ASSESSMENT OF CONTINUED USE OF GEO-POTATO SERVICE FROM TECHNOLOGY ACCEPTANCE PERSPECTIVE

S. M. ASHIK-UZ-ZAMAN

Department of Agricultural Extension and Information System
Sher-e-Bangla Agricultural University

Dhaka-1207

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BY

S. M. ASHIK-UZ-ZAMAN

Registration No. 11-04546

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Approved by:

Md. Mahbubul Alam, PhD
Supervisor &
Professor
Department of Agricultural Extension
and Information System
Sher-e-Bangla Agricultural University
Dhaka-1207

Prof. Md. Abul Bashar
Co- Supervisor &
Professor
Department of Agricultural Extension
and Information System
Sher-e-Bangla Agricultural University
Dhaka-1207

Dr. Muhammad Humayun Kabir
Professor & Chairman
Department of Agricultural Extension & Information System
Sher-e-Bangla Agricultural University
Dhaka-1207

CERTIFICATE

This is to certify that the thesis entitled, **"ASSESSMENT OF CONTINUED USE OF GEO-POTATO SERVICE FROM TECHNOLOGY ACCEPTANCE PERSPECTIVE"** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka in partial fulfilment of the requirements for the degree of **Master of Science (MS) in Agricultural Extension**, embodies the result of a piece of bona-fide research work conducted by **S. M. ASHIK-UZ-ZAMAN, Registration no. 11-04546** under my supervision and guidance. No part of this thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this study has been dully acknowledgement by him.

Dated: JUNE, 2018

Dhaka, Bangladesh

Md. Mahbubul Alam, PhD
Supervisor &
Professor
Department of Agricultural Extension and Information System
Sher-e-Bangla Agricultural University
Dhaka-1207

Dedicated
To
My Beloved
Parents

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ABBREVIATION AND ACRONYMS

AVE	Average Variance Extracted
BARI	Bangladesh Agricultural Research Institute
BBS	Bangladesh Bureau of Statistics
DAE	Department of Agricultural Extension
DoI	Diffusion of Innovation
DSS	Decision Support System
ECM	Expectation-Confirmation Model
ECT	Expectation-Confirmation Theory
EDT	Expectation-Disconfirmation Theory
FAO	Food and Agricultural Organization
GEO-POTATO	GEO-POTATO is a Decision-Support Service (DSS) for farmers in Bangladesh for an optimal control strategy of the late blight disease in potato.
ICR	Internal Consistency Reliability (Composite Reliability)
ICT	Information Communication Technology
IS	Information System
IT	Information Technology
ITD	Innovation Diffusion Theory
MoA	Ministry of Agriculture
PEOU	Perceived Ease of Use
PLS	Partial Least Square
PU	Perceived Usefulness
SEM	Structural Equation Modelling
SPSS	Statistical Package for Social Science
TAM	Technology Acceptance Model
TCRC	Tuber Crop Research Center
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology

ASSESSMENT OF CONTINUED USE OF GEO-POTATO SERVICE FROM TECHNOLOGY ACCEPTANCE PERSPECTIVE

S. M. Ashik-Uz-Zaman

ABSTRACT

The GEO-POTATO is a Decision-Support Service (DSS) for farmers in Bangladesh for an optimal control strategy of the late blight disease in potato. Through development of a DSS based on a combination of satellite information and models infection period late blight can be forecasted. However, the key concern of this study was to determine the salient factors which motivate farmers to continued use of GEO-POTATO service. A theoretical model was proposed based on extended Expectation-Confirmation Theory (ECT) which incorporated with service quality model. Data were collected from 105 farmers from Sadar upazila of Munshiganj district using a structured interview schedule during 15th March-25th March, 2019. Data were analyzed by Partial Least Square-based Structural Equation Modeling (PLS-SEM) using Smart PLS v2.0 M3. Result revealed disconfirmation and post-usage usefulness were two antecedents of satisfaction that combined explained 65.6% of the variance of satisfaction. Satisfaction and post-usage usefulness was used as predictor of continuance intention, they jointly explained 50.7% of the variance of continuance intention. Finally, this model proposed several theoretical and practical recommendation concerning mobile enabled service and strengthening user support service and arrange ICT skill training for sustainability of such approaches like GEO-POTATO.

CHAPTER I
INTRODUCTION

1.1 General Background

Bangladesh is area-wise the third largest potato producer in Asia after China and India and among the top 10 of the potato producing countries in the world. The average area of harvested potato in Bangladesh is 445,000 ha (FAOSTAT, 2013) making it the second major food crop in Bangladesh after rice, which is mainly grown for subsistence. In contrast, potato is grown as the major cash crop during the dry winter season of Bangladesh (December - March). It is estimated that over 750,000 small farmers in Bangladesh produce a potato crop (Egger, 2012). Because of the short growing cycle (approximately 90 days) the returns on investment for farmers are quick and also potentially high compared to other crops that can be grown in the winter season.

Late blight (*Phytophthora infestans*) is the most potential disease threat to the potato crop, accounting for significant annual losses world-wide. It causes 25-57% yield losses in potato. The disease can destroy the entire foliage quickly causing reduced tuber yields. Sporangia released from infected plants are known to be capable of wind borne migration for over several kilometers. The disease is of common occurrence in Bangladesh for over 30 years and causes considerable yield loss. Research on this disease is going on at Tuber Crops Research Centre (TCRC), Bangladesh Agricultural Research Institute (BARI) over several years. Research findings obtained so far on late blight in Bangladesh are presented in brief. The disease is very common and widespread in the county wherever potato is grown with varying degree of severity. Severe infestation of late blight occurrence was recorded in 2006-07 crop season where the mean disease incidence in the country ranged 50.0-78.4%. Recently in a study under natural condition yield loss has been estimated 17.44, 25.23 and 35.84%, respectively from BARI TPS-1 (MR), Dheera (T) and Chamak (S). In general, the disease appears during the first week of January when the day temperature range 14-19°C

and night temperature 9-13°C accompanied with foggy weather and heavy deposition of dew. Late blight periodically destroys the potato crop with the last major incident reported in the potato growing season of 2006-2007 when between 50% to almost 80% of the yield was destroyed nationwide. (Dey, et al., 2010).

GEO-POTATO is one of the projects funded within the Geodata for Agriculture and Water (G4AW) facility, which improves food security in developing countries by using satellite data. Netherlands Space Office (NSO) is executing this program, commissioned by the Dutch Ministry of Foreign Affairs. GEO-POTATO project initiate in Bangladesh to develop a decision-support service for farmers for an optimal control strategy of the late blight disease in potato.

1.2 What is GEO-POTATO?

The GEO-POTATO is a Decision-Support Service (DSS) for farmers in Bangladesh for an optimal control strategy of the late blight disease in potato. Late blight (*Phytophthora infestans*) is a highly infectious and destructive fungal disease in Solanaceae crops, i.e. among others potatoes and tomatoes. Especially under favorable weather conditions, i.e. temperatures between 12° and 25°C and a relative atmospheric humidity >85%, the disease spreads very quickly through wind and water and can have devastating effects on the potato crop and production. Through development of a DSS based on a combination of satellite information and models infection period late blight can be forecasted. A timely advice through mobile phone for the application of an appropriate fungicide can help farmers to prevent the infection of the potato crop with late blight.

The GEO-POTATO project has selected Munshiganj as region to develop and introduce the service in the season 2016/2017. Upscaling of the service to the Rangpur region is foreseen in the season 2017/2018. Baseline studies are carried out in both Munshiganj and Rangpur to better understand the needs, practices and performance of farmers, and the context of potato farming in these regions.

1.3 What is DSS?

DSS are interactive, computer-based systems that aid users in judgment and choice activities. They provide data storage and retrieval but enhance the traditional information access and retrieval functions with support for model building and model-based reasoning. They support framing, modeling, and problem solving.

Typical application areas of DSSs are management and planning in business, health care, the military, and any area in which management will encounter complex decision situations. Decision support service are typically used for strategic and tactical decisions faced by upper-level management decisions with a reasonably low frequency and high potential consequences in which the time taken for thinking through and modeling the problem pays off generously in the long run.

1.4 Statement of the Problem

The last decades has seen an increasing body of Information Communication Technology (ICT) application based research on information Technology (IT) use. Based on Innovation Diffusion Theory (ITD) (Rogers, 1995) and Technology Acceptance Model (TAM) (Davis, et al., 1989), these studies have explained variables that motivate individuals to accept a new ICT application, and how they do it. While initial acceptance of IT application is an important first step toward realizing its success, long-term viability of that and its eventual success depend on its continued use rather than first-time use. Understanding continued use of GEO-POTATO is the goal of this study.

The Expectation Confirmation Theory (ECT) (Bhattacherjee, 2001) is one of the most widely cited models for evaluating IT continuance, and this model has been extended to other study backgrounds, or expanded with other theoretical perspectives.

ECT describes the comparison between pre-adoption expectation and post-adoption perceived performance as a means to determine users' satisfaction of a

service (GEO-POTATO); satisfaction is thus the antecedent of continuance intentions. After some time using the service (GEO-POTAOTO), a user will gain experience and understand the performance of the service (GEO-POTATO), forming a new cognition. The user will compare this new cognition with his or her initial expectation to ascertain whether the assessment is identical, which is called confirmation. When user expectation is lower than the actual performance of the service (GEO-POTATO) cognition, the result is a negative confirmation. The confirmation level affects user satisfaction, and the satisfaction level affects user continued use of GEO-POTATO service. This leads to the following research questions:

1. What are the salient motivational factors underlying user's intention to continued using GEO-POTATO service after its initial acceptance?
2. To what extent this motivational factors contribute users' continued use of GEO-POTATO?
3. What factors influence users' continued use of GEO-POTATO service?

1.5 Objectives of the Study

Based on the issue explanations made in section 1.4, the objectives of this study mentioned below:

1. To identify the salient factors that motivate the continued use of GEO-POTATO.
2. To determine the extent of continued use of GEO-POTATO.
3. To explore the contribution of selected factors for continued use of GEO-POTATO.

1.6 Justification of the Study

Potato is the third most important crop in Bangladesh. In respect of nutrient, potatoes are comparable with rice and wheat. It can easily be digestible. Although potato is a temperate crop, it can be grown in most parts of the country during the

winter season. It is being cultivated in Bangladesh since 1960 from exotic varieties specially brought from the Netherlands. At present, potato is grown in about 4.61 lac hectares of land to produce 84 lac tons (Chowdhury and Hasan, 2013). The average yield of potato is 13.32-18.08 ton/ha (BBS, 2012, 2011). Its production can be increased up to 30-40 ton/ha using high yielding varieties and improved production technology (Chowdhury and Hasan, 2013). Moreover, in recent years, potato has become an important crop for food security, especially during extreme flooding during the monsoon. Potato is the only crop for which seed stocks are kept in cold stores ready for immediate planting after floods. At present nearly 460thousand hectares (ha) of cultivable land is under potato cultivation and the country produced 8,326 thousand tons potato in the year 2010-2011 (BBS, 2012). In the scenario of Bangladesh, after the rice (Boro-irrigated rice, Aman-rainfed rice, Aus-short duration rice), potato is the second most important crop in terms of consumption in some parts of the country such as Munshigonj district. Recently, it has become important and popular food crop because of quick economic return and its multiple uses as vegetable and delicious processed items. In spite of having great potential and scope, there are many challenges for successful production of potato in Bangladesh. It suffers from many pests and diseases among which late blight, caused by the *Phytophthora infestans*, is the worst. The disease is still causing major damage in many potato production areas and control is only possible by applying fungicides frequently. GEO-POTATO developed a DSS dependent on a combination of satellite data and models disease period late bight can be determined. A convenient advice through cell phone for the use of a suitable fungicide can assist farmers with preventing the contamination of the potato crop with late blight. However this thesis is important because initial acceptance of GEO-POTATO is an important first step toward realizing GEO-POTATO success, long term viability of GEO-POTATO service and its eventual success depend on its continued use rather than first time use. Hence this study seeks to find out what are the salient motivation underlying user's intention to

continue using GEO-POTATO after its initial acceptance. This study is further important in order to understand extent this motivation contributes continuance intention of GEO-POTATO. It will be useful to researchers, scholars and organizations who are interested in understanding the continuance of an IT use. On the other hand this study may facilitate to identify the factor that motivate farmer to reuse of GEO-POTATO. From academic perspective, findings of this study and the methodology used in this study would inspire other researchers to conduct further investigation. Finally, the findings of this study will hope to provide insights to the policy makers on how to develop, and capitalize ICT based tools for effective extension service in Bangladesh.

1.7 Scope and Limitations of the Study

This study is driven with a view to surveying continuance use of GEO-POTATO service by the farmers. Regardless, with a particular true objective to make the examination reasonable and critical, the going with repressions have been viewed as all through the investigation:

1. The study was conducted in one upazila namely Munshiganj Sadar under Munshiganj district.

2. There are various factors that may impact with continued use of GEO-POTATO, anyway just couple of factors which regarded essential and consistent with the investigation setting were considered for this examination.

3. Farmers which are using GEO-POTATO over 1 year were considered as the respondents of this study.

4. This study utilized self-reflected perceptual variables which may influence certain interpretations of the findings.

5. Survey was conducted with a relatively smaller sample size which might limit the generalizability of the findings.

1.8 Assumptions of this Study

The researcher made the accompanying suspicions while undertaking this study:

1. The farmers incorporated into the sample of the study were sufficiently able to fulfill the quarries outlined by the researcher.

2. The data outfitted by the respondents were right and illustrative of the populace and free from any inclination.

3. Environmental conditions and organizational procedures under which the GEO-POTATO project area are generally similar throughout the study area.

4. Ecological conditions and authoritative methodology under which the GEO-POTATO project are for the most part comparative all through the study territory.

5. Data furnished from the respondents were normally distributed.

1.9 Definition of the Terms

This study intended to determine farmers' continuance intention of GEO-POTATO, and the salient factors that might affect their intention to continue use of this service. Before further discussion, some key concepts and definitions of the terms are presented in this section.

Concept	Definition
DSS	DSS are interactive, computer-based systems that aid users in judgment and choice activities. They provide data storage and retrieval but enhance the traditional information access and retrieval functions with support for model building and model-based reasoning. They support framing, modeling, and problem solving (Druzdzel and Roger, 2000).

