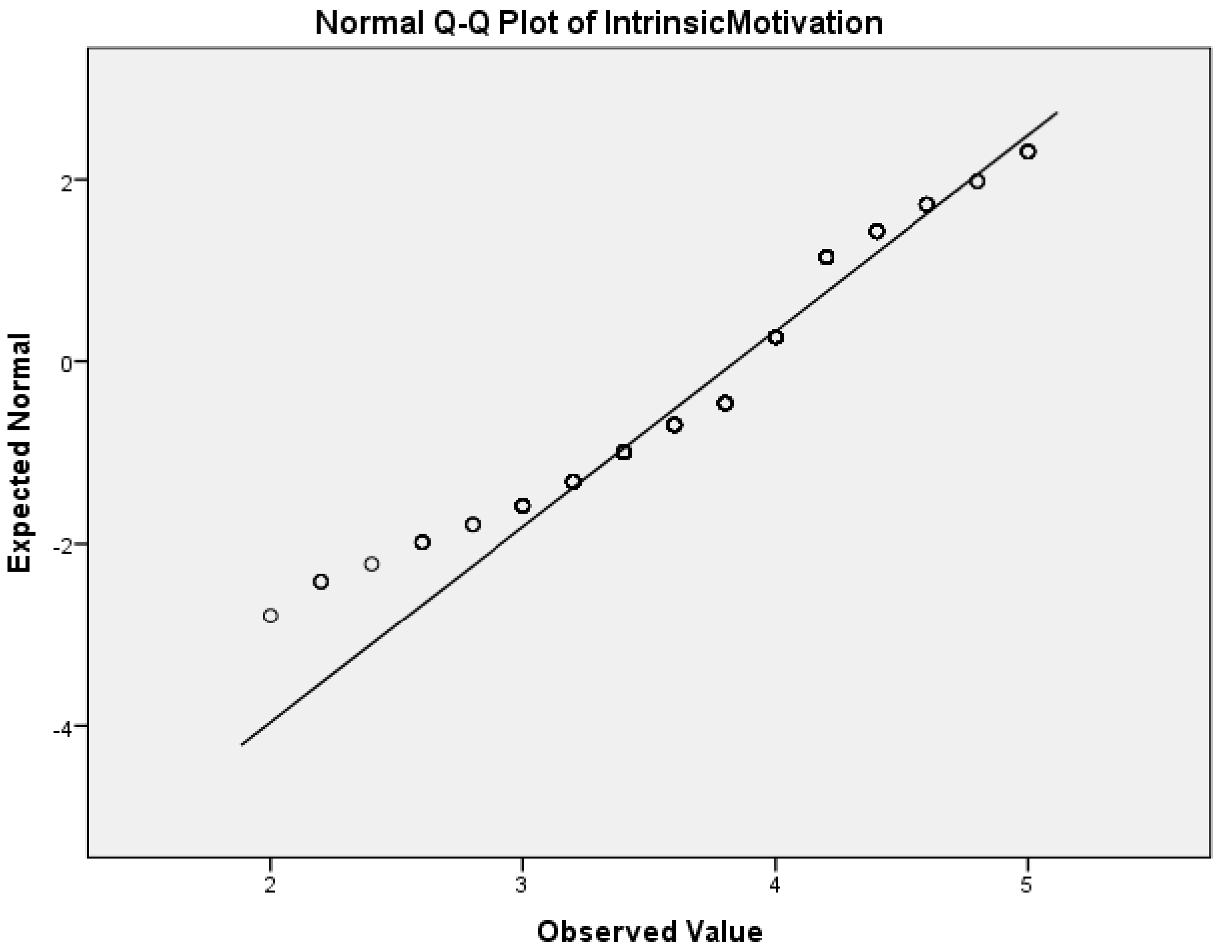
20
40
60
2.00
3.00
4.00
5.00
ContextofUse

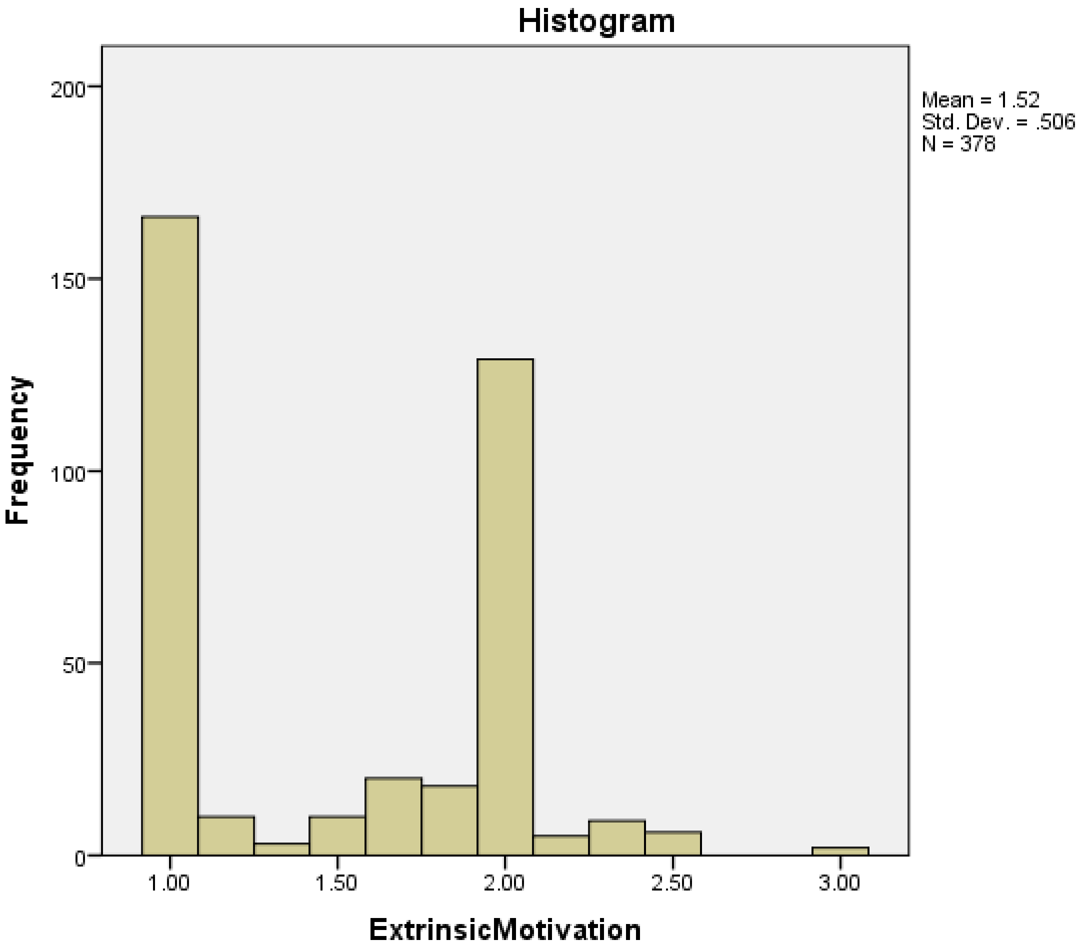


Intrinsic Motivation


Histogram
Mean = 3.84
Std. Dev. = .465
N = 378
Frequency
200
150
100
50
0
2.00
3.00
4.00
5.00
IntrinsicMotivation


Normal Q-Q Plot of IntrinsicMotivation
2
0
-2
-4
Expected Normal
2
3
4
5
Observed Value

Extrinsic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Mean = 1.52
Std. Dev. = .506
N = 378
Frequency
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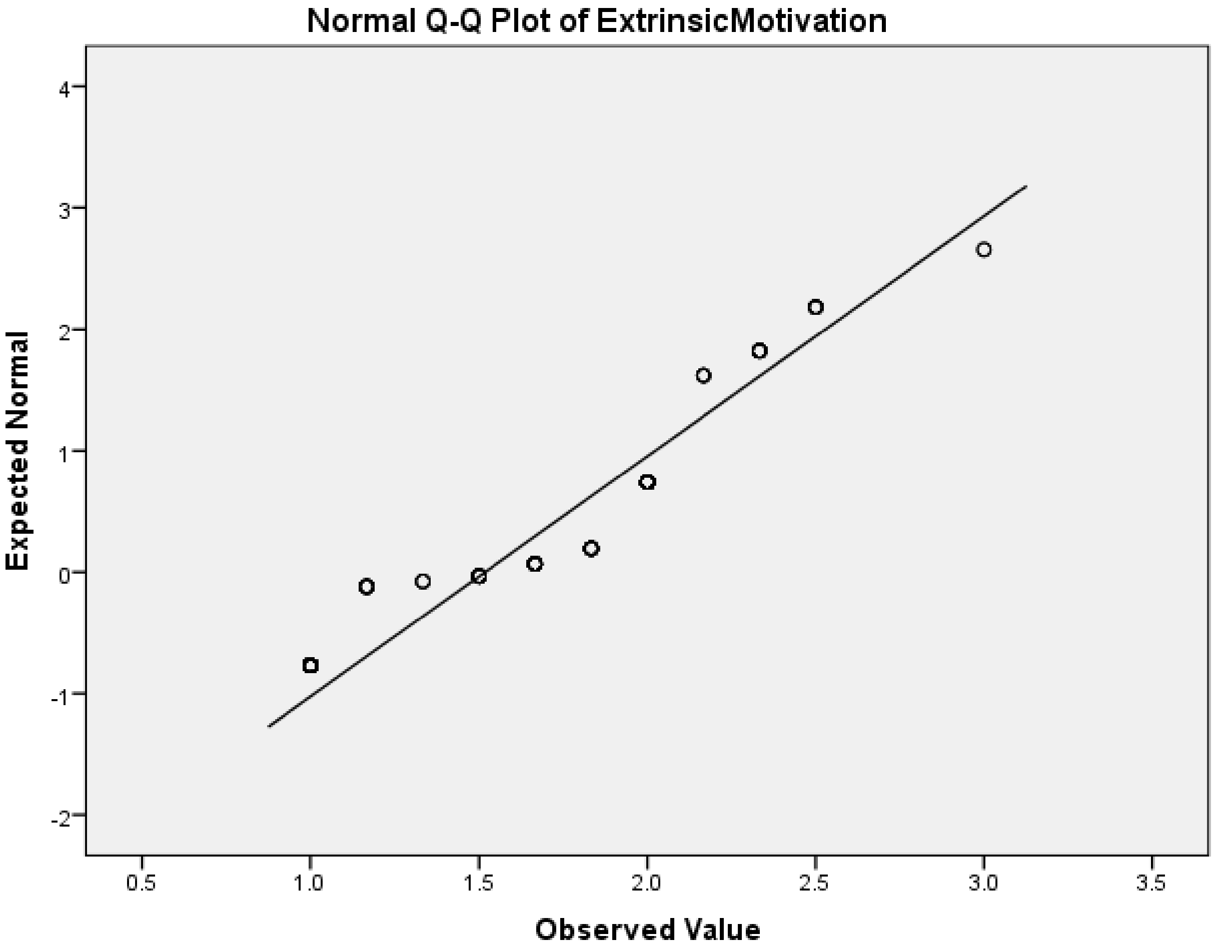
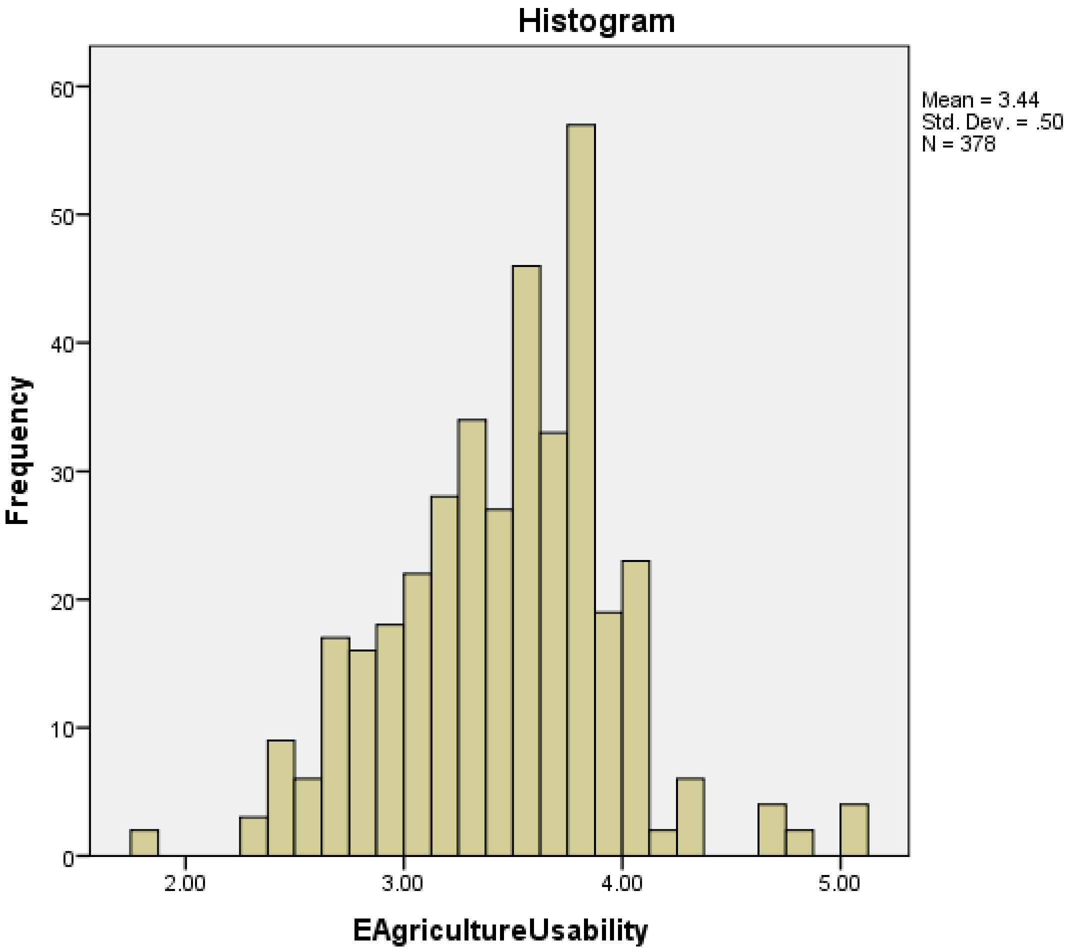
50
0
1.00
1.50
2.00
2.50
3.00
ExtrinsicMotivation