GEO-POTATO	GEO-POTATO is a Decision-Support Service (DSS) for farmers in Bangladesh for an optimal control strategy of the late blight disease in potato.
Information Technology	Information technology (IT) is the use of computers to store, retrieve, transmit, and manipulate data or information, often in the context of a business or other enterprise. IT is considered to be a subset of information and communications technology (ICT). An information technology system (IT system) is generally an information system, a communications system or, more specifically speaking, a computer system – including all hardware, software and peripheral equipment – operated by a limited group of users. (Wikipedia, 2019)
Post-Usage Usefulness	Post-usage usefulness reflects a long-term, transaction-invariant belief aggregated from prior usefulness perception (Lee, et al., 2010).
Disconfirmation	Disconfirmation, the user's level of satisfaction with the service is determined by the user's initial expectations (pre-adoption expectation) on a service and discrepancies between expectations and service performance (Khalifa, et al., 2002).
IT Self-efficacy	IT self-efficacy reflects users' conviction and his/her ability to independently perform an intended behavior (Bhattacherjee, et al., 2007).

Satisfaction	Satisfaction is a transaction-specific short-term affect based on the immediately preceding usage experience (Veloutsou, et al., 2005).
User Support	The consumer's judgment about (a service interaction's) overall excellence or superiority (Verma, 2012).
Continuance Intention	Continuance intention is defined as an individual's intention to continue using an information technology (in contrast to initial use or acceptance) (Bhattacherjee, 2001).

CHAPTER II
REVIEW OF LITERATURE

The goal of this Chapter is to review the after-effects of a portion of the prior examinations and prominent articles having relevance to this enquiry. The researcher attempted to aggregate required findings by studying corresponding theses, writings, periodicals, professionals and academic journals and the Internet. To address the search objectives, this study reviews the existing literature which deemed relevant to the phenomenon of interest such as expectation-disconfirmation literature, Information and Communication Technology (ICT) continuance intention literature and proposes a theoretical understanding of the current investigation into three sections. The first section is concerned with the review of literature of the on the concept of Expectation-Confirmation Theory (ECT) and ICT/IT continuance intention and shows how ECT encourages IT continuance intention. The second section demonstrate the salient factors that might influence farmers to continued use of GEO-POTATO service. Third and the final section proposes a conceptual framework of this study based on the discussion presented in the first two sections.

2.1 Expectation-Confirmation Theory and its Relation to IT/ICT Continuance intention

This section first presents the concept of Expectation-Confirmation Theory (ECT) and then discuss the importance of this theory for technology continuance. Lastly, it describes how ECT plays a vital role in technology acceptance and continuance.

2.1.1 Concept of Expectation-Confirmation Theory (ECT)

ECT is widely used in the user (here farmer) behavior literature to study user satisfaction, post-purchase behavior (e.g., repurchase, complaining), and service marketing in general (Anderson and Sullivan, 1993; Dabholkar et al., 2000; Tse and Wilton, 1988). The predictive ability of this theory has been demonstrated over a wide range of product repurchase and service continuance contexts (Oliver, 1993).
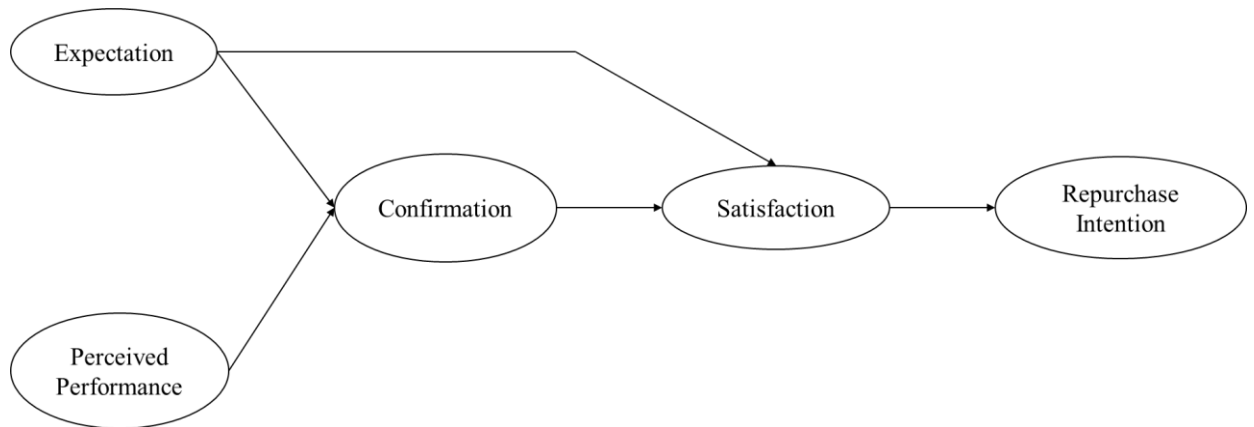
Figure 2.1 Expectation-Confirmation Theory (Oliver, 1980)

The process by which farmers reach continuous use intention in favor of any technology in an ECT framework is described as follows. First farmers form an initial expectation of a specific product or service prior to adoption. Second, they accept and use that product or service. Following a period of initial consumption and/or use of technology, they form perception about its performance. Third, they assess its perceived performance vis-à-vis their original expectation and determine the extent to which their expectation is confirmed or disconfirmed. Fourth, they form a satisfaction or affect, based on their confirmation level and expectation on which that confirmation was based. Finally, satisfied farmers form a repurchase intention, while dissatisfied users' discontinuance its subsequent use.

ECT focuses on the factors affecting farmers' satisfaction, GEO-POTATO service repurchase, and service issues. The main ideas of ECT follow two dimensions: farmer expectations before using service and perceived performance after using services. Farmers' expectation may affect their attitudes toward products or services and after they purchase a product or service they may compare their initial expectation with post-perspective performance. After farmers purchase or use a product/service, they generate positive or negative attitude that effects their satisfaction. If consumers' pre-expectation are lower than post perceived performance, positive disconfirmation leads to their satisfaction. Consumer

satisfaction has a positive effect on their continuous intentions; when consumers experience greater satisfaction, they have greater repurchase intention.

ECT is broadly applied to examine the continuance intention of Information system (IS) users. In practice model replaces pre-consumption expectation by post-consumption expectation. (Hossain and Quaddus, 2011). In marketing literature, this model demonstrates how a user (here farmers) reach a repurchase intention. First, farmer form initial expectation about a specific service prior to use; mainly based on prior experience and existing knowledge (Zeithaml and Berry, 1990) plus through interactions with different members of the communication channels (Rogers, 1995). Through mass-media advertising, package information, media reports, and interviews, consumers come across about product information. Furthermore, they learn more about the products from interpersonal communication channel includes personal selling, feedback from prior users, advice from opinion leaders, and formal or informal discussions among peer consumers (Premkumar and Bhattacherjee, 2008; Rogers, 1995). For a same service, the quality of expectations, therefore, may vary across farmers (Tse and Wilton, 1988) depending on the quality and reliability of the communication channel and/or information source. Unrealistic expectations can be generated because of wrong and misleading information and by lack of product knowledge. For example, based on the product information, a consumer may perceive the performance level of the product (Boulding, et al., 1994; Oliver, 1980), but if the information itself is misleading or overstating, the expectations will be unrealistic, which would affect the whole satisfaction-intention process (Spreng, et al., 1996). Second, if they perceive the service as useful, they accept, purchase, and use it. Following a period of initial consumption, they form perceptions about its performance. Third, they assess the perceived performance of the product/service based on their initial expectation and determine the extent to which their expectation is confirmed (confirmation, also called as disconfirmation). If the

product performs better than expected (i.e., perceived performance is greater than expectation), a positive disconfirmation is expected to occur. Alternatively, if the consumers' evaluation about the product falls below the expectation (i.e., perceived performance is less than expectation), a negative disconfirmation occurs. And in case, if the product performance just matches with the expectation a "simple confirmation" is expected to occur. Based on their confirmation of the expectation the consumers form a level of satisfaction. Positive disconfirmation (performance > expectation), even simple confirmation (performance = expectation) strengthens consumers' attitude toward the product and forms a sense of satisfaction (Oliver and DeSarbo, 1988; Erevelles and Leavitt, 1992). However, negative disconfirmation (performance < expectation) leads to weaken the positive attitude toward the product and form a sense of dissatisfaction. Finally, satisfied consumers are expected to form a repurchase intention while dissatisfied users are expected to discontinue its subsequent use and/or search or switch for a substitute product. Studies also find that dissatisfied consumers would still repurchase due to lack of alternatives, convenience, etc. (Brady and Cronin, 2001; White and Yu, 2005). Furthermore, a number of satisfied consumers may still not repurchase (Reichheld, 1993).

ECT is however not beyond of limitation which lies in its "expectation generation" processes. In ECT, the process of expectation generation is derived from expectancy theory (Tolman, 1932; Oliver and Winer, 1987; Oliver and Burke, 1999). In line with these studies, literature finds that expectation can be generated from many sources including prior experience, desire, attitude to a particular product/service, and both personal and commercial communications. For a consumer product, even without having any specific and defined expectations, a customer may intend to and purchase a product. The same thing might happen to mandatory IS users (Khalifa and Liu, 2004). But generally, it is quite unlikely to purchase an IS without having a set of expectations. To make the things even more

complicated, the novelty element of IS may cause to form a distinguished set of expectations which vary significantly from user to user (e.g., online shopping). Hence, the traditional ECT has the limitation in explaining IS expectation formation process (Khalifa and Liu, 2004). Moreover, ECT mainly focuses on consumers' repurchase intention of product/service, dealing with the belief about and attitude toward a product/service's attributes or performance (Olson, et al. 1979). It cannot capture the IS products'/services' quality factors (system quality, information quality, and service quality) and hence cannot fully explain the notion of end-user satisfaction of IS systems (for detail, see Khalifa and Liu, 2004).

Also ECT needs to be modified in defining the subject as ECT deals with consumers rather than with customers (though sometimes these are used interchangeably), as traditionally, customer pays for a product/service whereas consumer consumes/uses the product/service; though both can be the same person. However, in IS context, it needs to be the "user": the actual consumer of an IS.

In order to study users' continued usage behavior of IS products/services, Expectation-Confirmation model (ECM) was first proposed by Bhattacherjee (2001).

The model is predominantly concentrated on post-acceptance variables (such as "post-usage expectations" which the author named as "perceived usefulness") rather than on "pre-use expectations" because ECM posits that "the effects of any pre-acceptance variables are already captured within the confirmation and satisfaction constructs" (Bhattacherjee, 2001, p.355). However, as the "perceived usefulness" is often misinterpreted and confused with the pre-usage "perceived usefulness" of technology acceptance model (TAM) (Davis, et al., 1989), in proposing the extension of ECM, Bhattacherjee, et al., (2008) suggested using "post-usage usefulness" which reflects a long-term belief aggregated from prior usefulness perceptions. ECM also emphasizes that post-consumption expectations are more important because expectations are changed or get modified with time as

is often the case of IS use. Therefore, ECM replaced the expectation construct of ECT by post-usage perceived usefulness. ECM also took the IS context and renamed the repurchase intention to continued usage intention. Moreover, and more importantly, ECM defined confirmation as "the congruence between expectation and actual performance" (Bhattacherjee, 2001, p.359) and removed the performance construct of ECT because ECM assumes that the influence of perceived performance is already explained by confirmation. ECM posits that an individual user's intention for continued use of an IS is dependent on three variables: the user's level of satisfaction with the IS, the extent of user's confirmation of expectations, and post-usage perceived usefulness.

The process by which IS users reach a continued use decision is as follows (Bhattacherjee, 2001). First, after using a particular IS for a period of time the users' form a conception of perceived usefulness, which is expected to be the most salient ex-post factor influencing user's post-acceptance effect (e.g., satisfaction) about that particular IS. Second, the users determine to what extent their perception of usefulness about that IS has been confirmed, by comparing the performance of the IS to the perception of usefulness. If the user finds that the product/service is as useful as he/she perceived, he/she forms a notion of satisfaction. Finally, satisfied users intend to continue the usage of that IS whereas dissatisfied users intend to discontinue the service; though sometimes they cannot really discontinue because of some external factors (e.g., mandatory use). However, users' perception on usefulness also drives them directly to continuance intention because when they find a product/service is useful to their needs, they do not bother to go through the confirmation process, rather they form a direct intention toward reusing the product/ service; and vice versa. Moreover, the confirmation has an immediate effect on users' satisfaction as well as a longer-term effect on their post-usage usefulness perception (Bhattacherjee, et al., 2008).

2.1.2 Concept of Information Technology (IT) continuance model

The IT continuance model has its origins in the expectation disconfirmation theory (EDT) developed by Oliver (Oliver, 1980) in the marketing literature. EDT was designed to explain the determinants and outcomes of consumer satisfaction and dissatisfaction in product repurchase and service retention contexts. This theory proposes that consumers go through a multi-stage process while making product repurchase decisions. First, before using it for the first time, they form an initial expectation about a product, based on marketing initiatives, media reports, feedback from prior users and so forth. Then, they use the product for a period of time and assess the extent to which their actual product experience matched their initial expectations. This match, termed disconfirmation in EDT, and their initial product expectations are postulated to jointly determine users' extent of satisfaction or dissatisfaction with that product. Satisfaction, an evaluative affect resulting from users' transactional experience with the product, influences their intentions to repurchase that product, such that satisfied users continue using it while dissatisfied users stop using it.

Since its inception, several variations have been proposed to the original EDT model described above. For instance, Churchill and Suprenant (Churchil, et al., 1982; Tse and Walton, 1988) suggested perceived product performance as an additional determinant of disconfirmation and/ or satisfaction. Others (e.g.,Spreng et. al., 1996) have dropped the association between initial expectations and satisfaction, suggesting that the effect of expectation on satisfaction is fully mediated by disconfirmation, discounting Oliver's (1980) use of expectations as a predictor of satisfaction.

In adapting EDT to the specific case of IT products and services, Bhattacherjee (2001) proposed several extensions and modifications to the original model. These changes were grounded within prior knowledge of long-term (longitudinal) IT acceptance and usage and several auxiliary theories, such as self-perception theory

and cognitive dissonance theory. First, this study claimed that measurement of initial expectations as a predictor of disconfirmation and/or satisfaction is applicable only to those contexts where expectations remain reasonably stable over time. For instance, IT vendors routinely add new features and capabilities in later versions of their products to enhance user expectations. Further, users may have varied expectations of IT products and services, even when provided with identical information from vendors and/or third party sources. Some users form unrealistically high expectations, which when negatively disconfirmed, are lowered to more reasonable levels during the post-adoption phase. Others may initially have low expectations, if they are unsure of exactly what to expect from IT usage, which may increase during the post-adoption stage if they discover unanticipated benefits during actual usage experience. Under circumstances of changing expectations, (Bhattacherjee, 2001) argued that initial or pre-adoption expectations, which predicts IT acceptance well, is less salient to predicting long-term continuance, and that post-adoption processes such as continuance should instead focus on post-adoption expectations that are based on actual usage experiences rather than on vendor or third-party information.

Second, drawing from longitudinal studies of IT acceptance and use, the IT continuance model postulated perceived usefulness, defined as users' perceptions of the instrumentality or benefits of IT usage, as the most salient post-adoption expectation related to IT continuance (Bhattacherjee, 2001). Instrumentality considerations are known to be the primary consideration underlying IT usage in the workplace, and are empirically found to be stable predictors of usage in both initial and long-term usage contexts (Davis, et al., 1989; Krahanna, et al., 1999). Though other beliefs, such as the ease of use of an IT and its compatibility to work procedures, may predict initial usage, research has also observed that the effects of these beliefs tend to wear out over time as users gain experience with the target IT and are displaced by instrumentality or usefulness considerations (Krahanna et al.,

1999). In view of the observed salience of perceived usefulness in predicting long-term IT usage behaviors, the IT continuance model postulated perceived usefulness as having a direct positive effect on continuance intention over and above the indirect effect mediated by satisfaction (see Figure 2.2). The rationale for this direct association was that users may sometimes intend to continue using an IT if they believe that such usage will eventually improve their performance, even if such performance gains were not realized during prior usage experience. In other words, users who are negatively disconfirmed and dissatisfied with prior IT usage may still continue using an IT if they consider it to be useful in their work.
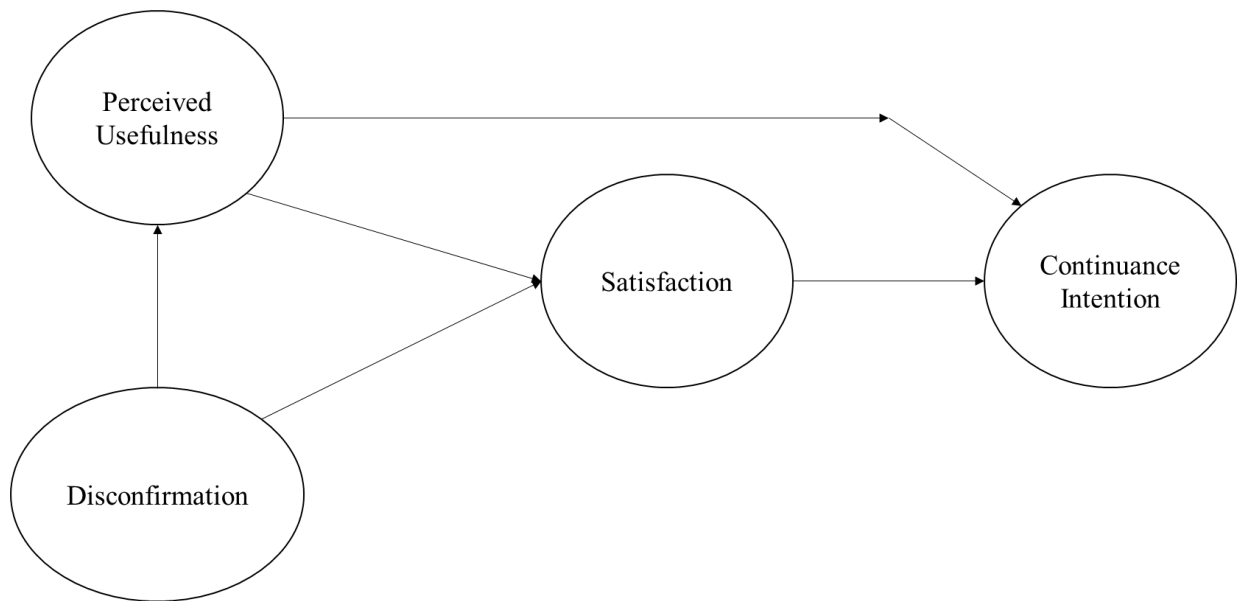
Figure 2.2 IT Continuance Model (Bhattacherjee, 2001)

Third change proposed in the IT continuance model is a direct positive association between disconfirmation and perceived usefulness. Extending Festinger's (1957) cognitive dissonance theory, Bhattacherjee (2001) proposed that disconfirmation of expectations, by virtue of its effect on satisfaction and intention, influences not only future behavior, but also future perceptions, such as post-adoption expectations of usefulness. This is because disconfirmation is an instance of cognitive dissonance, and when faced with such dissonance, users try to adjust

their behavior, perceptions, or both to minimize the psychological effect of dissonance.

Lastly, Bhattacherjee (2001) proposed a positive relationship between perceived usefulness and satisfaction. The rationale for this relationship was that since most attitude theories such as the theory of reasoned action (TRA) (Ajzen, 1980) and the theory of planned behavior (TPB) (Ajzen, 1991) posit attitude (an affect) as a mediator between cognitive beliefs and intention, and satisfaction, being the most salient affect in the continuance context, may well mediate the effect of perceived usefulness on continuance intention.

2.1.3 Information Technology continuance usage intention

Continuance usage intention has been the subject of significant theoretical developments and empirical advances under a mixture of terms, such as IS continuance (Bhattacherjee, 2001; Limayem, Hirt and Cheung, 2007), post-adoptive IT usage (Jasperson, et al., 2005), and IT usage (Bhattacherjee and Premkumar, 2004; Kim and Malhotra, 2005). IS continuance or IS continuous usage represents behavioral patterns reflecting continued use of a particular IS. Continuance refers to a form of post adoption behavior. Although the term post-adoption actually indicates to a suite of behaviors that follow initial acceptance, including continuance, routinization, infusion, adaptation, assimilation, etc., in the literature it is often used as a synonym for continuance (Limayem, et al., 2007). Continuance intention was considered as the dependent variable rather than continuance behavior.

Bhattacherjee's (2001) model of IS continuance includes three variables: user satisfaction, the confirmation of expectations through prior IS use, and perceived usefulness (PU) that represents post-adoption expectations. ECT has a solid theoretical foundation and focuses on the motivations for individual users' IS continuance intentions that emerge in the IS post-adoption stage (Bhattacherjee, 2001). Later, many studies attempted to advance IT continuance research by using

other theories. Different researchers defined various definitions for continuance intention, for example Jasperson, et al., (2005) defined "post-adoptive behavior as the myriad feature adoption decisions, feature use behaviors, and feature extension behaviors made by an individual user after an IT application has been installed, made accessible to the user, and applied by the user in accomplishing his/her work activities" (Jasperson, et al., 2005). Limayem, et al., defined "IS continuance is not a one-time event, but may better be envisioned as the result of a series of individual decisions to continue using a particular IS, thereby reflecting its longitudinal nature." (Limayem, et al., 2007). Chang defined "the degree to which an individual is willing to use systems in the future and to recommend it to others (e.g. friends) in the future." (Chang, 2013). Lu defined "continuance intention is a mental state reflecting an individual's decision to repeat her current behavior and can be compared to intention to repurchase in marketing." (Lu, 2014). In this study we investigate what are the underlying or salient factor of users' continuance intention of any product or service. Above literature we find that user satisfaction, confirmation/disconfirmation and perceived usefulness is the salient factor which influence users to continuance use intention of any product.

2.2 Identification of Salient Factors of Continuance Intention of GEO-POTATO Service Use

Understanding the farmers' continuance intention of GEO-POTATO service is the key focus of this study. Review presented in section 2.1.3 already revealed the Expectation-Confirmation of IS continuance. Therefore, it can be concluded that expectation-confirmation theory is the key motivator for the GEO-POTATO service continuance intention. However, it is important to know what drives farmers to continue use of GEO-POTATO service. There are many factors that might have influence over user's decision to use any system. Rather than selecting the factors arbitrarily or using a grounding approach (Martin and Turner, 1986), this study adopted a theoretical approach to determine the drivers of continuance intention of farmer to use GEO-POTATO service. There have been several models

in agricultural extension, information system or technology adoption literature that explain why people use a particular system. Similar to ECT most ECM studies concentrated on individual-level decision (e.g., intention to continued use of a specific computer application) rather than organizational decision (e.g., will repurchase a specific software or IS) or national-level decision (e.g., whether to go for electronic voting more extensively). Every empirical study dealt with the individual-level satisfaction or individual-level continuance intention behavior rather than study the organization-level variables. To study the continued usage intention of IS product/services, literature largely depends on the ECT and its successor, ECM; along with a large body of research theories.

IS Continuance Model

Oliver (1980) first proposed expectation–confirmation model (ECM). Based on ECM: a theory widely used in the consumer behavior literature to study consumer satisfaction, post-purchase and service marketing in general, Bhattacherjee suggested an extended model integrating ECM and the technology acceptance model (TAM) (Davis, 1989) with the belief component of perceived usefulness (PU). Based on the continuance use of IS, IS continuance intention is expected to depend on three variables: user satisfaction; the confirmation of expectations through prior IS use; and PU represents post-adoption expectations. Bhattacherjee proposed that satisfaction with IS use is a salient predictor of users' continuance intention, followed by PU as a significant but weaker predictor. Confirmation and PU are major determinants of satisfaction (Bhattacherjee, 2001; Yuan, et al., 2014). The ECT suggested by Bhattacherjee is based on a solid theoretical foundation that focuses on the motivations for individual users' IS continuance intentions during IS post-adoption stage (Limayem, et al., 2007). Research showed that factors influencing continuance decisions are different from those affecting initial acceptance. For example, ease of use is no longer a significant determinant of the post-adoption stage (Karahanna, et al., 1999).

Researchers integrated the originally proposed ECT with complementary theoretical perspectives and different constructs. For example, Lin et al. (2005) proposed an extended ECT by adding perceived playfulness to investigate web site continuance intentions. Tang, et al., (2014) suggested a body of research theories extended ECT by incorporating experiential learning and perceived self-efficacy to examine blog continuance learning behavioral intentions.

Technology Acceptance Model (TAM)

The technology acceptance model is an adaptation of technology reasoned action (TRA) for the field of IS (Davis, 1989). TAM originated from TRA and has two main constructs, PU and perceived ease of use (PEOU). PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, Bagozzi and Warshaw, 1989). PEOU is defined as "the degree to which a person believes that using a particular system would be free from effort" (Davis, et al., 1989). Further, TAM suggests that PU is impacted by PEOU. TAM is often considered as one of the most influential and most often used theories in acceptance of information systems (Benbasat and Barki, 2007; Lee, Kozar and Larsen, 2003; GAO, Krogstie, Chen and Zhou, 2014).

Theory of Planned Behavior (TPB)

TPB is a seminal theory connecting belief systems with actual behavior, aiming at its explanation and even prediction (Ajzen, 1991). Ajzen extended the TRA theory to establish TPB. TPB adds to TRA by incorporating perceived behavioral control. TPB postulates three conceptually independent predictors; namely attitudes, subjective norms, and perceived behavioral control. This theory aims to explain voluntary behavior, based on a conscious decision of the actor (Ajzen, 1991).

Some researchers used TPB to explain IT continuance intention. Al-Debei, et al., (2013) extended TPB through the inclusion of perceived value construct and used the extended theory to explain users' continuance participation intentions and

behavior on Facebook. Another example, Courtois, et al., (2014) adopted a TPB approach to verify the dynamic nature of students' acceptance of the tablet as a learning tool at three waves of data collection, both at pre- and short and long-term postadoption stages.

Elsewhere, Kim and Malhotra (2005) found that IT continuance intention was influenced by PU and PEOU as well as prior usage experience. For example, Wu and Zhang, (2014) proposed a unified model integrating the TAM, the IS success model and social motivation theories to investigate continuance intentions towards E-Learning 2.0 in an organizational context. Research on IT continuance intention makes use of a variety of key theories and models. Table 2.1 described different models including IS Continuance Model, Technology acceptance model (TAM), Theory of planned behavior (TPB), Theory of reasoned action (TRA), Unified Theory of Acceptance and Use of Technology (UTAUT).

Table 2.1 Literature analysis of ECT use in the IS area

Reference	Research type	Discipline area	Independent constructs	Dependent construct	Theories used
Bhattacherjee (2001)	Empirical	Online brokerage	Confirmation, satisfaction, perceived usefulness	Continuance intention	ECT, ECM
Bhattacherjee (2001)	Empirical	Online banking	Perceived usefulness, confirmation, satisfaction	IS continuance intention	ECT, TAM,
Hsu, et al. (2004)	Empirical	Service	Disconfirmation, Satisfaction, self-efficacy	Continuance Intention	ECT

Table 2.1 Literature analysis of ECT use in the IS area (Continued)

Reference	Research type	Discipline area	Independent constructs	Dependent construct	Theories used
Bhattacherjee and Premkumar(2004)	Empirical and qualitative	Computer based training	Disconfirmation, satisfaction	Continued intention	ECT
Lin, et al., (2005)	Analytical	Internet service	Confirmation, satisfaction, perceived usefulness	Continuance intention	ECT
Cheung, et al., (2005)	Critical review	Online service	Intention	Continuance intention	ECT
Chiu, et al., (2005)	Empirical	e-learning	Satisfaction, perceived usefulness	Continuance intention	ECT
Roca, et al., (2006)	Empirical	e-learning service	Disconfirmation, satisfaction, post usage usefulness	Continuance intention	ECT
Thong, et al., (2006)	Empirical	Internet Service	Disconfirmation, satisfaction, post-usage usefulness	Continuance intention	ECT
Hsu, et al., (2006)	Empirical	Online shopping	Disconfirmation, satisfaction, post-usage usefulness	Continuance intention	ECT
Hayashi, et al., (2004)	Conceptual	Database application	Post-usage usefulness, disconfirmation, satisfaction, self-efficacy	IS continuance intention	ECT, TAM
Limayem, et al., (2007)	Empirical	Internet service	Disconfirmation, satisfaction,	IS continuance intention	ECT

Table 2.1 Literature analysis of ECT use in the IS area (Continued)

Premkumar and Bhattacherjee (2008)	Empirical	Service	Post-usage usefulness, disconfirmation, satisfaction	Continuance intention	ECT
Doong and Lai (2008)	Empirical	Internet service	Disconfirmation, satisfaction	Continuance intention	ECT
Limayem and cheung (2008)	Empirical	IS use	Disconfirmation, post-usage usefulness	Continuance intention	ECT
Yen and lu (2008)	Empirical	Online service	Disconfirmation, satisfaction	Continuance intention	ECT
Liao, et al., (2009)	Empirical	IT adoption	Disconfirmation, satisfaction, post-usage usefulness	Continuance intention	ECT

We defined user support as "the consumer's judgment about [a service interaction's] overall excellence or superiority" (Parasuraman, Zeithaml and Berry, 1988 p. 15). Attitude has been defined most broadly as "An evaluation of the attitude object" (Fiske and Taylor, 1991). Similarly, Fishbein and Ajzen (1975). argued that "affect is the most essential part of the attitude concept" and that an attitude can be described as "a general evaluation or feeling of favorableness toward the object in question" (1975, p.11) Furthermore, Fishbein and Ajzen proposed that concepts that are susceptible to bipolar evaluation (that is, as favorable or unfavorable), such as attraction, value, sentiment, valence, and utility, should be subsumed under the category of attitude. User support can be considered to be an attitude regarding a service interaction. Previous research has shown that customer evaluations of service quality affect a range of customer behaviors that are profitable for organizations. For example, Zeithaml, Berry and Parasuraman (1996) provided evidence of a link between user support and customers' loyalty to

an organization and willingness to pay a premium for the service that organization offers.