Normal Q-Q Plot of ExtrinsicMotivation
Expected Normal
Observed Value
4
3
2
1
0
-1
-2
0.5
1.0
1.5
2.0
2.5
3.0
3.5


Histogram
Mean = 3.44
Std. Dev. = .50
N = 378
Frequency
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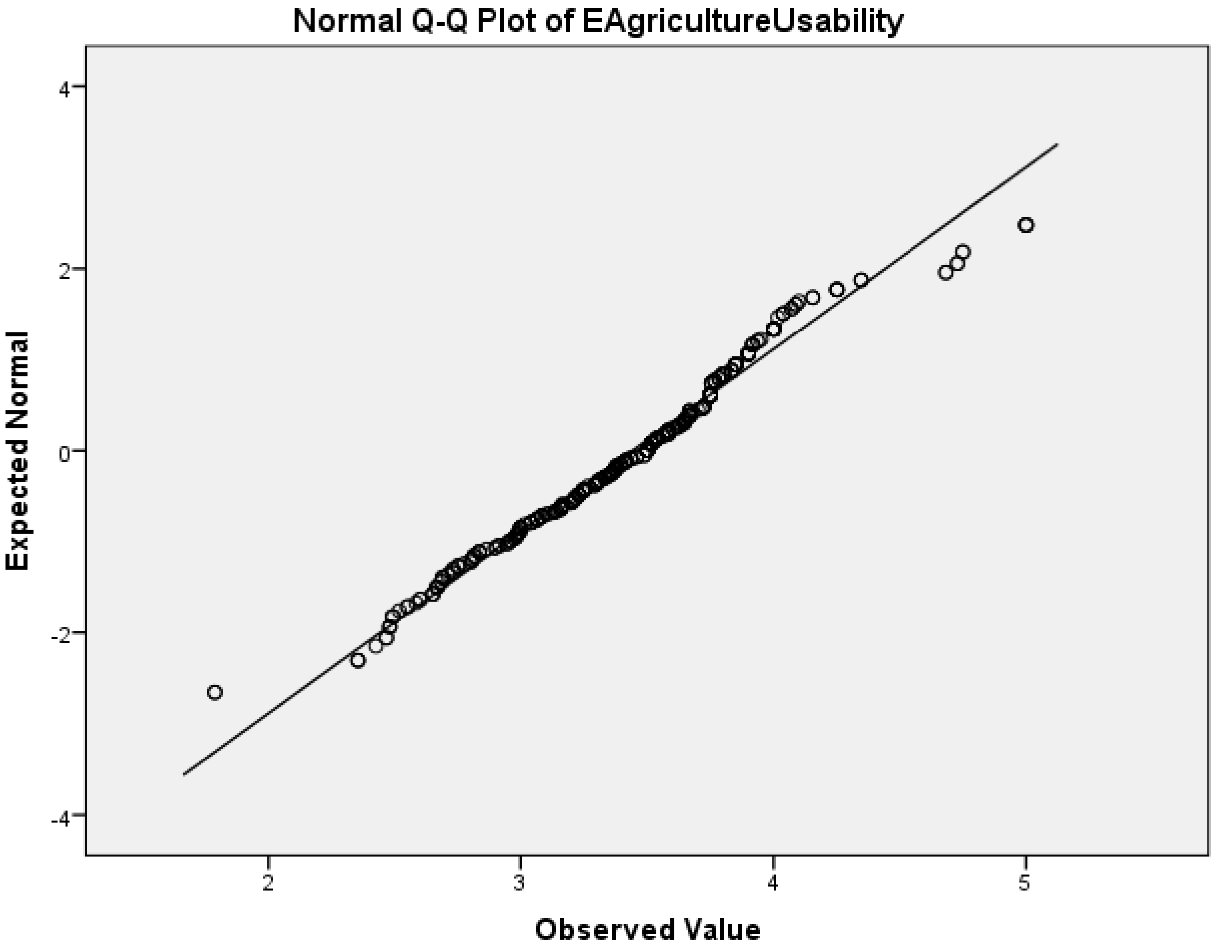
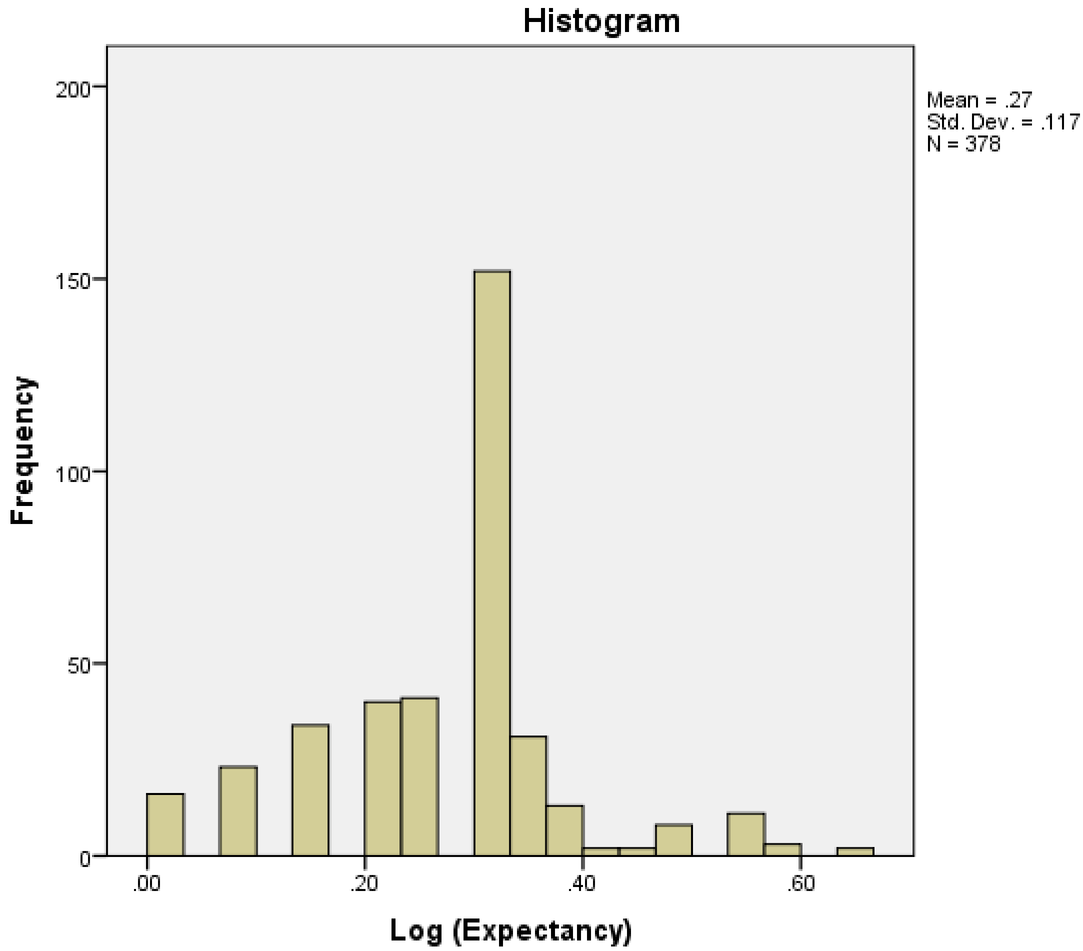
50
40
30
20
10
0
2.00
3.00
4.00
5.00
EAgricultureUsability



Log (Expectancy)