Over the years, a number of modifications and changes have been observed in the theories of ECT. Bhattacherjee, et al., (2008) proposed an extended IT continuance model which we discussed 2.1.3 section of this chapter. Extended IT continuance model propose four predictor of IS continuance intention viz disconfirmation, satisfaction, post-usage usefulness, IT self-efficacy. The conceptual framework proposed in the Figure 4 was based on the core concept of the extended IT continuance model incorporates with user support with relation to disconfirmation.

Unlike extended IT continuance model, no moderator was proposed in the model yet the effect of age, service experience, farm size, gender and education to service use were controlled in the model. The constructs used in the model is presented in Table 2 along with their operationalization.

Table 2.2 Constructs and their operationalization of this study

Constructs	Definition
Disconfirmation	Disconfirmation, the user's level of satisfaction with the service is determined by the user's initial expectations (pre-adoption expectation) on a service and discrepancies between expectations and service performance (Khalifa, et al., 2002).
Post-usage Usefulness	Post-usage usefulness reflects a long-term, transaction-invariant belief aggregated from prior usefulness perception (Lee, et al., 2010).

Table 2.2 Constructs and their operationalization of this study (Continued)

Constructs	Definition
Satisfaction	Satisfaction is a transaction-specific short-term affect based on the immediately preceding usage experience (Veloutsou, et al., 2005).
IT self-efficacy	IT self-efficacy reflects users' conviction his/her ability to independently perform an intended behavior (Bhattacherjee, et al., 2007).
User support	The consumer's judgment about (a service interaction's) overall excellence or superiority (Verma, 2012).
Continuance Intention	Continuance intention is defined as an individual's intention to continue using an information technology (in contrast to initial use or acceptance) (Bhattacherjee, 2001).

2.3 The Conceptual Framework and Hypothesis Development

Conceptual framework is the foundation for understanding the research issues and linkage among different variables. It helps as guiding principles for analyzing the research issues. It also helps easy visualization of the relationship between the dependent and independent variables. Drawing on the insights presented in earlier sections, this section presents the research model of this study based on extended model of IT continuance with the incorporation of user support. The model depicts that farmers continuance intention to use a service positively related five independent factors viz. Post-usage usefulness, disconfirmation, IT self-efficacy,

satisfaction and user support while the effect of age, service experience, [1]farm size were controlled in the model.
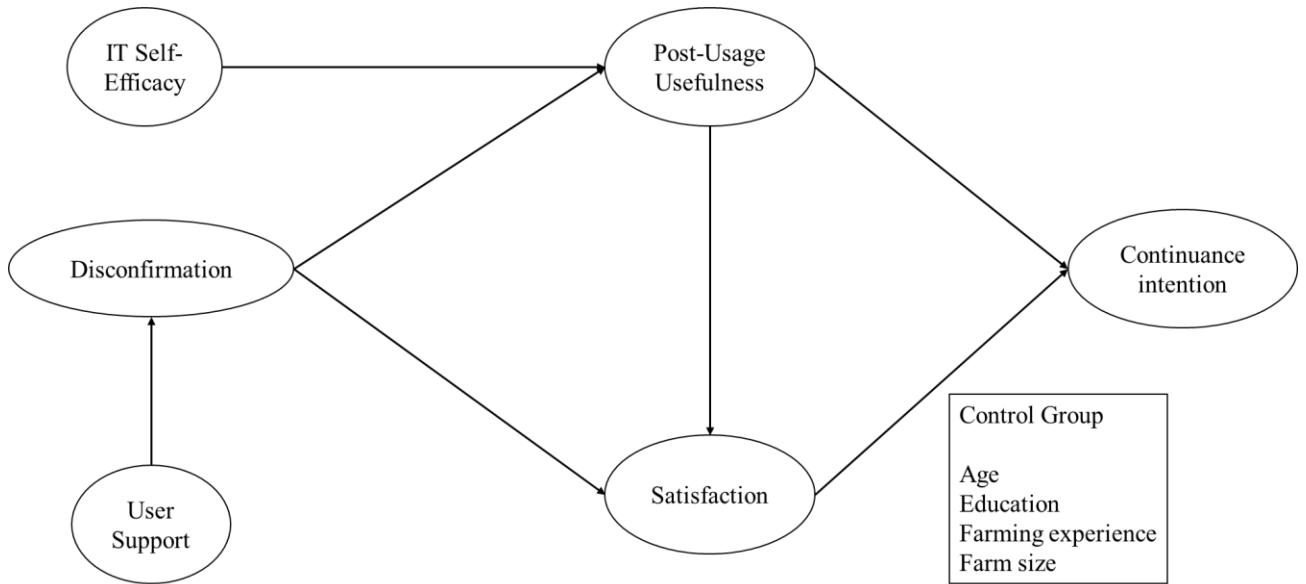
Figure 2.3 Conceptual Framework

ECT examines both pre-consumption and post-consumption variables while the proposed model focuses only on post-acceptance variables. This is so because the effects of any pre-acceptance variables are already captured within the confirmation and satisfaction constructs. Second, ECT only examines the effect of pre-consumption (ex-ante) expectation, but not post-consumption (ex-post) expectation. As described before, ex post expectation is especially important for products or services where expectation may change with time, as is often the case with IS use. Hence, the proposed continuance model amends ECT to include ex post expectation. Third, (ex-post) expectation is represented in the proposed model by (ex-post) perceived usefulness. This representation is consistent with ECT's definition of expectation as individual beliefs or sum of beliefs, because perceived usefulness is a cognitive belief salient to IS use (Davis, et al., 1989). Although expectation theoretically may be a broader construct, encompassing many additional beliefs (e.g., ease of use), based on TAM-based studies, perceived

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[1] Gender was dropped after the data collection since all the respondents found male in this study

usefulness is an adequate expectation in the IS continuance context because it is the only belief that is demonstrated to consistently influence user intention across temporal stages of IS use (e.g., Davis, et al., 1989; Karahanna, et al., 1999). These studies provide indirect support for the satisfaction-continuance intention association derived from ECT. This leads to the first hypothesis:

H1. Users' level of satisfaction with GEO-POTATO use is positively associated with their continuance intention.

ECT posits that user satisfaction is determined by two constructs: expectation of the IS and confirmation of expectation following actual use. Expectation provides the baseline level, against which confirmation is assessed by users to determine their evaluative response or satisfaction. Confirmation is positively related to satisfaction with IS use because it implies realization of the expected benefits of IS use, while disconfirmation (perceived performance lagging expectation) denotes failure to achieve expectation. Although the confirmation-satisfaction association is yet to be examined empirically in IS use research, industry studies provide anecdotal support for this association. Hence:

H2. Users' extent of disconfirmation is positively associated with their satisfaction.

TAM hypothesizes perceived usefulness as a direct predictor of acceptance intention (in addition to its indirect effect via attitude) to account for circumstances where high instrumentality considerations may override low affect in motivating usage intentions. As Davis, et al., (1989) note, people form intentions toward behaviors they believe will increase their job performance, over and above whatever positive or negative feelings may be evoked toward the behavior -(p. 986) Enhanced performance is instrumental in achieving various rewards that are extrinsic to the task context, such as promotions or monetary gains (Vroom, 1964). IS use is often viewed as the means to that end. Such means-end behavior is largely based on cognitive decision rules or heuristics that are

invoked without conscious thought whenever faced with similar behavioral contexts, without necessarily activating the positive affect associated with performance-contingent rewards (Davis, et al., 1989). Although the usefulness-intention association was originally derived in an acceptance context, it is likely to hold true in continuance contexts, because human tendencies for subconsciously pursuing instrumental behaviors or striving for rewards are independent of the timing or stage of such behaviors. This leads to the fourth hypothesis:

H3. Users' GEO-POTATO continuance intention is positively associated with their post-usage usefulness.

Finally, just as the cognitive beliefs in IS acceptance contexts (i.e., ease of use and perceived usefulness) are related (Davis, et al., 1989), those in IS continuance contexts (i.e., confirmation and perceived usefulness) may also be related. For instance, users may have low initial usefulness perceptions of a new IS because they are unsure what to expect from its use. Nonetheless, they may still want to accept it with the intent of making their usage experience a basis for forming more concrete perceptions. Although low initial usefulness perceptions are easily confirmed, such perceptions may be adjusted higher as a result of the confirmation experience, when users realize that their initial perceptions were unrealistically low. Theoretical support for this association comes from cognitive dissonance theory (Festinger, 1957), which suggests that users may experience cognitive dissonance or psychological tension if their pre-acceptance usefulness perceptions (which earlier led to acceptance) are disconfirmed during actual use. Rational users may try to remedy this dissonance by distorting or modifying their usefulness perceptions in order to be more consistent with reality. In other words, confirmation will end to elevate users' post-usage usefulness and disconfirmation will reduce such perceptions. Hence:

H4. Users' extent of disconfirmation is positively associated with their post-usage usefulness of GEO-POTATO use.

Self-efficacy reflects one's conviction in his ability to independently perform an intended behavior (Ajzen, 2002). Self-efficacy reflects an internal locus of control since it focuses on one's personal skills and abilities. Bandura (1982) stated that people might withdraw themselves from a task if they perceive a low sense of efficacy in a given domain. People's perception on self-efficacy may drive them to accomplish a difficult task irrespective of their other limitations otherwise. People with lower self-efficacy believe may frustrated more easily by the obstacles they face in accomplishing a task while people with higher self-efficacy believe may overcome those obstacles by their sense of efficacy and accomplish a task easily (Compeau and Higgins, 1995). So people with higher self-efficacy may realize the usefulness of the GEO-POTATO service as following they might have continuance intention use of GEO-POTATO service. As well as people with lower self-efficacy may find obstacle to use GEO-POTATO service as following they might have negative or low positive intention of continuance use of GEO-POTATO. So, this study assumes that self-efficacy have direct relation with the post-usage usefulness but has the indirect relation with the continuance intention. Hence,

H5: Users' IT self-efficacy is positively related to GEO-POTATO post-usage usefulness.

An argument in prior studies is that attitudes serve a variety of functions for individuals (Fiske and Taylor, 1991). One function served by attitudes has been referred to as the "instrumental" or "utilitarian" function (Katz, 1960). According to this perspective, individuals seek to maximize rewards and minimize penalties when dealing with an environment. Furthermore, they form attitudes to reflect this desire, forming positive attitudes toward stimuli they perceive as rewarding and

negative attitudes toward stimuli they perceive as punitive. Stimuli that are not perceived as particularly rewarding or punitive are generally not the targets of intense attitudes. Previous research has demonstrated that customers differ in their perceptions of which aspects of service interactions are potentially rewarding, punitive, or neither (e.g., Price, Arnould and Tierney, 1995). For example, Iacobucci and Ostrom, (1994) found variation in customer responses to different aspects of user support interactions. More specifically, some customers have been found to form intense attitudes toward user support interactions on the basis of the interpersonal skills of the user support providers, whereas other customers have been found to be relatively indifferent to these interpersonal skills. Therefore, it is expected that users support service influences user to disconfirmation of using any service. This study assumes that user support has positive relation with disconfirmation.

H6: User support service has positive relation with the disconfirmation

Post-consumption expectation is represented as ex post perceived usefulness in the proposed IS continuance model. TAM found perceived usefulness and perceived ease of use as salient beliefs influencing IS acceptance behavior across a broad range of end-user computing technologies and user population (e.g., Davis, et al., 1989; Mathieson, 1991; Taylor and Todd, 1995). Perceived usefulness captures the instrumentality of IS use, while ease of use taps into the self-efficacy dimension. Because perceived usefulness and ease of use are the primary motivators of IS acceptance, it is plausible that they can also influence subsequent continuance decisions. However, empirical studies comparing the relative effects of perceived usefulness and ease of use during pre-acceptance and post acceptance stages of IS use report that (1) usefulness impacts attitude substantively and consistently during both stages of IS use, and (2) ease of use has an inconsistent effect on attitude in the initial stages, which seems to further subside and become non-significant in later stages (Davis, et al., 1989; Karahanna, et al., 1999). This

finding led Karahanna, et al., (1999) to observe, users gain experience with the system, ease of use concerns seem to be resolved and displaced by more instrumental considerations involving the efficiency of the innovation to increase one's job performance (i.e., perceived usefulness). In keeping with these observations, perceived usefulness is expected to be the most salient ex-post expectation influencing users' post-acceptance affect (satisfaction).

H7: Users' Post-usage usefulness of GEO-POTATO is positively associated with their satisfaction.

2.4 Control variables

In this study age, education, service experience, farm size and gender were considered as the control variables. Assume that these five variables were not considered as the predictor but as the control variables.

CHAPTER III
METHODOLOGY

This chapter portrays the methodology and techniques utilized as a part of this study. This part is isolated into three areas. The primary area portrays the diagram of research outline. The second area depicts the measurement of variables. At long last, the third area depicts the strategies applied in data analysis.

3.1 Research Design
3.1.1 Locale of the study

Munshiganj district was purposively chosen as the study area for two reasons. To start with, Munshiganj district is the highest potato growing area in Bangladesh. Second, GEO-POTATO project area is in the Munshiganj district. Munshiganj district has six upazilas. Nonetheless, considering the time and spending impediment one upazilas, in particular, Munshiganj Sadar upazila was purposively chosen as the study area.

3.1.2 Population and sampling frame

As the study concerns about continued use of GEO-POTATO service by farmers, all the GEO-POTATO users in Munshiganj upazila were constituted the population of the study. The list of all the GEO-POTATO farmers in Munshiganj sadar upazila were collected. Thus, a total of 350 farmers were constituted the population of this study. Respondents (i.e., 105 persons) who participate to the survey were selected based on their availability and consent to participate to the survey. Thus, a total of 105 persons were interviewed for this study. Respondents were informed about the study purpose beforehand to the data collection and seek for their consent. Data collection was conducted only once they willingly agreed to participate in the survey as a voluntary basis. Data collection was done in a face-to-face situation during a period from 15th March, 2019 to 25th March, 2019.

Table 3.1 Population and sample of this study

Union	Population	Sample size	Pre-test sample
Adhera	149	45	3
Char kewar	100	30	0
Mohakhali	101	30	2
Total	350	105	5

3.1.3 Instrument for data collection

Since the reasons for study were to test the hypotheses and measure the variances, a cross-sectional survey strategy was operationalized for this study. Henceforth, data was gathered utilizing an organized meeting plan. Remembering the targets, the study adjusted approved estimation things from earlier investigations, at whatever point conceivable. The beforehand prepared interview schedule was pre-tried and vital adjustments were completed. In most instances, closed form questions were used. Approved estimation things of each construct with their literature sources were exhibited in an English version of the interview schedule as joined in the Appendix-A.

3.1.4 Variables of the Study

Four types of variables were used for this study:

i.   **Dependent variable:** It is a variable that is the outcome or result or impact of different factors. This variable is frequently known as a criterion or reliant variable. The estimation of the reliant variable relies upon the estimation of alternate factors, that is, autonomous factors. To find farmers' continued use of GEO-POTATO service, continuance intention is considered as the dependent variable.

ii.   **Independent variables:** These variable are regularly called as indicator variables or predictor variables. In a trial setting, a researcher needs to control the

variable or acquaint another variable with see its impact on the criterion variable. In this study, three independent variables were used. These were: Disconfirmation, IT self- efficacy, User support.

iii. **Control variable:** It is a variable that the researcher does not want to test in a study and therefore controls its effect on the other variables being studied. Here, age, gender, education, farm size and service experience of the farmers were considered as the control variables.

iv. **Mediator variable: It** is a variable that explains the relationship or provides a causal link between other variables. This is often known as intervening variable that accounts for the relation between the predictor and the criterion variables. Here, satisfaction and post-usage usefulness were used as mediator variables.

3.2 Measurement of Variables
3.2.1 Measurement of Independent Variables
3.2.1.1 Disconfirmation

Disconfirmation was measured using Bhattacharjee's (2001b) perceived confirmation scale. Disconfirmation was measured by using a 5-point modified Likert scale ranging from 'strongly disagree' to 'strongly agree' against four statements.

Items	Score Assigned
Strongly Disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly Agree	5

Disconfirmation score was determined by summing the scores of all the four statements. Thus, the score could range from 4 to 20, where '4' indicated the lesser level of disconfirmation and '20' indicated the highest level of agreement.

3.2.1.2 IT Self-efficacy

IT self-efficacy was measured using modified version of Venkatesh, et al., (2003) five item self-efficacy scale. Since self-efficacy represents one's confidence in one's ability to independently perform a given behavior. IT Self-efficacy was measured by using 5-point modified Likert scale ranging from 'strongly disagree' to 'strongly agree' against five statements.

Items	Score Assigned
Strongly Disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly Agree	5

IT self-efficacy score was determined by summing the scores of all the five statements. Thus, the score could range from 5 to 25, where '5' indicated the lesser level of IT Self-efficacy and '25' indicated the highest level of agreement.

3.2.1.3 User Support

User Support was measured using an adapted version of Au, et al., (2008) four item User Support scale. User Support was measured by using a 5-point rating scale ranging from 'Very low' to 'very high' against four statements.

Items	Score Assigned
Very low	1
Low	2
Medium	3
High	4
Very High	5

User Support score was determined by summing the scores of all the four statements. Thus, the score could range from 4 to 20, where '4' indicated the lesser level of User Support and '20' indicated the highest level of agreement.

3.2.2 Measurement of Mediator Variable

3.2.2.1 Post-usage Usefulness

Post-Usage usefulness was measured using Davis, et al.,'s (1989) Post-usage Usefulness by using 5-point modified Likert scale ranging from 'strongly disagree' to 'strongly agree' against five statements.

Items	Score Assigned
Strongly Disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly Agree	5

Post-usage Usefulness score was determined by summing the scores of all the five statements. Thus, the score could range from 5 to 25, where '5' indicated the

lesser level of Post-usage Usefulness and '25' indicated the highest level of agreement.

3.2.2.2 Satisfaction

Satisfaction was measured using Spreng, et al.,'s (1996) overall satisfaction scale from the ECT literature, originally designed to assess farmers' satisfaction. Satisfaction was measured by using 5-point modified Likert scale ranging from 'strongly disagree' to 'strongly agree' against four statements.

Items	Score Assigned
Strongly Disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly Agree	5

Satisfaction score was determined by summing the scores of all the four statements. Thus, the score could range from 4 to 20, where '4' indicated the lesser level of satisfaction and '20' indicated the highest level of agreement.

3.2.3 Measurement of Dependent Variable

The respondents' responses were estimated by using a 5-point scale (1-5) ranging from 'strongly disagree' to 'strongly agree'.

Items	Score Assigned
Strongly disagree	1
Disagree	2
Undecided	3
Agree	4
Strongly agree	5

The continuance intention of GEO-POTATO score of a respondent was obtained by adding the scores and it could range from 4 to 20, where '4' indicates no continuance intention to use GEO-POTATO service and '20' indicates highest Continuance intention to use GEO-POTATO service.

3.3 Data Analysis
3.3.1 Editing

Raw data were reviewed for omitting errors. The researcher made a careful scrutiny when he completed an interview so that all data were included to facilitate coding and tabulation.

3.3.2 Coding and tabulation

The researcher consulted with the research supervisor and co-supervisor, made a detailed coding plan. All responses were given in numerical score. The respondent responses were transferred to a master sheet to facilitate tabulation. In accordance with the objectives of the research, all of the data were tabulated.

3.3.3 Categorization of data

For coding operation, the collected data were classified into various categories. These categories were developed for each of the variables. In case of scale variables (e.g. post-usage usefulness, disconfirmation, satisfaction, user support, IT self-efficacy), a composite score was computed based on respondents' responses in a 5-point modified Likert scale against each items. Thereafter, each construct was categorized on the basis of respondents' response frequency.

3.3.4 Method of data analysis

Data analysis required two phases. First, validation phase and second, result phase. The validation phase establishes the reliability and validity of the measurement items. Four tests need to be carried out to test the reliability and validity of the measurement model, internal consistency (composite reliability), convergent validity (average variance extracted), and discriminant validity and indicator reliability (Hair, et al., 2014). Internal consistency is the value of Cronbach's alpha

which assumes that all the indicators have equal outer loading on the relative constructs. It is expected that the outer loading for each indicator should be above 0.7. However, considering the explorative nature as well as the context, value equal to or greater than 0.65 was considered as accepted. Internal consistency can also be measured by observing the value (0.60-0.70) of composite reliability of a latent variable. Convergent validity shows whether the indicator can converge or share a high proportion of the variation of the constructs. Average Variance Extracted (AVE) is the common measure of convergent validity which is the grand mean of the squared loadings of a construct's indicators. A value greater than 0.50 is regarded as a satisfactory AVE score, which says that the construct explains more than half of the variance of its indicators.

Discriminant validity shows the distinctiveness of one construct from others and this can be examined by the cross-loadings of the indicators. If the outer loadings of one indicator on the respective construct are higher than all of its loadings on other constructs assure that the construct has no discriminant validity problem. On the other hand, for indicator reliability, a bootstrapping[2] procedure needs to be performed. If it shows that the indicator's weight is statistically significant, then the indicator should be retained otherwise should be removed from the model.

To validate the measurement items and test the structural model, Partial Least Squares (PLS)-based Structural Equation Modeling (SEM) was used for this study (Hair, et al., 2014). Two factors were considered when selecting this modeling approach over traditional statistical tools like SPSS (Statistical Package for Social Sciences). First, PLS-SEM is regarded as a second generation statistical tool over the first generation tool like SPSS and therefore highly accepted to behavioral scientists and academics. Second, tool like SPSS is limited in its ability to measure multi-level path model. As the theoretical model of this study consists of six independent variables, one mediator variable, one dependent variable and two

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[2] A test that relies on random sampling with replacement

control variables, the confounding effect of one variable on other variables cannot be captured by SPSS and hence, SmartPLS v.2 M3 software application was used to test the model of this study.

Five (5%) percent level of significance was used to test the significance level of each hypothesis. If the computed value of (β) was equal to or greater than the designated level of significance, than the hypothesis was supported and it was concluded that there was a significant contribution of the independent variables to the dependent variable. And if the computed value of (β) is smaller than the designated level of significance than the hypotheses was not supported. Therefore, it assumes that there was no significant contribution of the independent variables to the dependent variable. The results of the reliability and validity tests were present in Chapter Four.

CHAPTER IV
RESULTS AND DISCUSSION

This Chapter presents the results of this study into five sections. First, selected characteristics of the sample and descriptive statistic of this study are presented. Second, sample's distribution based on their observed scores under each dimension are presented. Third, reliability and validity of the measurement items followed by results of the structured model are provided. Finally, farmers' continued use of GEO-POTATO service is discussed.

4.1 Respondents Characteristics and Descriptive Statistics

In this section the respondent's characteristics and descriptive statistics are presented in Table 4.1 and Table 4.2. All the variables were categorized on the basis of their possible scores except age which was categorized based on the classification provided by the Ministry of Youth and Sports, Government of the People's Republic of Bangladesh.

Table 4.1 Distribution of respondents according to their characteristics

Characteristics	Frequency	Percent	Observed range	Mean	Standard Deviation
Age (in years)					
Young (Up to 35)	24	22.9	25-52	39.52	5.57
Middle (36-50)	79	75.2			
Old (>50)	2	1.9			
Gender					
Male	105				
Service Experience (in years)					
Short (up to 10)	17	16.2	5-32	17.31	5.97
Medium (11-20)	66	62.9			
Long (>20)	22	21			
Farm size					
Small (0.21-1ha)	67	63.8	.24-2.80 ha	.9448	.59
Medium (1.01-3 ha)	38	36.2			

Table 4.1 Distribution of respondents according to their characteristics (Continued)

Characteristics	Frequency	Percent	Observed range	Mean	Standard Deviation
Education					
Cannot read and write	14	13.3	1-4	3.15	1.09
Can sign only	13	12.4			
Can read and write	21	20			
Attend to class	57	54.3			

Table 4.2 Descriptive statistics of constructs used in this study

Constructs	Possible range	Observed Range		Mean	Standard deviation
		Min	Max		
Post-usage Usefulness	5-25	9	25	18.44	3.24
Disconfirmation	4-20	6	20	14.43	2.53
IT self-efficacy	5-25	5	25	17.56	5.24
Satisfaction	4-20	7	20	14.67	2.73
Users' Support	4-20	8	20	13.95	2.79
Continuance Intention	4-20	12	20	16.67	2.45

Table 4.1 reveals that all of the respondents (100%) were male. The mean of the respondents' age was 39.52 years with a standard deviation of 5.57. Based on the classification provided by the Ministry of Youth and Sports-Government of the People's Republic of Bangladesh, 22.9% and 1.9% of the respondents were young and old aged while 75.2 percent were middle aged. Distribution of the respondents according to their length of service were found almost identical with their age distribution with a mean of 17.31 years. The highest proportions (62.9 percent) of the respondents had medium service experience while 16.2 percent had short and 21 percent had long service experience. Distribution of the respondents regarding

their farm size were found that 63.8 percent respondents have small land and 36.2 percent respondents have medium land. In the case of education, 54.3 percent of the respondent attend to any class while cannot read and write, can sign only, can read and write respondent were 13.3, 12.4 and 20 percent respectively.