Histogram
Mean = .27
Std. Dev. = .117
N = 378
Frequency
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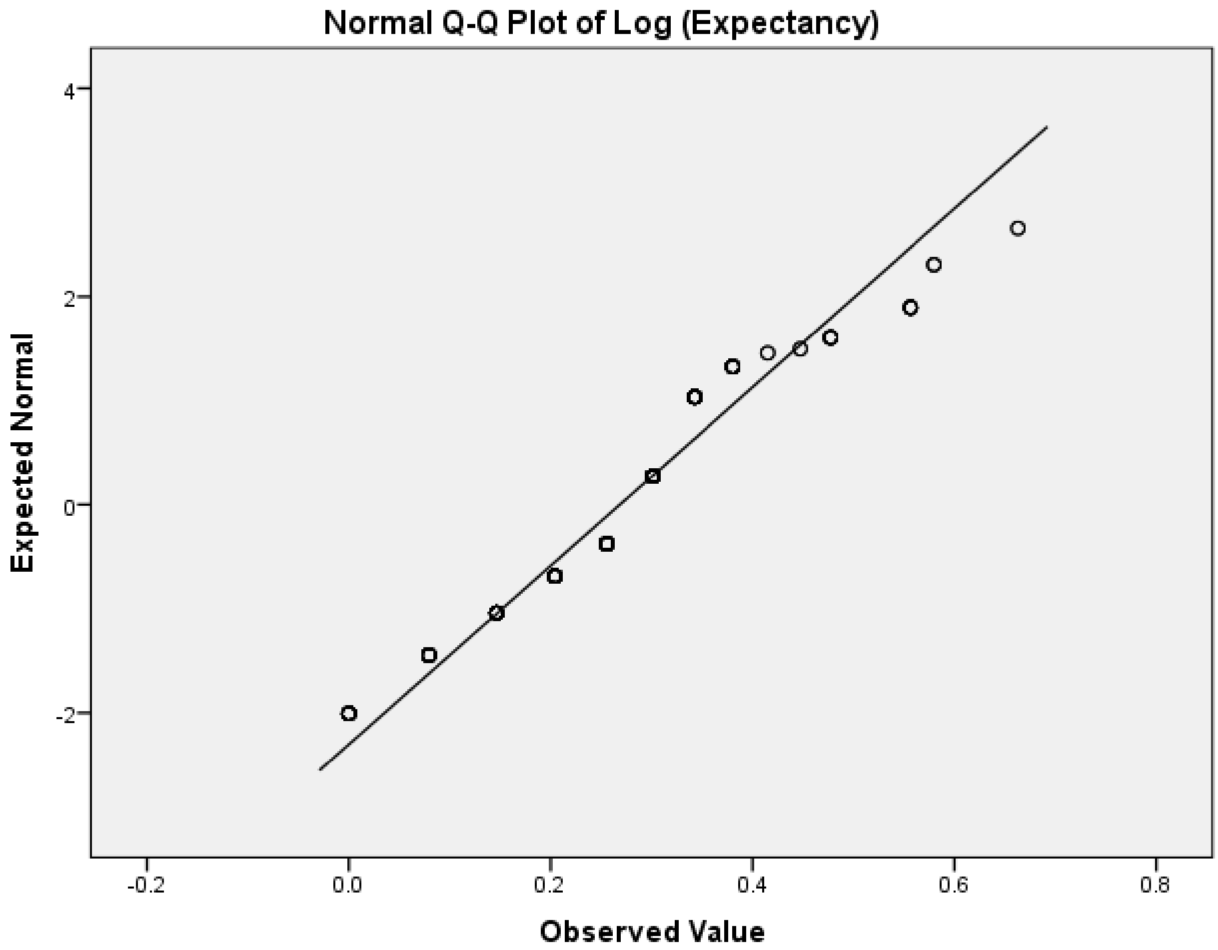
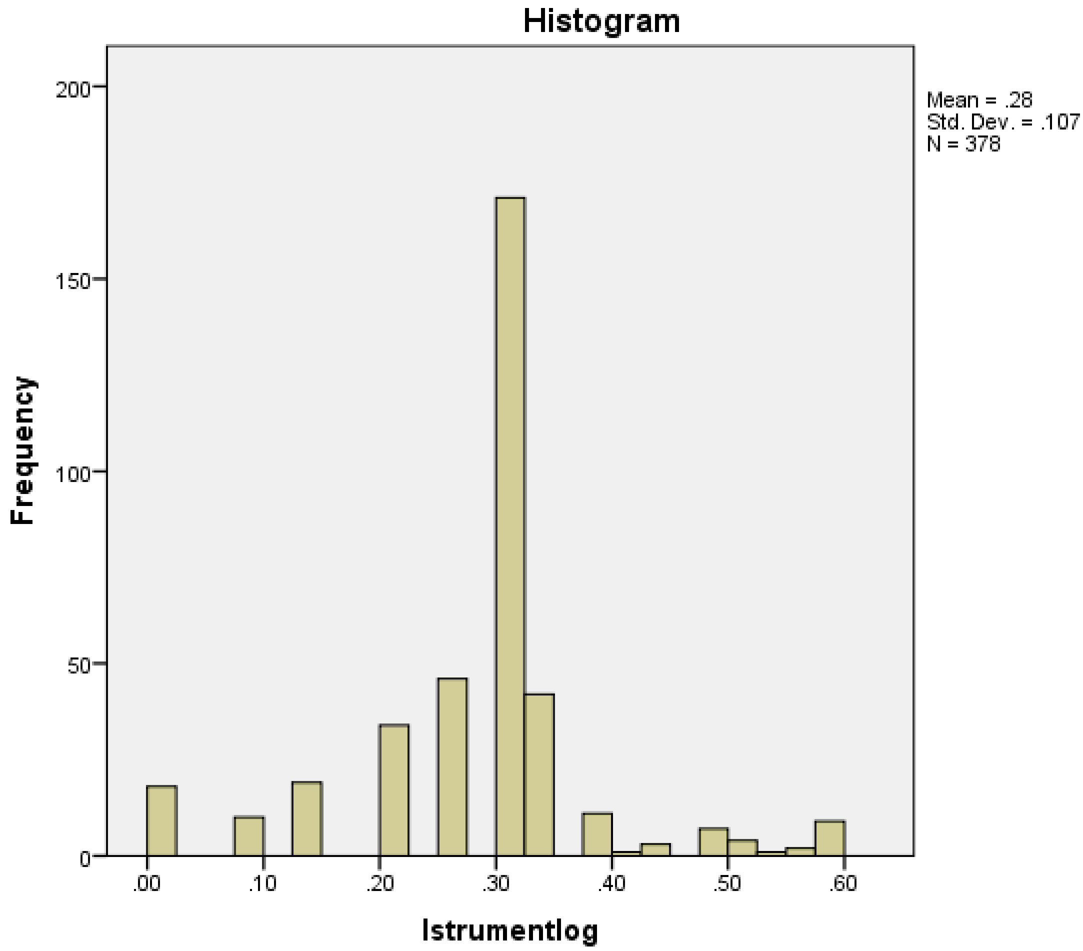
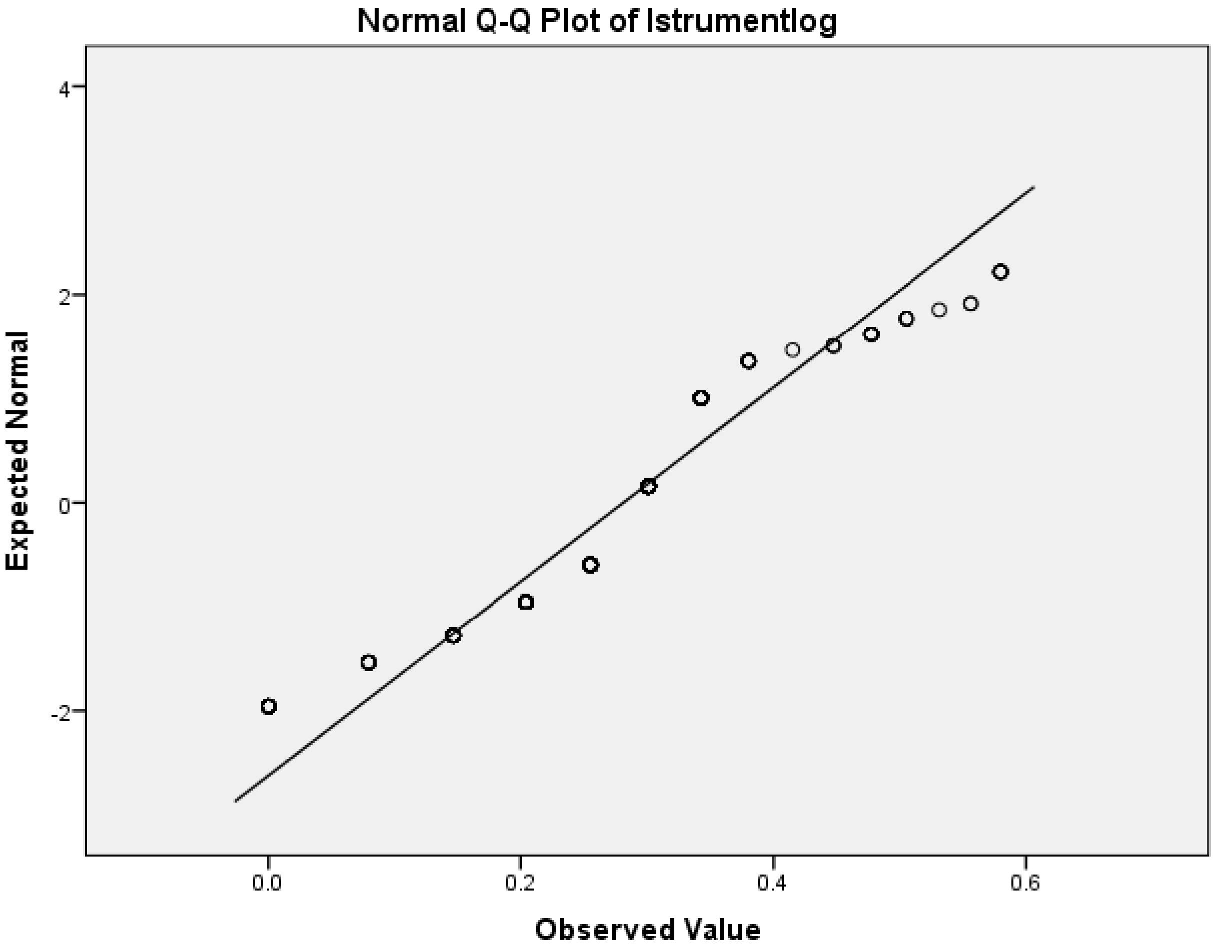
150
100
50
0
.00
.20
.40
.60
Log (Expectancy)