4.2 Respondent's Distribution based on the Salient Factors of Continued use of GEO-POTATO service

Respondents' frequency distribution based on the observed scores of the salient factors of farmers' continuance intention of using GEO-POTATO is presented in this section. Figure 4.1 shows the frequency distribution of the respondents based on their response.
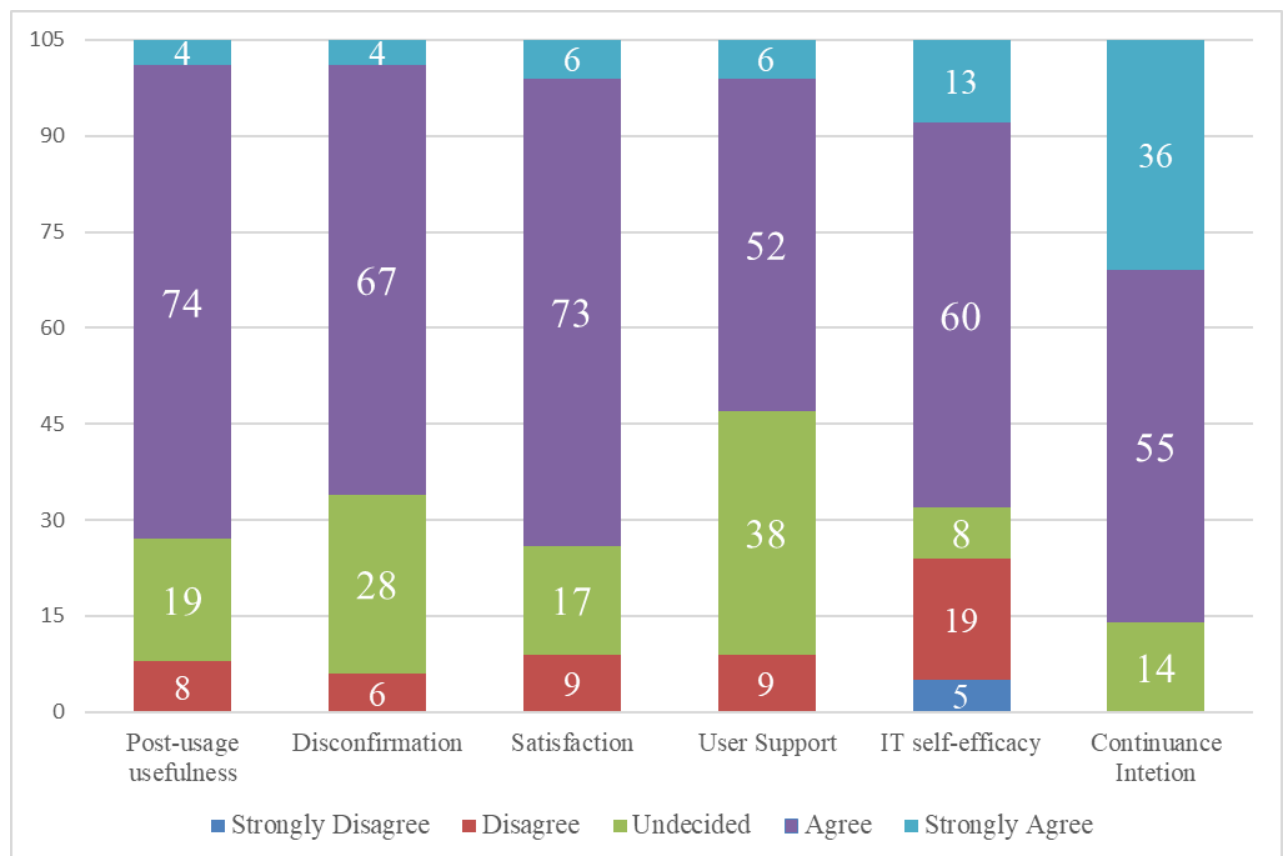
Figure 4.1 Frequency distribution of selected variables

Respondents' percentage distribution based on the observed scores of the salient factors of farmers' continuance intention of using GEO-POTATO is presented in this section. Figure 4.2 shows the percentage distribution of the respondents based on their response.
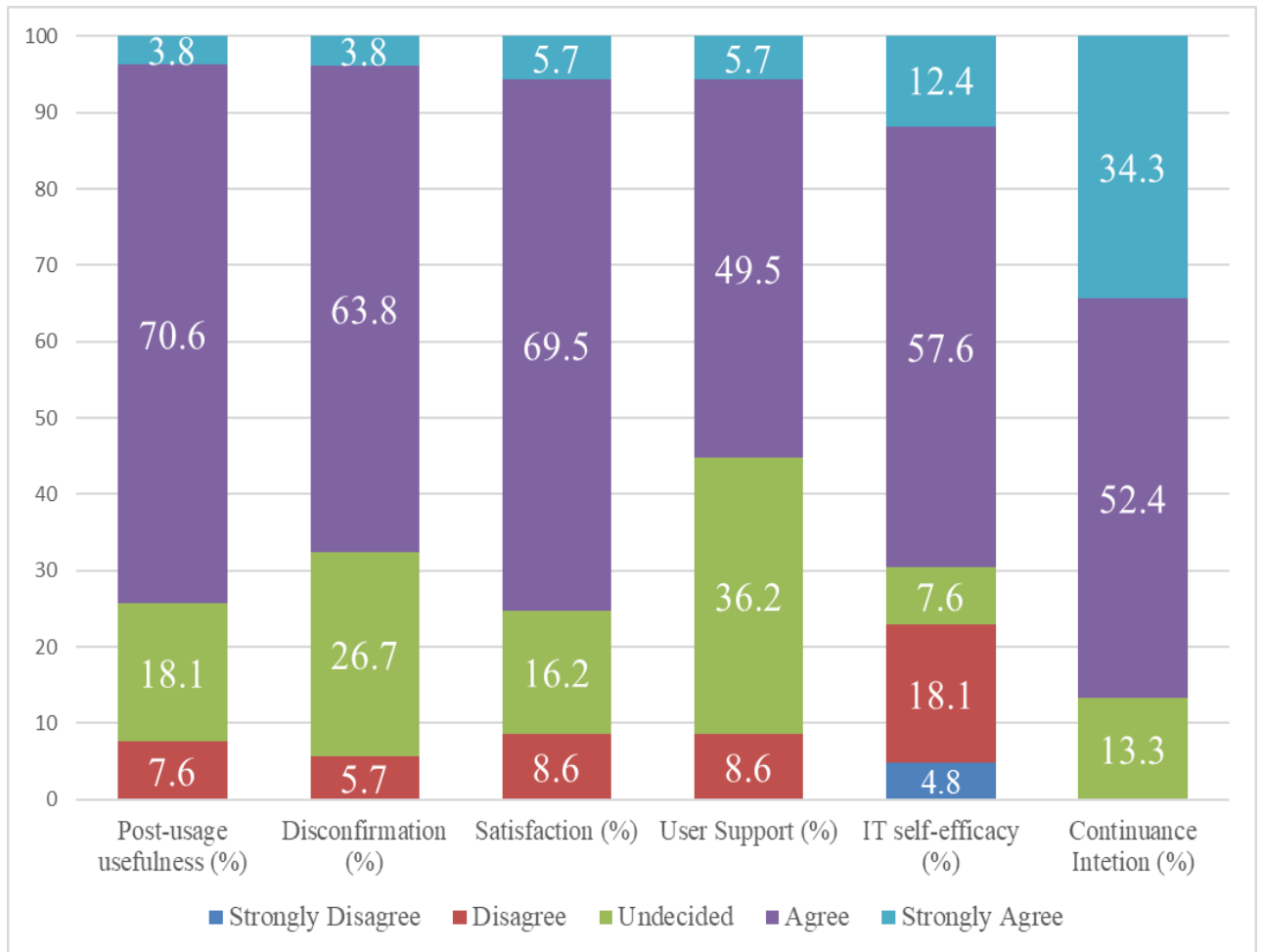
Figure 4.2 Percentage distribution of selected variables

4.2.1 Post-usage usefulness

The observed post-usage usefulness scores of the respondents ranged from 9 to 25. The average post-usage usefulness score was 18.44 and the standard deviation was 3.24. Based on the possible range of post-usage usefulness score (5-25). Here 74 respondents responded as "Agree", 19 responded as "Undecided", 8 responded "Disagree" and 8 responded as "Strongly agree". Majority (70.5%) of the respondent agreed with post-usage usefulness of GEO-POTATO. Whereas 18.1% were Undecided. (See Fig 4.3).
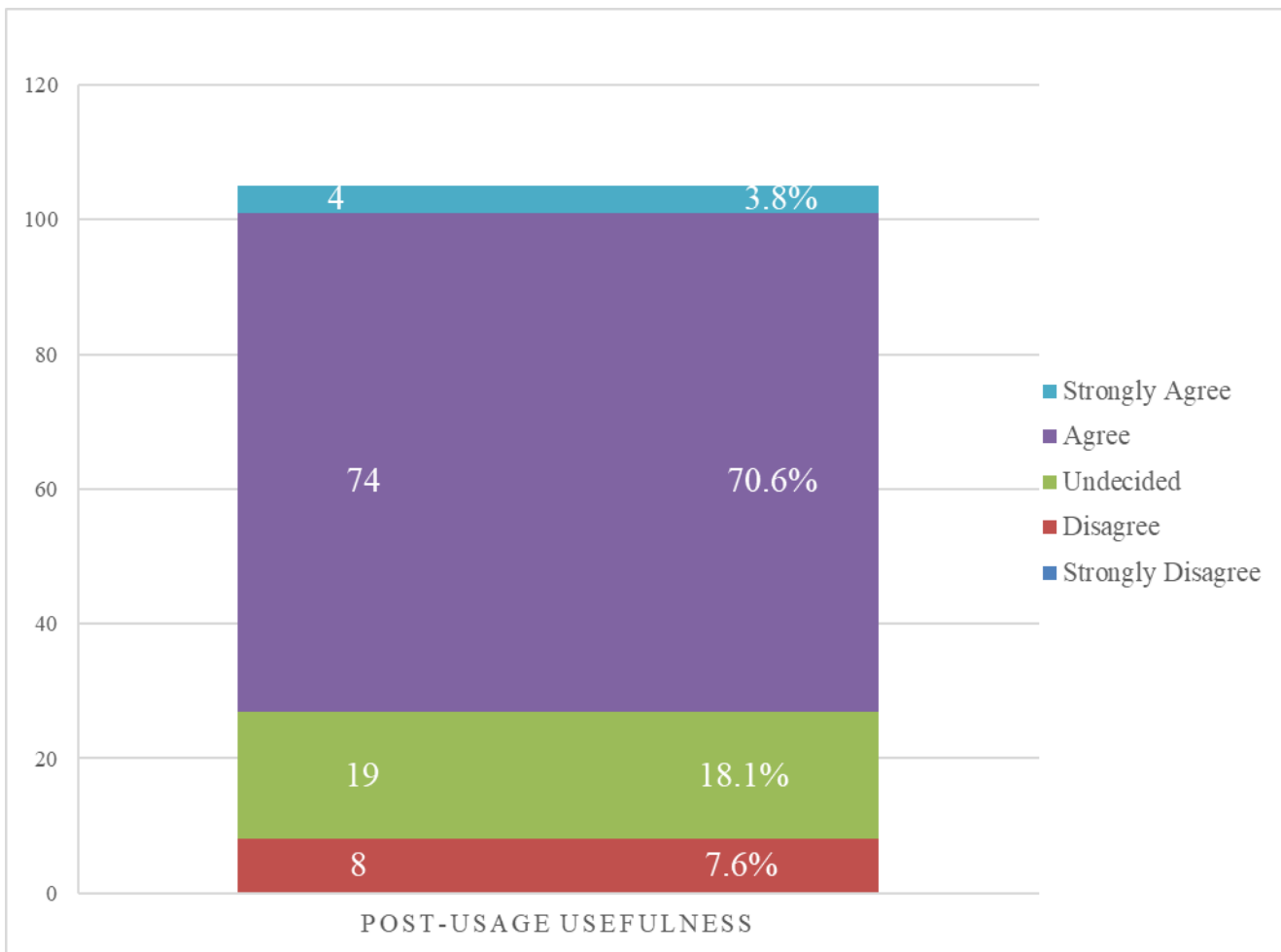
Figure 4.3 Frequency distribution of Post-usage Usefulness

4.2.2 Disconfirmation

The observed disconfirmation scores of the respondents ranged from 6 to 20. The average disconfirmation score was 14.43 and the standard deviation was 2.53. Based on the possible range of disconfirmation score (4-20). Here 67 respondents responded as "Agree", 28 responded as "Undecided", 6 responded "Disagree" and 7 responded as "Strongly agree". Majority (63.8%) of the respondent agreed with the disconfirmation of GEO-POTATO while 26.7% responded were undecided and 3.8% responded were strongly agree with disconfirmation of GEO-POTATO. (See Fig 4.4).
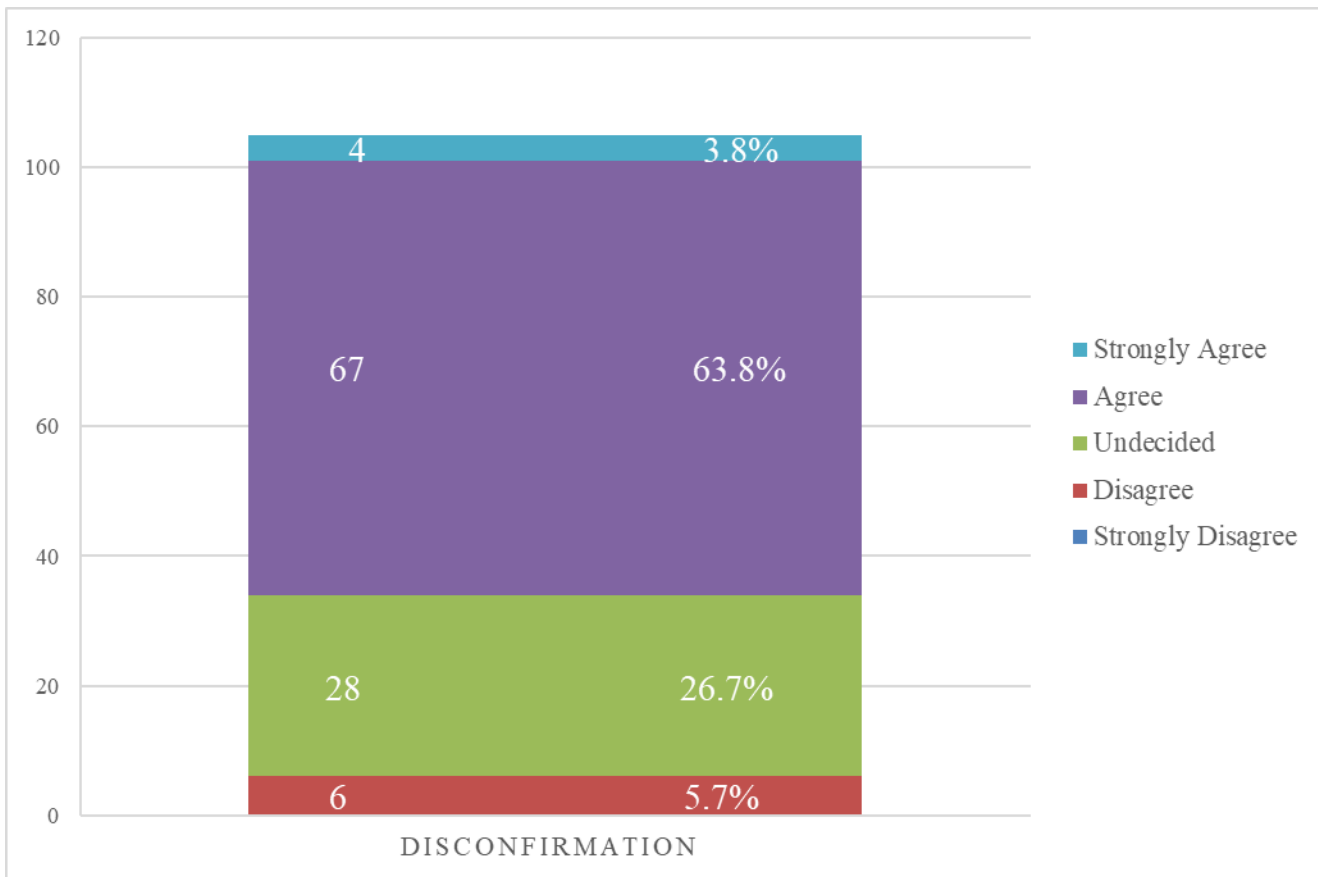
Figure 4.4 Frequency distribution of Disconfirmation