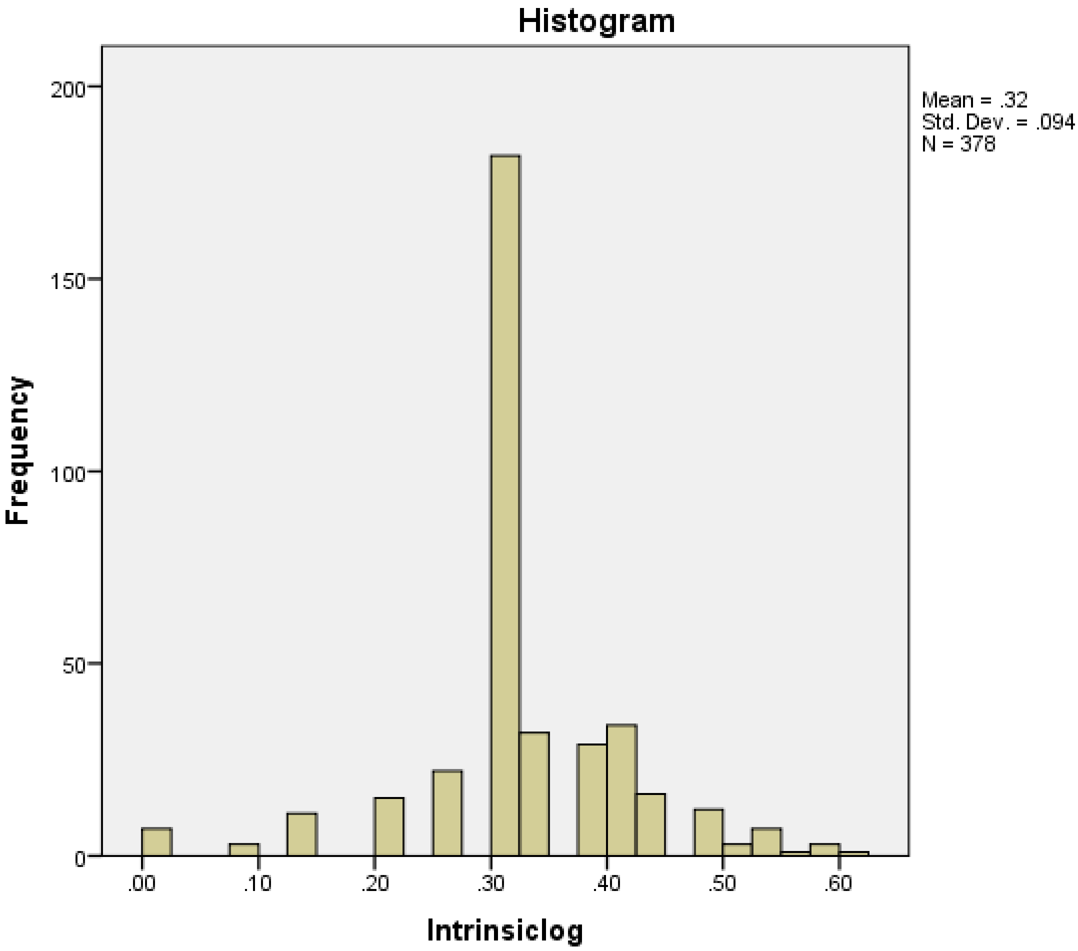


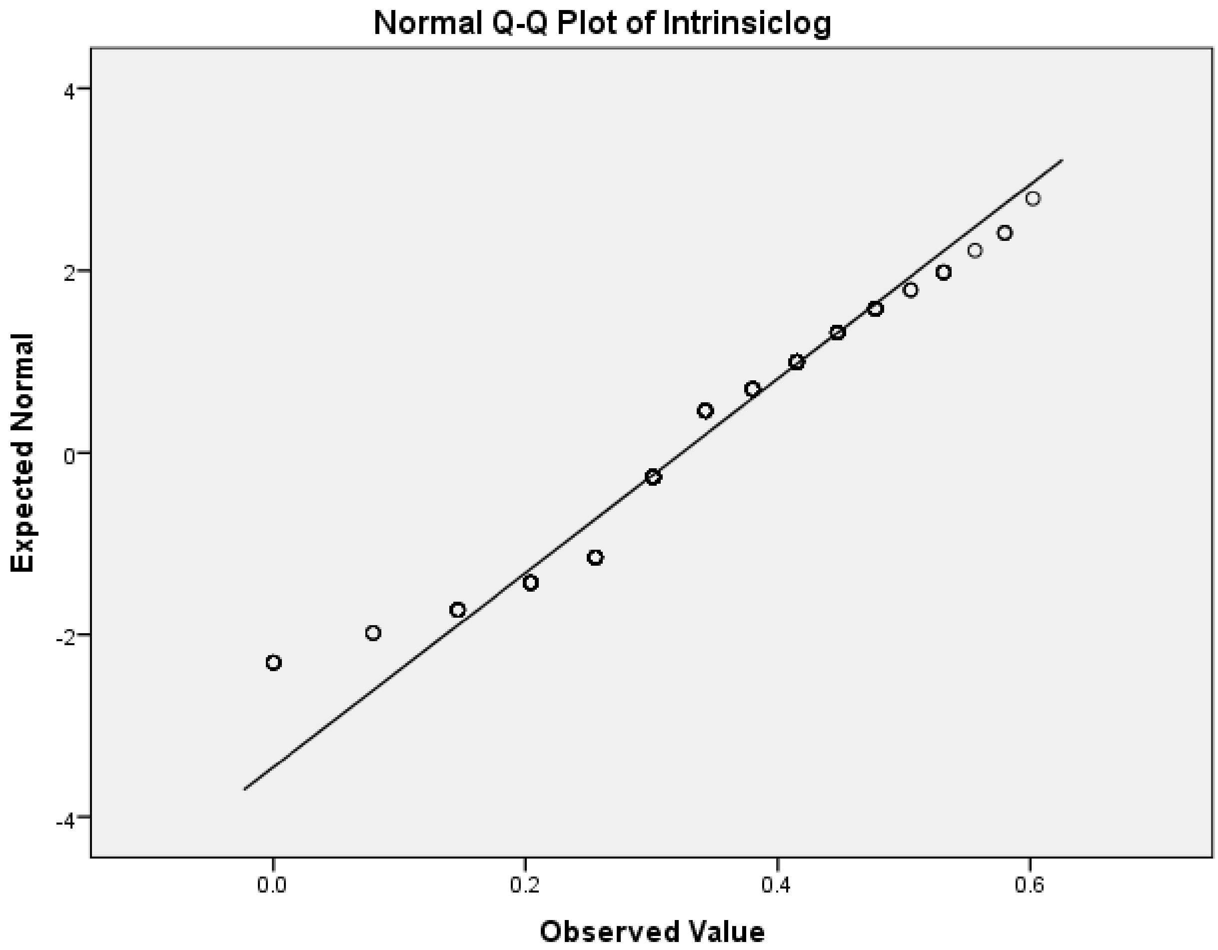
Log (Instrumentality)


Histogram
Frequency
200
150
100
50
0
.00
.10
.20
.30
.40
.50
.60
Istrumentlog
Mean = .28
Std. Dev. = .107
N = 378

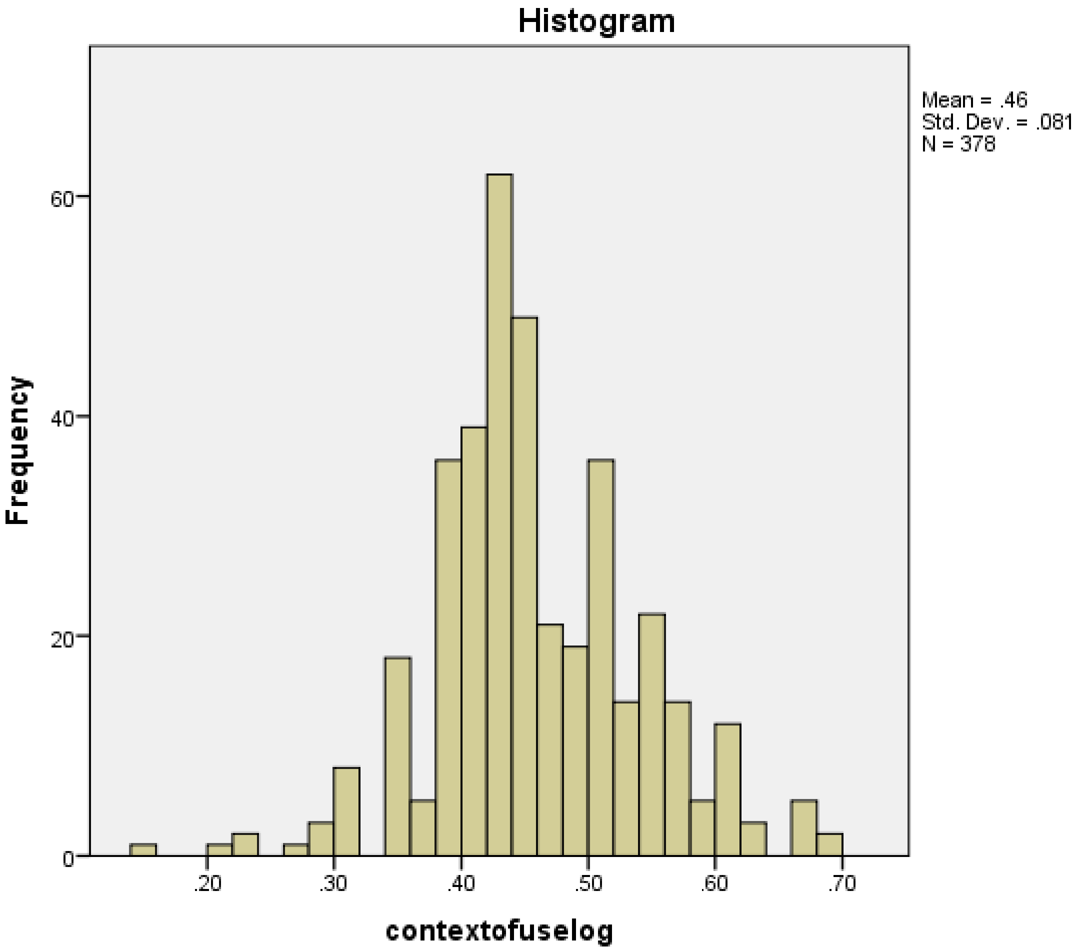


Log (Intrinsic)


Histogram
Mean = .32
Std. Dev. = .094
N = 378
Frequency
0
50
100
150
200
.00
.10
.20
.30
.40
.50
.60
Intrinsiclog



Log (Context of Use)



Histogram
Mean = .46
Std. Dev. = .081
N = 378
Frequency
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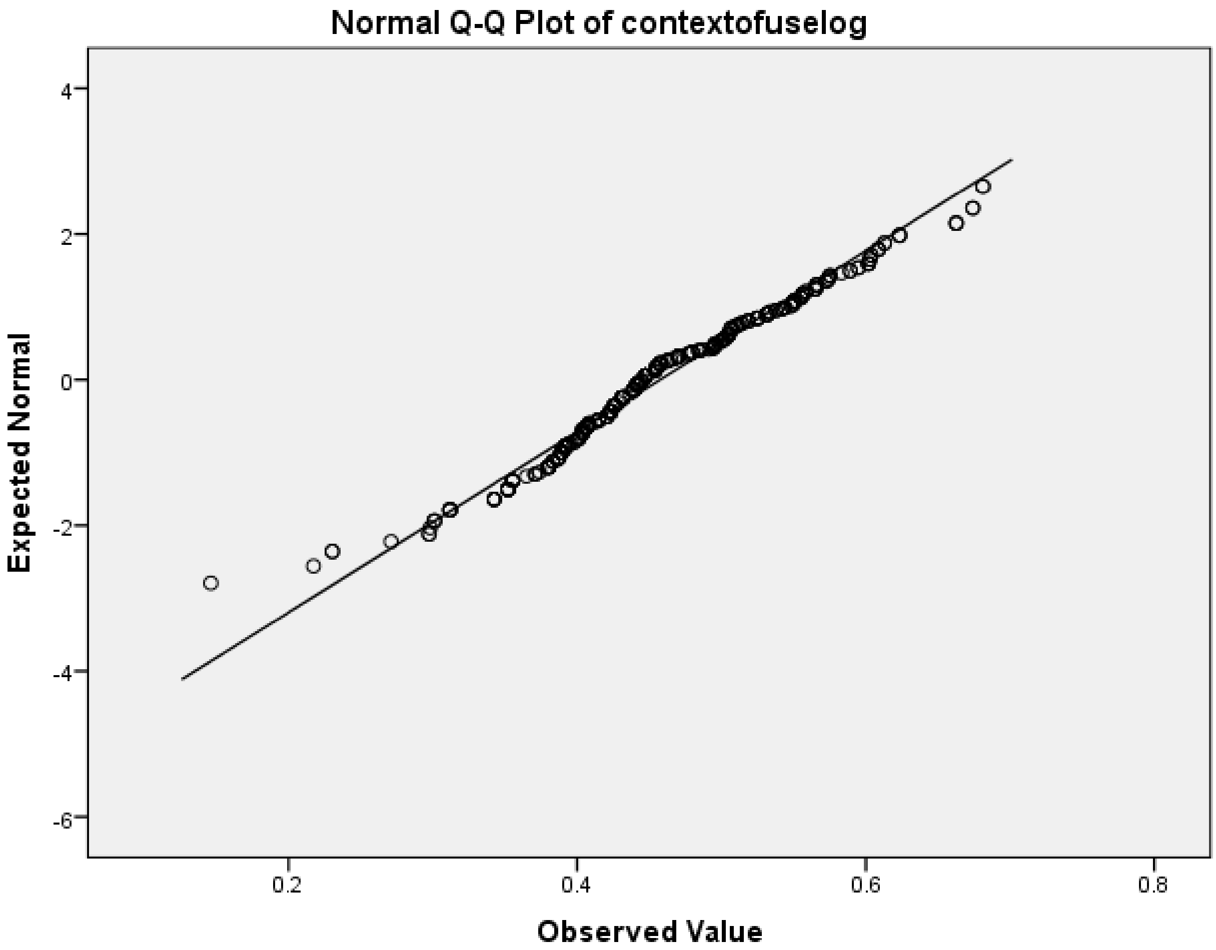
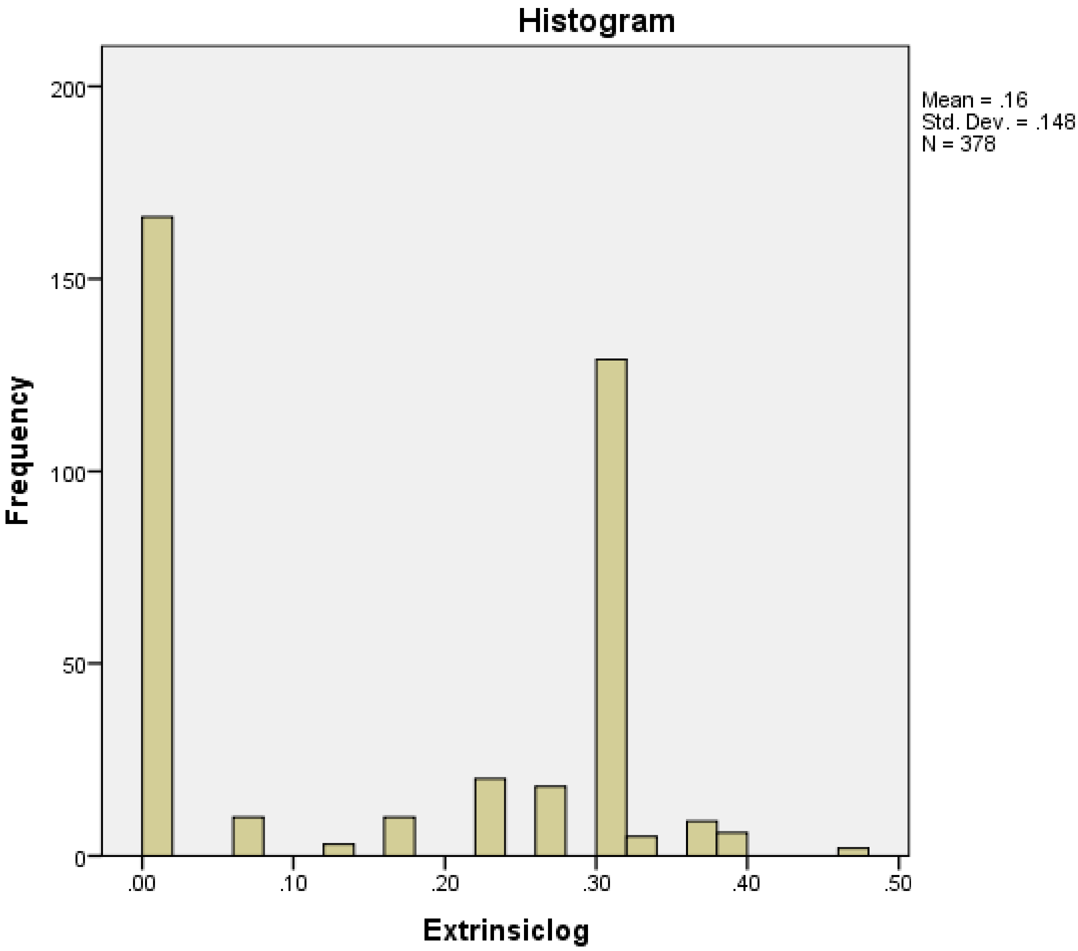
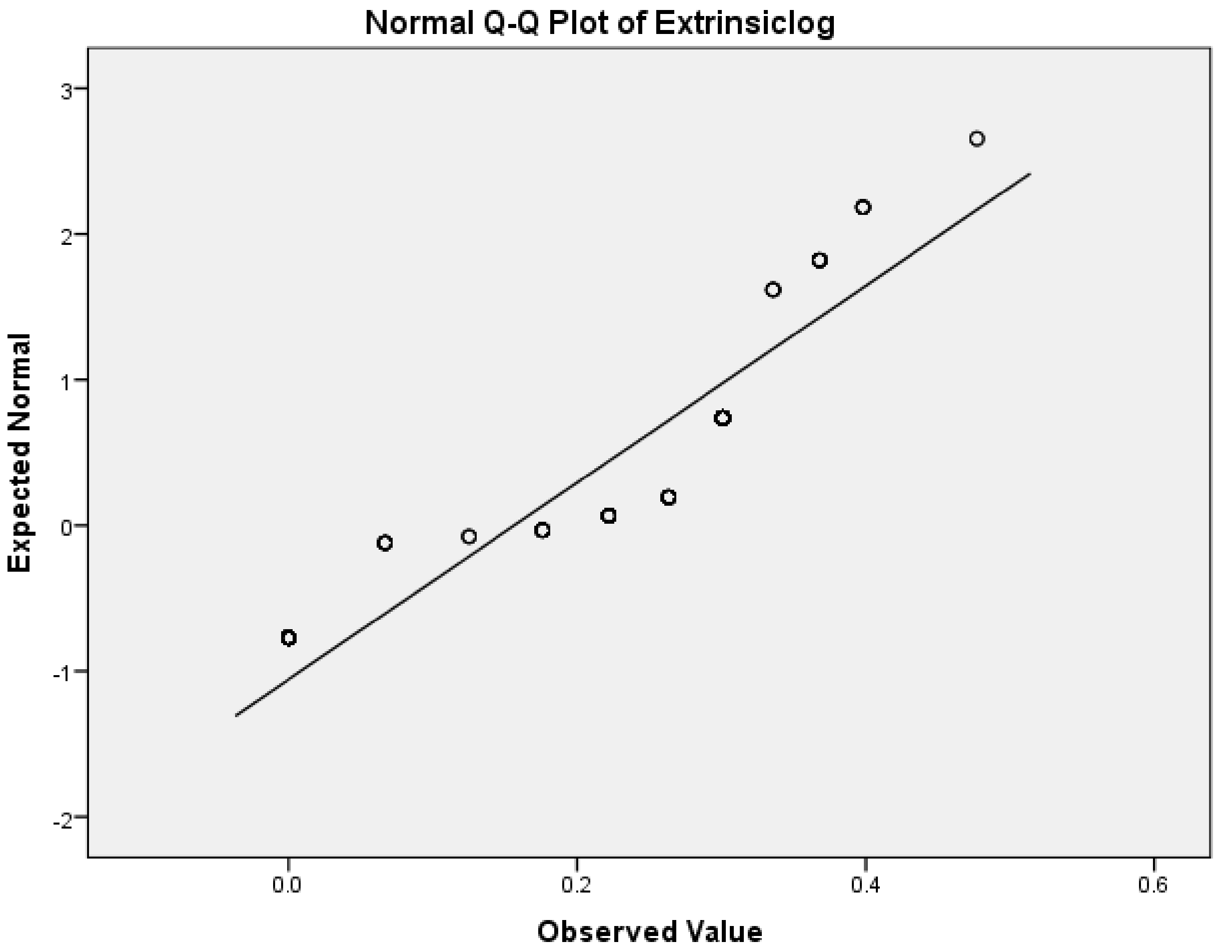
20
40
60
.20
.30
.40
.50
.60
.70
contextofuselog