4.2.3 IT self-efficacy

The observed IT self-efficacy scores of the respondents ranged from 5 to 25. The average IT self-efficacy score was 17.56 and the standard deviation was 5.24. Based on the possible range of IT self-efficacy score (5-25). Here 60 respondents responded as "Agree", 8 responded as "Undecided", 19 responded "Disagree", 13 responded as "Strongly agree" and 5 responded as "Strongly disagree". Majority (57.6%) of the respondent agreed they had IT self-efficacy but only (4.8%) responded as "Strongly disagree" because of lack of their education. (See Fig 4.5).
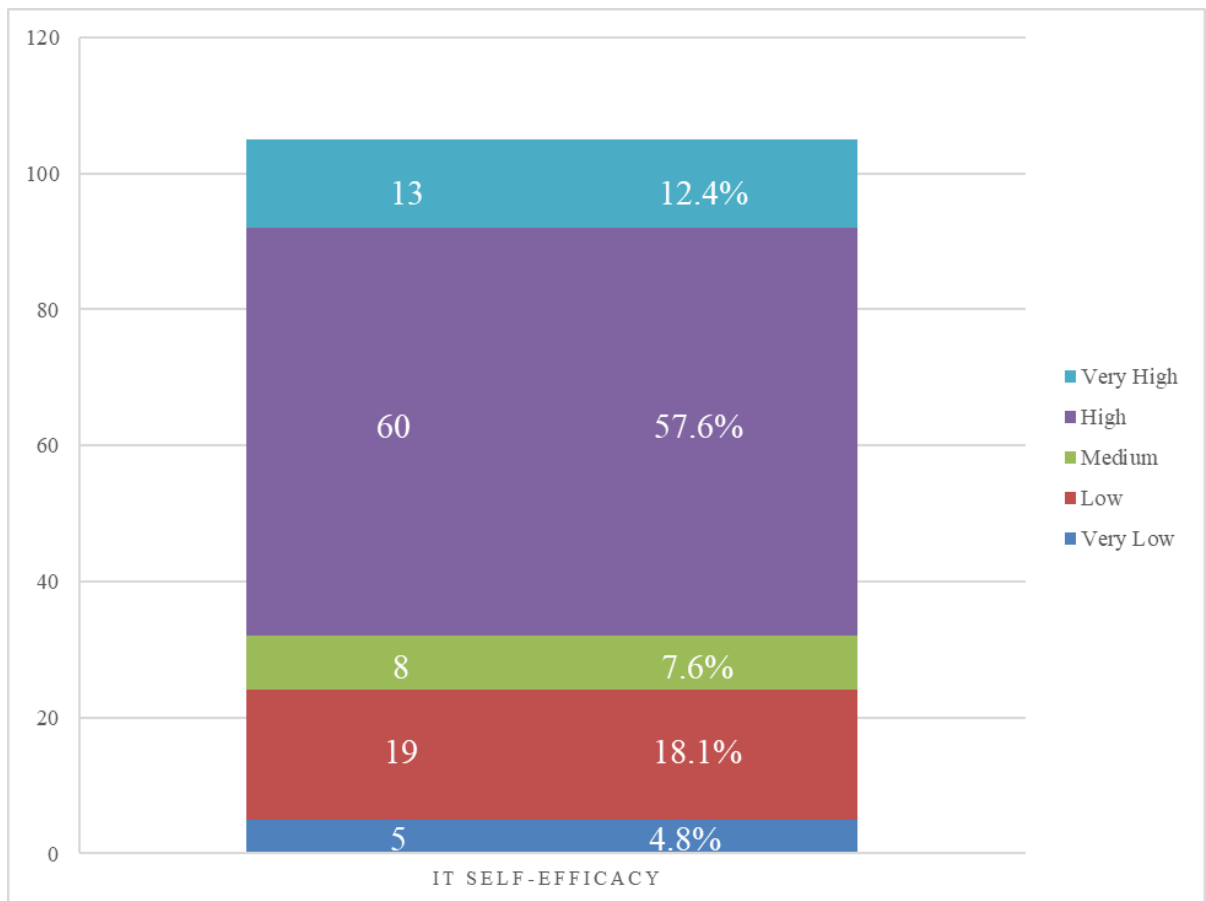
Figure 4.5 Frequency distribution of IT Self-efficacy

4.2.4 Satisfaction

The observed satisfaction scores of the respondents ranged from 7 to 20. The average satisfaction score was 14.67 and the standard deviation was 2.73. Based on the possible range of satisfaction score (4-20). Here 73 respondents responded as "Agree", 17 responded as "Undecided", 9 responded "Disagree" and 6 responded as "Strongly agree". Majority (69.5%) of the respondents agreed their satisfied with GEO-POTATO service, 16.2% were undecided and 8.6% disagreed with satisfaction. (See Fig 4.6).
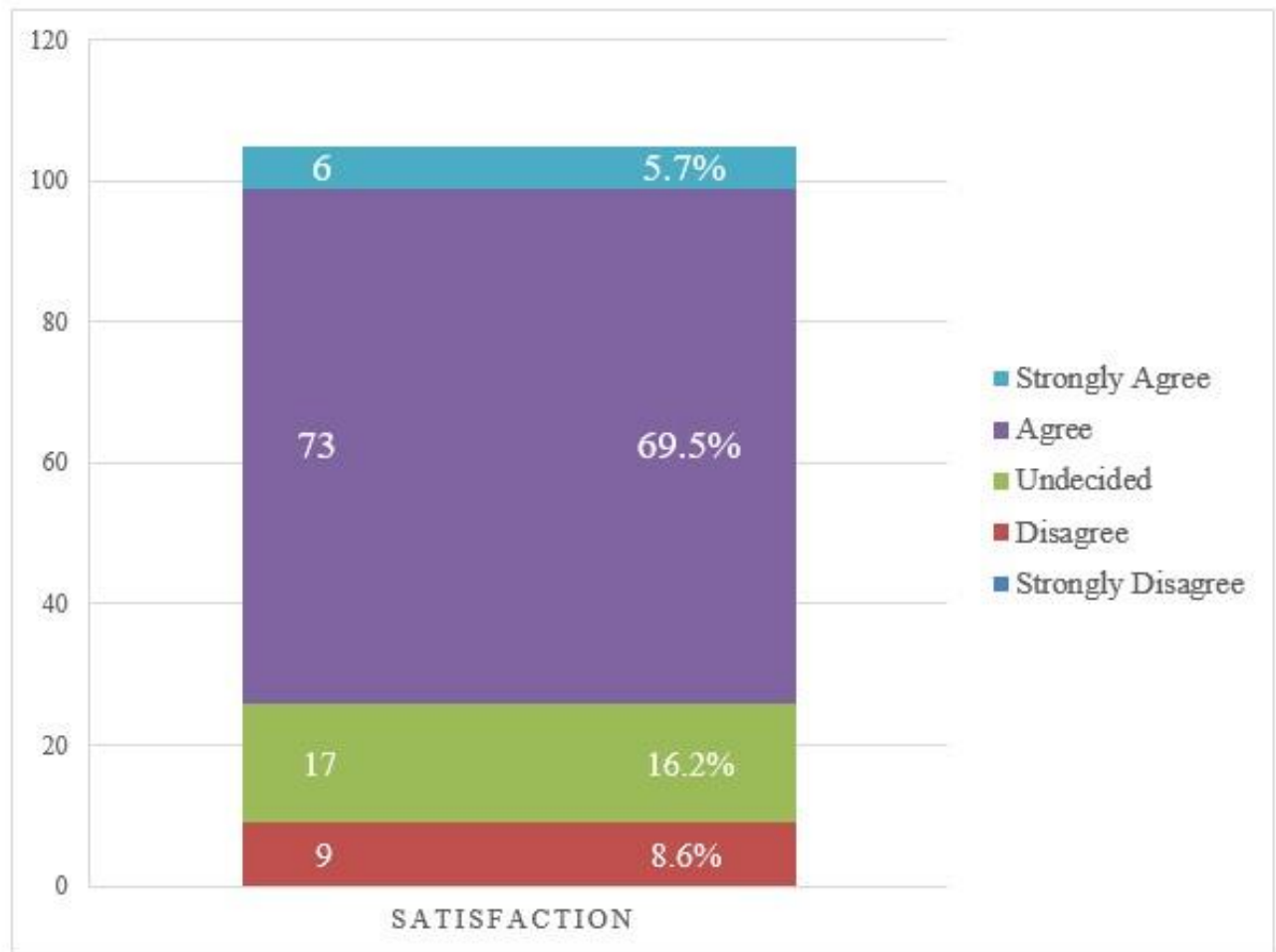
Figure 4.6 Frequency distribution of Satisfaction

4.2.5 Users' Support

The observed users' support scores of the respondents ranged from 8 to 20. The average user support score was 13.95 and the standard deviation was 2.79. Based on the possible range of user support score (4-20). Here 52 respondents responded as "High", 38 responded as "Medium", 9 responded "Low" and 6 responded as "Very high". Majority (49.5%) of the respondent find that GEO-POTATO has high user support while 36.2% respondents thinks that as a medium. 5.7% of respondent agreed that GEO-POTATO has very high user support. (See Fig 4.7).
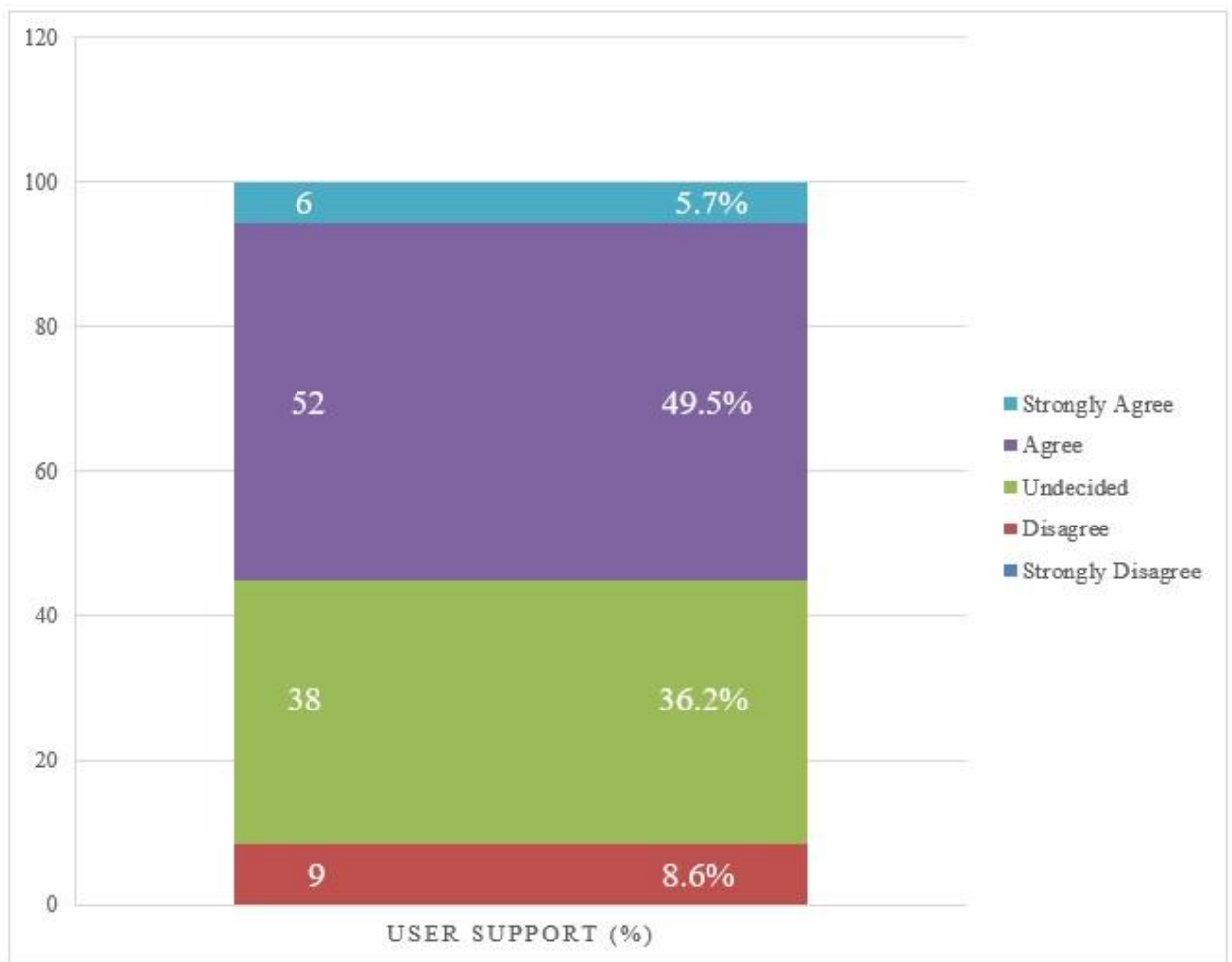
Figure 4.7 Frequency distribution of Users' Support