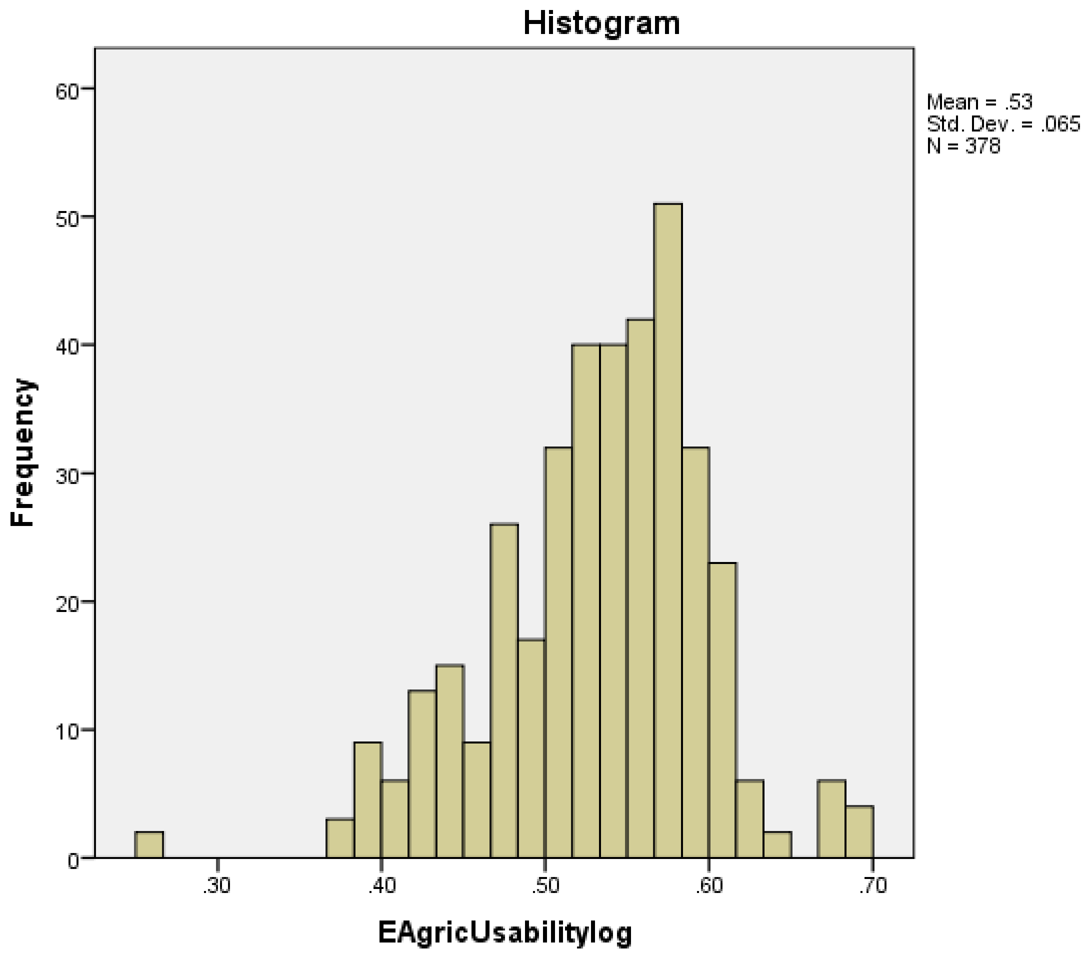


Log (Extrinsic Motivation)

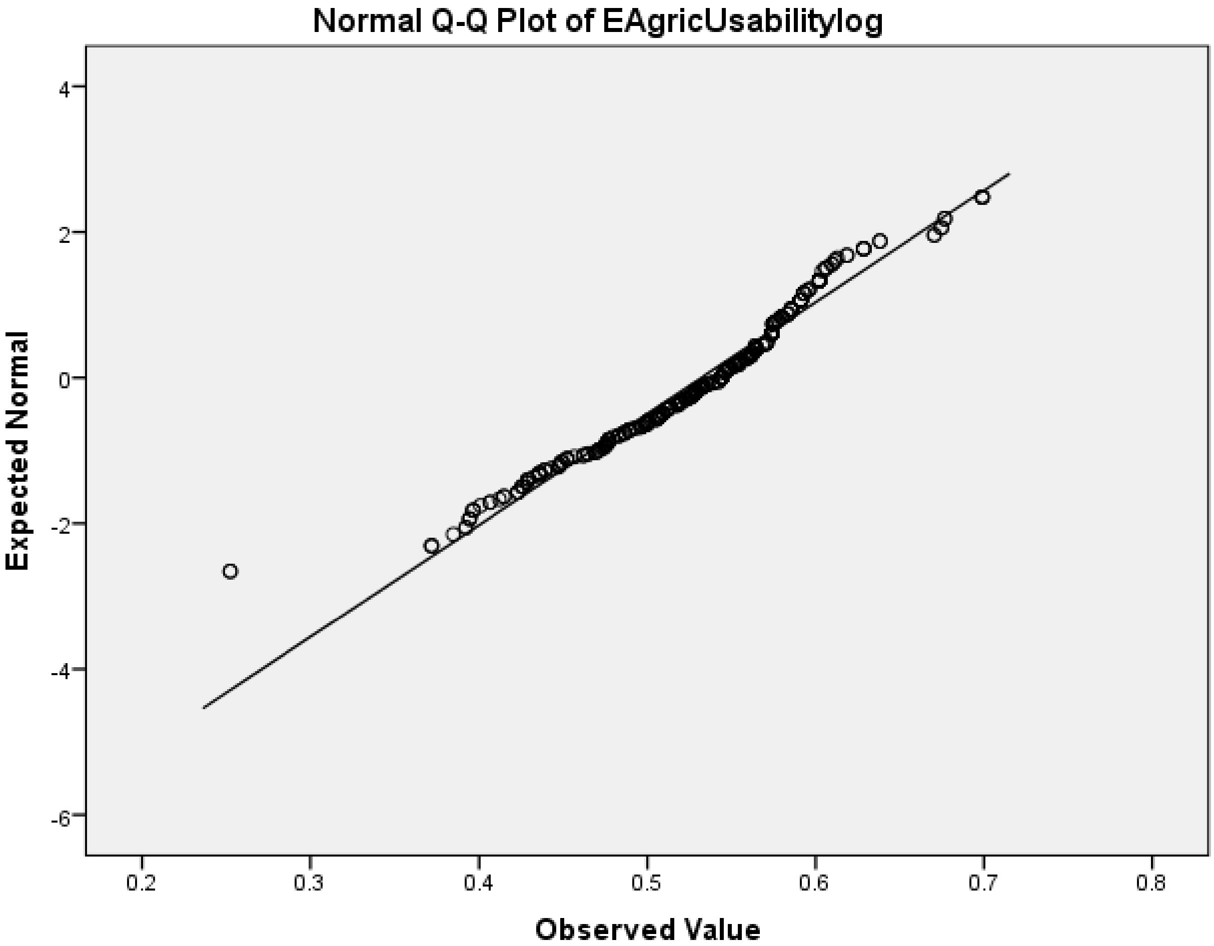

Histogram
Mean = .16
Std. Dev. = .148
N = 378
Frequency
200
150
100
50
0
.00
.10
.20
.30
.40
.50
Extrinsiclog



Log (E Agriculture Usability)

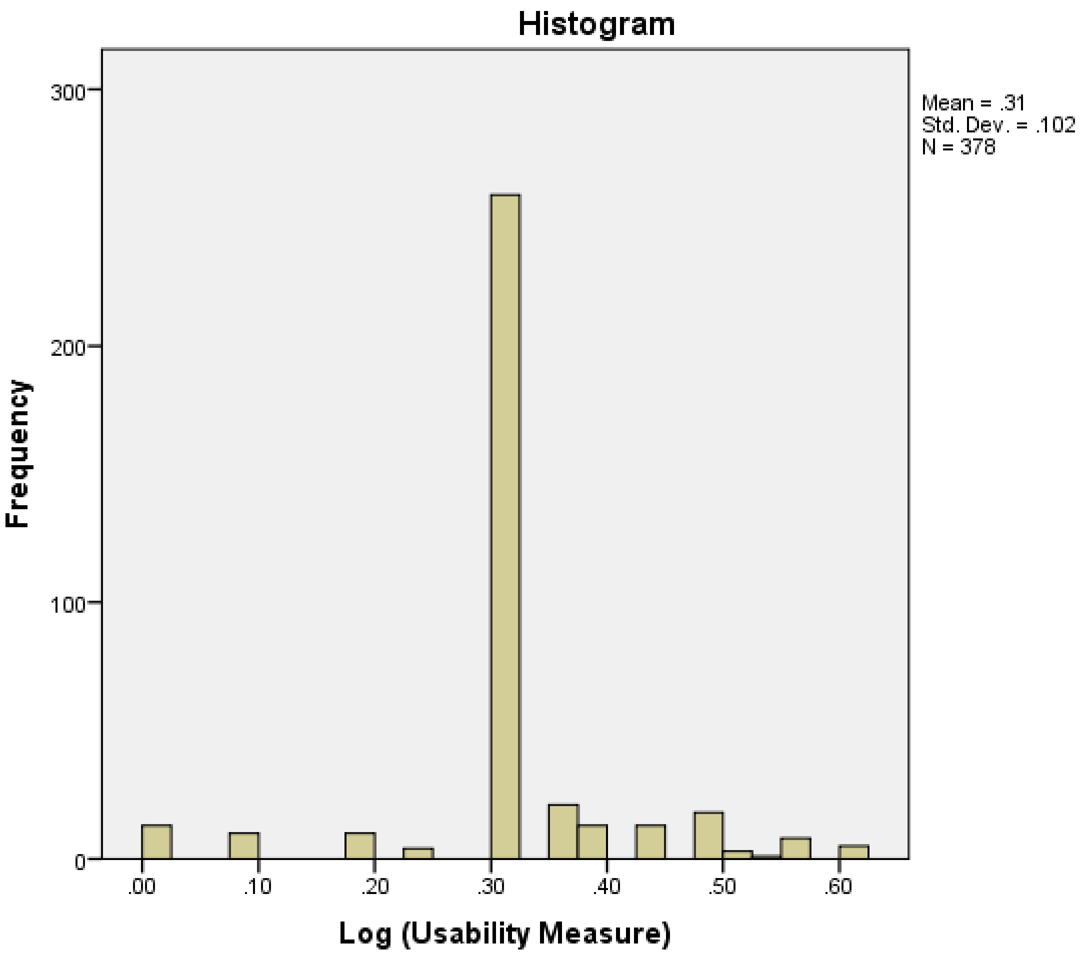


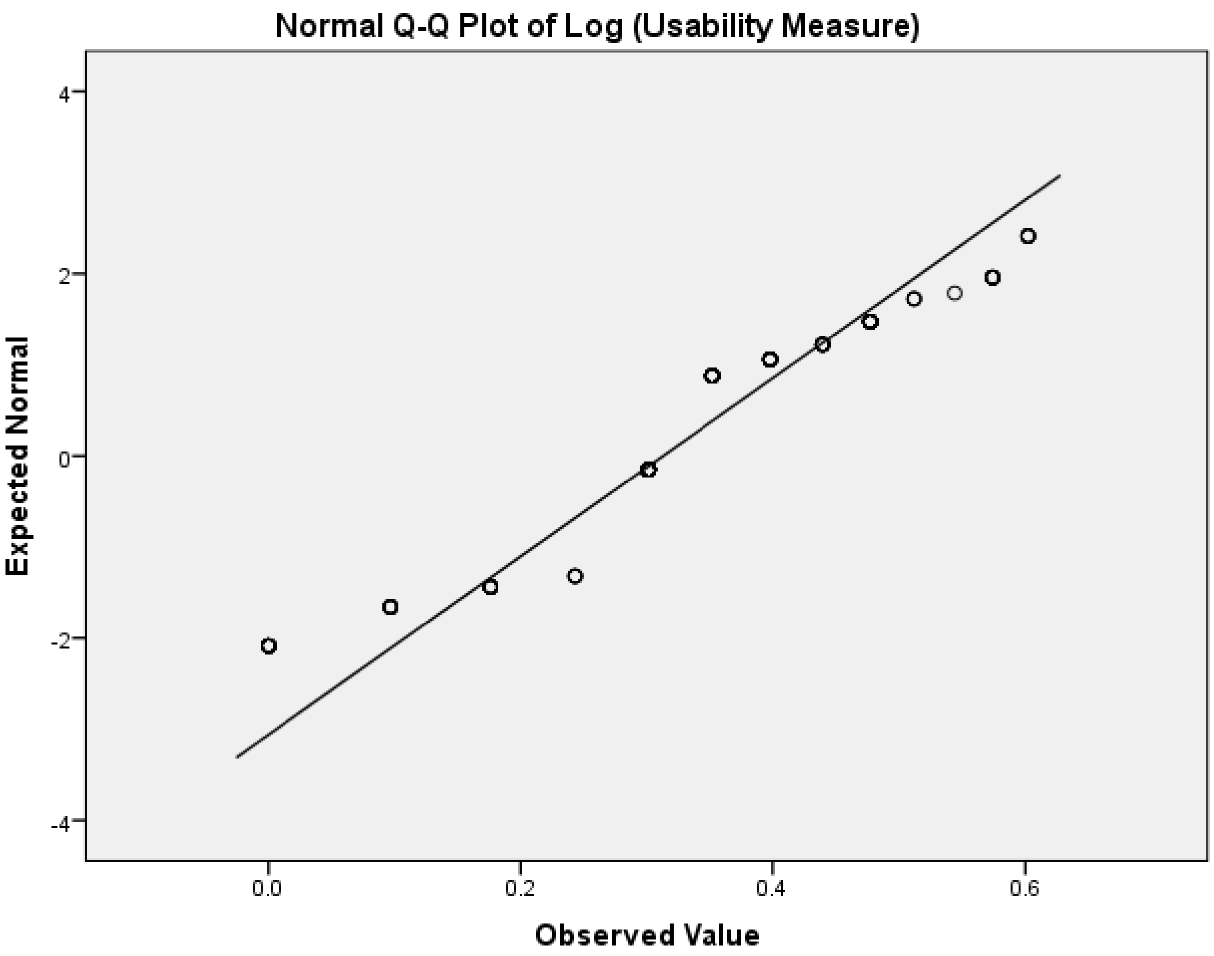
Histogram
Mean = .53
Std. Dev. = .065
N = 378
Frequency
60
50
40
30
20
10
0
.30
.40
.50
.60
.70
EAgricUsabilitylog



Normal Q-Q Plot of EAgricUsabilitylog
Expected Normal
Observed Value
4
2
0
-2
-4
-6
0.2
0.3
0.4
0.5
0.6
0.7
0.8

Log (Usability Measures)




Normal Q-Q Plot of Log (Usability Measure)
Expected Normal
Observed Value
4
2
0
-2
-4
0.0
0.2
0.4
0.6

Appendix III: Multiple hierarchical regression tables

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.234[a]	.055	.042	.51872	.055	4.319	5	372	.001
2	.633[b]	.400	.391	.41368	.346	213.886	1	371	.000

a. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.811	5	1.162	4.319	.001[b]
	Residual	100.094	372	.269		
	Total	105.905	377			
2	Regression	42.414	6	7.069	41.307	.000[c]
	Residual	63.491	371	.171		
	Total	105.905	377			

a. Dependent Variable: Instrumentality

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

c. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.457	.169		20.441	.000
	Gender_1	.087	.058	.079	1.499	.135
	Age_1	.138	.038	.201	3.623	.000
	Region_1	-.033	.024	-.071	-1.370	.172
	Land_Size_1	-.018	.031	-.033	-.596	.551
	Education_1	-.031	.024	-.070	-1.326	.186
2	(Constant)	2.067	.165		12.528	.000
	Gender_1	.084	.046	.076	1.823	.069
	Age_1	.125	.030	.183	4.140	.000
	Region_1	-.014	.020	-.029	-.716	.474
	Land_Size_1	-.097	.025	-.176	-3.876	.000
	Education_1	-.035	.019	-.078	-1.863	.063
	Expectancy	.405	.028	.610	14.625	.000

a. Dependent Variable: Instrumentality

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change

1	.163[a]	.027	.014	.44668	.027	2.041	5	372	.072
2	.554[b]	.307	.295	.37756	.280	149.691	1	371	.000
3	.633[c]	.401	.390	.35141	.094	58.252	1	370	.000
4	.679[d]	.461	.450	.33361	.061	41.544	1	369	.000
5	.794[e]	.630	.621	.27700	.168	167.239	1	368	.000

a. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy

c. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality

d. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Context of Use

e. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Context of Use, Usability Measures

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.036	5	.407	2.041	.072[b]
	Residual	74.224	372	.200		
	Total	76.259	377			
2	Regression	23.374	6	3.896	27.329	.000[c]
	Residual	52.885	371	.143		
	Total	76.259	377			
3	Regression	30.568	7	4.367	35.361	.000[d]
	Residual	45.692	370	.123		
	Total	76.259	377			
4	Regression	35.191	8	4.399	39.525	.000[e]

	Residual	41.068	369	.111		
	Total	76.259	377			
	Regression	48.023	9	5.336	69.543	.000[f]
5	Residual	28.236	368	.077		
	Total	76.259	377			

a. Dependent Variable: Intrinsic Motivation

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

c. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy

d. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality

e. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Context of Use

f. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Context of Use, Usability Measures

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.679	.146		25.266	.000
	Gender_1	.091	.050	.097	1.823	.069
	Age_1	.046	.033	.079	1.399	.163
	Region_1	-.018	.021	-.045	-.862	.389
	Land_Size_1	-.058	.026	-.124	-2.198	.029
	Education_1	.011	.020	.028	.528	.598
2	(Constant)	2.244	.170		13.197	.000
	Gender_1	.048	.042	.052	1.148	.252

	Age_1	.016	.028	.027	.573	.567
	Region_1	.000	.018	-.001	-.013	.989
	Land_Size_1	-.084	.022	-.180	-3.772	.000
	Education_1	.004	.017	.012	.254	.800
	Expectancy	.432	.035	.542	12.235	.000
3	(Constant)	1.801	.169		10.685	.000
	Gender_1	.042	.039	.045	1.066	.287
	Age_1	-.021	.026	-.037	-.812	.417
	Region_1	.001	.017	.003	.071	.944
	Land_Size_1	-.057	.021	-.123	-2.725	.007
	Education_1	.022	.016	.059	1.380	.169
	Expectancy	.121	.052	.152	2.313	.021
	Instrumentality	.427	.056	.503	7.632	.000
4	(Constant)	1.649	.162		10.195	.000
	Gender_1	.035	.037	.037	.932	.352
	Age_1	.015	.026	.026	.585	.559
	Region_1	-4.556E-005	.016	.000	-.003	.998
	Land_Size_1	-.073	.020	-.157	-3.627	.000
	Education_1	.015	.015	.041	1.004	.316
	Expectancy	.084	.050	.106	1.689	.092
	Instrumentality	.232	.061	.273	3.791	.000
	Context of Use	.332	.052	.361	6.446	.000
5	(Constant)	.626	.156		4.018	.000
	Gender_1	-.002	.031	-.002	-.071	.944
	Age_1	.006	.021	.010	.269	.788
	Region_1	-.003	.013	-.007	-.219	.827
	Land_Size_1	-.057	.017	-.121	-3.370	.001
	Education_1	.032	.013	.084	2.486	.013
	Expectancy	-.051	.043	-.064	-1.193	.234

Instrumentality	.210	.051	.248	4.141	.000
Context of Use	.264	.043	.287	6.120	.000
Usability Measures	.458	.035	.481	12.932	.000

a. Dependent Variable: Intrinsic Motivation

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.288[a]	.083	.071	.41357	.083	6.744	5	372	.000
2	.493[b]	.243	.231	.37617	.160	78.655	1	371	.000
3	.562[c]	.315	.302	.35832	.072	38.882	1	370	.000

a. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy

c. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.767	5	1.153	6.744	.000[b]
	Residual	63.627	372	.171		
	Total	69.395	377			
2	Regression	16.897	6	2.816	19.902	.000[c]
	Residual	52.497	371	.142		
	Total	69.395	377			

3	Regression	21.889	7	3.127	24.355	.000[d]
	Residual	47.505	370	.128		
	Total	69.395	377			

a. Dependent Variable: Extrinsic Motivation

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

c. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy

d. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.909	.135		14.158	.000
	Gender_1	.038	.046	.043	.833	.405
	Age_1	.105	.030	.190	3.469	.001
	Region_1	-.016	.019	-.042	-.822	.412
	Land_Size_1	.012	.024	.027	.494	.621
	Education_1	-.071	.019	-.196	-3.770	.000
2	(Constant)	.872	.169		5.148	.000
	Gender_1	.008	.042	.009	.187	.852
	Age_1	.083	.028	.151	3.019	.003
	Region_1	-.003	.018	-.008	-.174	.862
	Land_Size_1	-.007	.022	-.016	-.317	.751
	Education_1	-.076	.017	-.209	-4.411	.000
	Expectancy	.312	.035	.410	8.869	.000
3	(Constant)	.503	.172		2.928	.004

Gender_1	.002	.040	.003	.060	.953
Age_1	.052	.027	.095	1.956	.051
Region_1	-.002	.017	-.005	-.113	.910
Land_Size_1	.015	.022	.034	.711	.478
Education_1	-.061	.017	-.167	-3.675	.000
Expectancy	.053	.053	.070	.993	.321
Instrumentality	.356	.057	.439	6.236	.000

a. Dependent Variable: Extrinsic Motivation

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.321[a]	.103	.091	.43725	.103	8.548	5	372	.000
2	.557[b]	.310	.299	.38391	.207	111.542	1	371	.000
3	.592[c]	.351	.339	.37295	.041	23.126	1	370	.000
4	.670[d]	.450	.438	.34394	.099	66.066	1	369	.000
5	.709[e]	.503	.490	.32739	.053	39.229	1	368	.000
6	.726[f]	.528	.515	.31945	.025	19.520	1	367	.000
7	.726[g]	.528	.514	.31987	.000	.046	1	366	.830

a. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy

c. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality

d. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Usability Measures

e. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Usability Measures, Context of Use

f. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Usability Measures, Context of Use, Intrinsic Motivation

g. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Usability Measures, Context of Use, Intrinsic Motivation, Extrinsic Motivation

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.172	5	1.634	8.548	.000[b]
	Residual	71.121	372	.191		
	Total	79.293	377			
2	Regression	24.612	6	4.102	27.831	.000[c]
	Residual	54.681	371	.147		
	Total	79.293	377			
3	Regression	27.828	7	3.975	28.581	.000[d]
	Residual	51.465	370	.139		
	Total	79.293	377			
4	Regression	35.644	8	4.455	37.665	.000[e]
	Residual	43.650	369	.118		
	Total	79.293	377			
5	Regression	39.848	9	4.428	41.307	.000[f]
	Residual	39.445	368	.107		
	Total	79.293	377			
6	Regression	41.840	10	4.184	41.000	.000[g]
	Residual	37.453	367	.102		

	Total	79.293	377			
	Regression	41.845	11	3.804	37.180	.000[h]
7	Residual	37.448	366	.102		
	Total	79.293	377			

a. Dependent Variable: E-Agriculture Usability

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

c. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy

d. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality

e. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Usability Measures

f. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Usability Measures, Context of Use

g. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Usability Measures, Context of Use, Intrinsic Motivation

h. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Usability Measures, Context of Use, Intrinsic Motivation, Extrinsic Motivation

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	2.965	.143		20.799	.000
1	Gender_1	.101	.049	.106	2.068	.039
	Age_1	.000	.032	.000	-.005	.996

	Region_1	.045	.021	.109	2.168	.031
	Land_Size_1	-.074	.026	-.156	-2.877	.004
	Education_1	.077	.020	.199	3.876	.000
2	(Constant)	1.705	.173		9.861	.000
	Gender_1	.064	.043	.067	1.483	.139
	Age_1	-.026	.028	-.044	-.934	.351
	Region_1	.060	.018	.147	3.327	.001
	Land_Size_1	-.097	.023	-.204	-4.283	.000
	Education_1	.072	.017	.185	4.093	.000
	Expectancy	.379	.036	.467	10.561	.000
3	(Constant)	1.409	.179		7.875	.000
	Gender_1	.059	.042	.062	1.421	.156
	Age_1	-.051	.028	-.087	-1.838	.067
	Region_1	.061	.018	.149	3.478	.001
	Land_Size_1	-.079	.022	-.167	-3.547	.000
	Education_1	.084	.017	.216	4.868	.000
	Expectancy	.171	.056	.211	3.083	.002
	Instrumentality	.286	.059	.330	4.809	.000
4	(Constant)	.592	.193		3.068	.002
	Gender_1	.029	.039	.031	.764	.446
	Age_1	-.053	.026	-.089	-2.047	.041
	Region_1	.059	.016	.144	3.625	.000
	Land_Size_1	-.069	.021	-.145	-3.339	.001
	Education_1	.095	.016	.246	5.991	.000
	Expectancy	.060	.053	.074	1.141	.255
	Instrumentality	.238	.055	.275	4.319	.000
	Usability Measures	.355	.044	.366	8.128	.000
5	(Constant)	.520	.184		2.824	.005
	Gender_1	.025	.037	.027	.689	.491

	Age_1	-.018	.025	-.030	-.702	.483
	Region_1	.058	.015	.141	3.746	.000
	Land_Size_1	-.085	.020	-.179	-4.285	.000
	Education_1	.088	.015	.226	5.769	.000
	Expectancy	.035	.051	.043	.697	.486
	Instrumentality	.055	.060	.063	.909	.364
	Usability Measures	.323	.042	.333	7.707	.000
	Context of Use	.319	.051	.340	6.263	.000
6	(Constant)	.354	.184		1.927	.055
	Gender_1	.026	.036	.027	.723	.470
	Age_1	-.019	.025	-.032	-.781	.435
	Region_1	.059	.015	.143	3.889	.000
	Land_Size_1	-.070	.020	-.147	-3.561	.000
	Education_1	.079	.015	.204	5.295	.000
	Expectancy	.049	.049	.060	.988	.324
	Instrumentality	-.001	.060	-.001	-.021	.983
	Usability Measures	.201	.049	.207	4.080	.000
	Context of Use	.249	.052	.266	4.772	.000
	Intrinsic Motivation	.266	.060	.260	4.418	.000
7	(Constant)	.344	.190		1.807	.072
	Gender_1	.026	.036	.027	.717	.474
	Age_1	-.020	.025	-.034	-.806	.421
	Region_1	.059	.015	.143	3.885	.000
	Land_Size_1	-.070	.020	-.147	-3.549	.000
	Education_1	.080	.015	.206	5.191	.000
	Expectancy	.048	.050	.059	.963	.336
	Instrumentality	-.004	.061	-.004	-.061	.952
	Usability Measures	.203	.050	.209	4.035	.000

Context of Use	.246	.055	.262	4.480	.000
Intrinsic Motivation	.266	.060	.261	4.417	.000
Extrinsic Motivation	.011	.050	.010	.215	.830

a. Dependent Variable: E-Agriculture Usability

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.321[a]	.103	.091	.43725	.103	8.548	5	372	.000
2	.557[b]	.310	.299	.38391	.207	111.542	1	371	.000
3	.592[c]	.351	.339	.37295	.041	23.126	1	370	.000
4	.693[d]	.480	.469	.33417	.129	91.876	1	369	.000
5	.694[e]	.481	.468	.33435	.001	.597	1	368	.440

a. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy

c. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality

d. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Intrinsic Motivation

e. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Intrinsic Motivation, Extrinsic Motivation

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.172	5	1.634	8.548	.000[b]
	Residual	71.121	372	.191		
	Total	79.293	377			
2	Regression	24.612	6	4.102	27.831	.000[c]
	Residual	54.681	371	.147		
	Total	79.293	377			
3	Regression	27.828	7	3.975	28.581	.000[d]
	Residual	51.465	370	.139		
	Total	79.293	377			
4	Regression	38.088	8	4.761	42.636	.000[e]
	Residual	41.205	369	.112		
	Total	79.293	377			
5	Regression	38.155	9	4.239	37.923	.000[f]
	Residual	41.138	368	.112		
	Total	79.293	377			

a. Dependent Variable: E-Agriculture Usability

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

c. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy

d. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality

e. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Intrinsic Motivation

f. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Expectancy, Instrumentality, Intrinsic Motivation, Extrinsic Motivation

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.965	.143		20.799	.000
	Gender_1	.101	.049	.106	2.068	.039
	Age_1	.000	.032	.000	-.005	.996
	Region_1	.045	.021	.109	2.168	.031
	Land_Size_1	-.074	.026	-.156	-2.877	.004
	Education_1	.077	.020	.199	3.876	.000
2	(Constant)	1.705	.173		9.861	.000
	Gender_1	.064	.043	.067	1.483	.139
	Age_1	-.026	.028	-.044	-.934	.351
	Region_1	.060	.018	.147	3.327	.001
	Land_Size_1	-.097	.023	-.204	-4.283	.000
	Education_1	.072	.017	.185	4.093	.000
	Expectancy	.379	.036	.467	10.561	.000
3	(Constant)	1.409	.179		7.875	.000
	Gender_1	.059	.042	.062	1.421	.156
	Age_1	-.051	.028	-.087	-1.838	.067
	Region_1	.061	.018	.149	3.478	.001
	Land_Size_1	-.079	.022	-.167	-3.547	.000
	Education_1	.084	.017	.216	4.868	.000
	Expectancy	.171	.056	.211	3.083	.002
	Instrumentality	.286	.059	.330	4.809	.000
4	(Constant)	.555	.183		3.029	.003
	Gender_1	.039	.037	.041	1.053	.293
	Age_1	-.041	.025	-.069	-1.645	.101
	Region_1	.061	.016	.148	3.846	.000

	Land_Size_1	-.052	.020	-.109	-2.575	.010
	Education_1	.073	.015	.189	4.733	.000
	Expectancy	.114	.050	.140	2.272	.024
	Instrumentality	.083	.057	.096	1.454	.147
	Intrinsic Motivation	.474	.049	.465	9.585	.000
5	(Constant)	.529	.187		2.832	.005
	Gender_1	.039	.037	.041	1.046	.296
	Age_1	-.043	.025	-.073	-1.711	.088
	Region_1	.061	.016	.148	3.848	.000
	Land_Size_1	-.052	.020	-.110	-2.589	.010
	Education_1	.075	.016	.194	4.792	.000
	Expectancy	.111	.050	.137	2.216	.027
	Instrumentality	.068	.061	.079	1.122	.263
	Intrinsic Motivation	.478	.050	.469	9.607	.000
	Extrinsic Motivation	.038	.049	.035	.773	.440

a. Dependent Variable: E-Agriculture Usability

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.321[a]	.103	.091	.43725	.103	8.548	5	372	.000

2	.629[b]	.396	.386	.35942	.293	179.548	1	371	.000
3	.706[c]	.498	.489	.32790	.103	75.750	1	370	.000
4	.725[d]	.526	.516	.31922	.028	21.409	1	369	.000

a. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Context of Use

c. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Context of Use, Usability Measures

d. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Context of Use, Usability Measures, Intrinsic Motivation

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.172	5	1.634	8.548	.000[b]
	Residual	71.121	372	.191		
	Total	79.293	377			
2	Regression	31.366	6	5.228	40.467	.000[c]
	Residual	47.927	371	.129		
	Total	79.293	377			
3	Regression	39.511	7	5.644	52.496	.000[d]
	Residual	39.782	370	.108		
	Total	79.293	377			
4	Regression	41.692	8	5.212	51.144	.000[e]
	Residual	37.601	369	.102		

Total	79.293	377			

a. Dependent Variable: E-Agriculture Usability

b. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1

c. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Context of Use

d. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Context of Use, Usability Measures

e. Predictors: (Constant), Education_1, Age_1, Region_1, Gender_1, Land_Size_1, Context of Use, Usability Measures, Intrinsic Motivation

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.965	.143		20.799	.000
	Gender_1	.101	.049	.106	2.068	.039
	Age_1	.000	.032	.000	-.005	.996
	Region_1	.045	.021	.109	2.168	.031
	Land_Size_1	-.074	.026	-.156	-2.877	.004
	Education_1	.077	.020	.199	3.876	.000
2	(Constant)	1.504	.160		9.399	.000
	Gender_1	.058	.040	.061	1.450	.148
	Age_1	.011	.026	.018	.400	.689
	Region_1	.055	.017	.134	3.256	.001
	Land_Size_1	-.096	.021	-.202	-4.532	.000
	Education_1	.075	.016	.194	4.593	.000
	Context of Use	.512	.038	.545	13.400	.000
3	(Constant)	.577	.181		3.195	.002

	Gender_1	.026	.037	.027	.705	.481
	Age_1	-.007	.024	-.013	-.309	.758
	Region_1	.056	.015	.137	3.629	.000
	Land_Size_1	-.086	.019	-.181	-4.438	.000
	Education_1	.087	.015	.224	5.797	.000
	Context of Use	.377	.038	.402	9.892	.000
	Usability Measures	.345	.040	.355	8.703	.000
4	(Constant)	.371	.182		2.041	.042
	Gender_1	.026	.036	.028	.736	.462
	Age_1	-.016	.024	-.027	-.691	.490
	Region_1	.057	.015	.140	3.819	.000
	Land_Size_1	-.068	.019	-.142	-3.501	.001
	Education_1	.080	.015	.207	5.466	.000
	Context of Use	.274	.043	.292	6.325	.000
	Usability Measures	.215	.048	.221	4.495	.000
	Intrinsic Motivation	.271	.059	.266	4.627	.000

a. Dependent Variable: E-Agriculture Usability