4.2.6 Continuance Intention

The observed continuance intention scores of the respondents ranged from 12 to 20. The average continuance intention score was 16.67 and the standard deviation was 2.45. Based on the possible range of continuance intention score (4-20). Here 55 respondents responded as "Agree", 14 responded as "Undecided" and 36 responded as "Strongly agree". Majority (52.4%) of the respondent agreed to continuance use of GEO-POTATO, 34.3% respondent were strongly agree to continue use of GEO-POTATO and 13.3% were undecided. (See Fig 4.8).
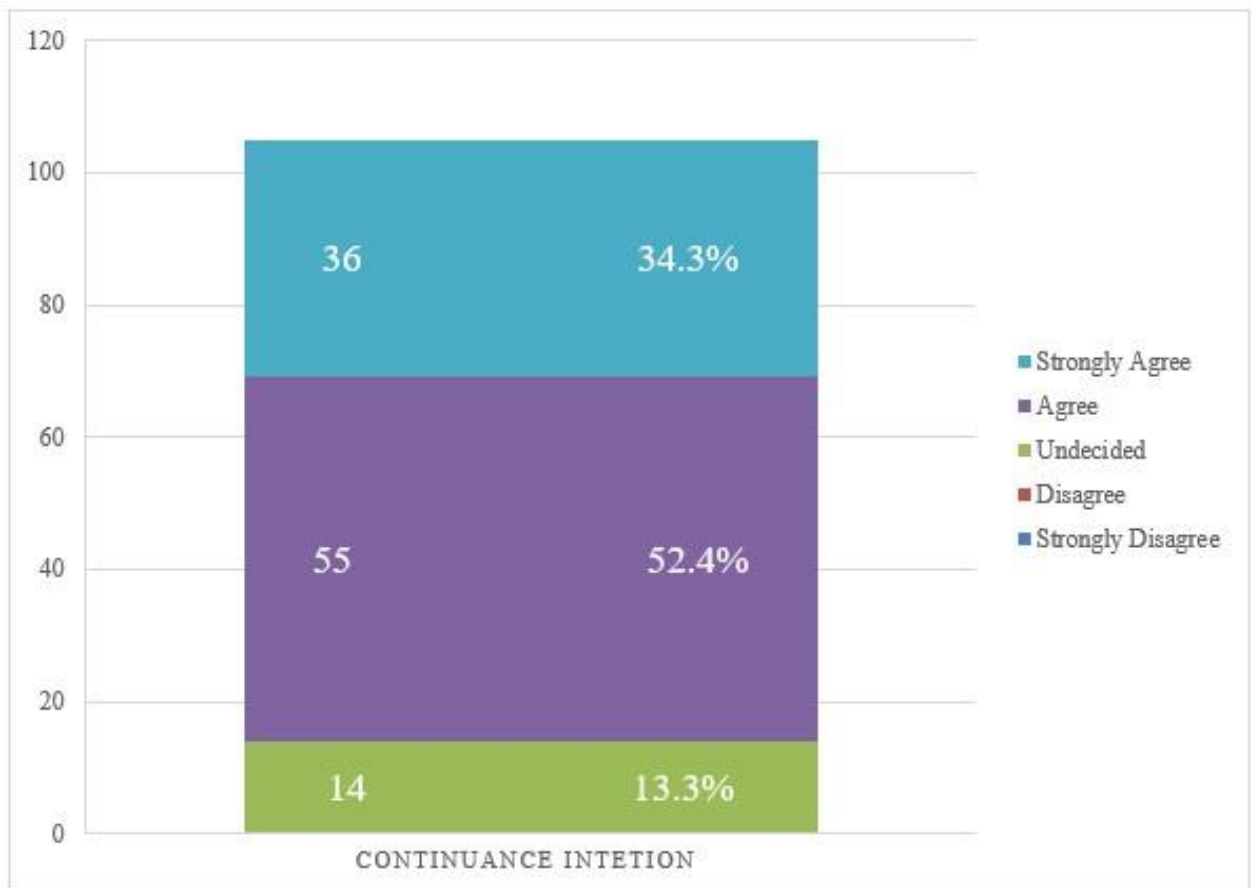
Figure 4.8 Frequency distribution of Continuance Intention

4.3 Reliability and Validity of the Measurement Model

PLS-SEM based analysis requires test of two models, measurement and structural models. Measurement model tests and reports reliability and validity of the measurement items while structural model shows the path-coefficients of the hypothesized relationships. To test the measurement model, first indicator reliability was assessed by observing the outer loadings of the measurement items. The threshold level of indicator is (0.70) given this investigation. The internal consistency reliability (i.e., composite reliability) (Table 4.3) demonstrates that all the constructs had high levels of internal consistency (>0.70). Convergent validity of the constructs are assessed by the value of Average Variance Extracted (AVE). The minimum requirements of AVE is 0.50. Therefore, it can be concluded that the convergent validity of all the constructs were satisfactory indicates that the constructs explained all the variance among the indicators.

Table 4.3 Measurement model of validation and bivariate correlations

	AVE	ICR	DCon	INT	SATIS	SE	Supp	UsF
DCon	0.756	0.925	**0.869**					
INT	0.879	0.967	0.609	**0.937**				
SATIS	0.885	0.968	0.762	0.684	**0.941**			
SE	0.960	0.992	0.274	0.307	0.355	**0.980**		
Supp	0.941	0.984	0.626	0.436	0.575	0.024	**0.970**	
UsF	0.710	0.924	0.744	0.645	0.750	0.368	0.651	**0.843**

Constructs: DCon (Disconfirmation), INT (Continuance Intention), SATIS (Satisfaction), SE (IT Self-efficacy), Supp (User Support), UsF (Post-usage usefulness).

- ICR= Internal Consistency Reliability (Composite Reliability); AVE = Average Variance Extracted
- Diagonal elements are the square root of AVE and off-diagonal elements are correlations.

Two steps were used to test the discriminant validity of the constructs. First, the cross-loadings of the indicators and second the Fornell-Larcker criterion (Fornell & Larcker, 1981). The cross-loadings of the constructs (Appendix-B) showed that the loadings of all the indicators on their respective constructs were higher than all of their cross loadings with other constructs. According to Fornell-Larcker criterion, if the square root of the AVE of each construct is higher than the construct's higher correlation with other constructs, it demonstrates discriminant validity. Table 4.9 indicates that the square roots (diagonal element in Table 4.9) of all the constructs were higher than their correlations with other constructs in the model. Therefore, it can be summarized that the cross-loadings and the Fornell-Lacker test provided support that the model had satisfactory discriminant validity. In addition to that, a Variance Inflation Factors (VIFs) test revealed that multi collinearity between the constructs was not a concern for this thesis.

4.4 Results of the Structural Model

The theoretical model and hypothesized relationships were tested by using Smart-PLS v2.0 M3. The explanatory power of the model was assessed by the R^2 of the dependent variable. Hypotheses were assessed by calculating the t-statistics for the standardized path co-efficient at the 5% level of significance. The model (Fig. 4.9) predicts that continuance intention (i.e., dependent variable) of farmer on any service were determined by their satisfaction and post-usage usefulness (i.e., mediator variable) which further contingent upon three exogenous factors, disconfirmation, IT self-efficacy and user support.

Satisfaction and post-usage usefulness was used as predictor of continuance intention use of GEO-POTATO service and they jointly explained 50.7% of the variance of continuance intention use (Fig. 4.9), while satisfaction was found to be the stronger predictor of continuance intention (β=0.456; p<0.00) compare to post-usage usefulness (β=0.303; p<0.00) (Table 4.4). Thus, it proves that

satisfaction and post-usage usefulness was the key determinants of continued use of GEO-POTATO service.

Disconfirmation and post-usage usefulness were two antecedents of satisfaction that combined explained 65.6% of the variance of satisfaction and the path-coefficient were found almost identical (β= 0.458 and β= 0.409, p<0.00). Furthermore, disconfirmation was also found as the stronger predictor of post-usage usefulness (β= 0.696, p<0.00) along with IT self-efficacy (β= 0.178, p<0.01) which explained 58.4% of the variance of post-usage usefulness. Finally user support was modeled as the single predictor of disconfirmation believe assuming that users received more support perceived disconfirmation higher than others. Figure 4.9 shows that support explained 39.2% of the variance of disconfirmation and positively influenced disconfirmation belief (β= 0.458, p<0.01).
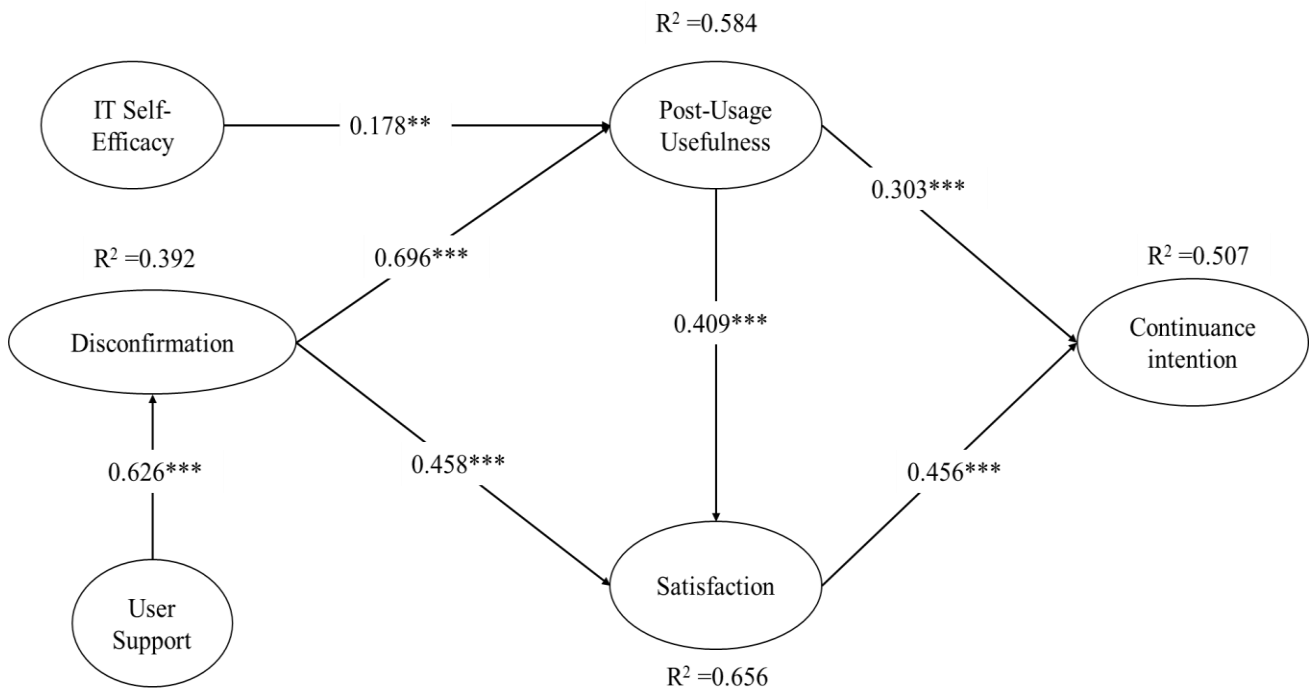
Figure 4.9 Results of the study model showing co-efficient and variance

Table 4.4 Results of the structural model of path coefficients

Relationship	Path Coefficients	t values	Sig. values	p values
Disconfirmation--> Satisfaction	0.458	4.497	***	0.00
Disconfirmation-->Post-usage Usefulness	0.696	11.214	***	0.00
Satisfaction--> Continuance Intention	0.456	4.719	***	0.00
IT Self-efficacy--> Post-usage usefulness	0.178	2.649	**	0.01
User Support--> Disconfirmation	0.626	9.524	***	0.00
Post-Usage usefulness--> Continuance Intention	0.303	3.086	***	0.00
Post-usage usefulness--> Satisfaction	0.409	3.695	***	0.00
NS=Not significant *p<0.05 **p<0.01 ***p<0.001				

Table 4.5 Summary of the proposed hypotheses

No	Hypothesis	Supported
H1	Users' level of satisfaction with GEO-POTATO use is positively associated with their continuance intention.	Yes
H2	Users' extent of disconfirmation is positively associated with their satisfaction.	Yes
H3	Users' GEO-POTATO continuance intention is positively associated with their post-usage usefulness.	Yes
H4	Users' extent of disconfirmation is positively associated with their post-usage usefulness of GEO-POTATO use.	Yes
H5	Users' IT self-efficacy is positively related to their GEO-POTATO post-usage usefulness.	Yes
H6	User support service has positive relation with the disconfirmation	Yes
H7	Users' Post-usage usefulness of GEO-POTATO is positively associated with their satisfaction.	Yes

4.5 Discussion of the research findings

A total of seven hypotheses were proposed in this study, and all the hypotheses were supported. This section provides the discussion of the key findings as follows:

Results of the study support ECT's contention that satisfaction with IS use is the strongest predictor of users' continuance intention ($\beta = 0.456$), followed by post-usage usefulness as a significant predictor ($\beta = 0.303$). Coupled with a strong intention-behavior association theorized and validated in prior research (e.g., Davis et al. 1989; Taylor and Todd 1995), the above associations suggest that satisfaction and post-usage usefulness are important predictors of actual continuance behaviors. Comparing the above results with prior TAM based studies of IS acceptance, some interesting patterns emerge. Post-usage usefulness was a stronger predictor of acceptance intention in TAM than attitude (Davis et al. 1989; Taylor and Todd 1995), while satisfaction was the stronger predictor of continuance intention in this study than post-usage usefulness. Post-usage

usefulness is a cognitive belief, while attitude and satisfaction both reflect user affect (pre- and post-acceptance respectively). The effect of post-usage usefulness on users' intention in both acceptance and continuance contexts confirms the significance of this association across temporal stages of continuance intention. Users' pre-acceptance attitude is based solely on cognitive beliefs (e.g., usefulness, ease of use) formed potentially via second-hand information from different information channel yet those are not free from any bias. Hence, user attitude potentially may be inaccurate, unrealistic, and uncertain. Users' may accommodate this uncertainty in affect by underweighting more uncertain attitude in their acceptance decisions and overweighting more certain satisfaction in continuance decisions. The finding of this study has important implications for technology acceptance and continuance intention phenomenon particularly in agriculture extension discipline. While ignoring pre-acceptance user attitude may not severely impact GEO-POTATO service acceptance among new users, ignoring post-acceptance user satisfaction can have disastrous consequences for user retention (continuance). Because post-usage usefulness is more crucial for acceptance intention and satisfaction is more dominant for continuance intention. Therefore, policy makers and IT-based service providers in agriculture should adopt a two-fold strategy for maximizing the outcome informing new (potential) users of the potential benefits of IT-based service use simultaneously educate old (continued) users on how to effectively use those technology so as to maximize their confirmation and satisfaction with the service.

Satisfaction, in other way, explain technology acceptance-discontinuance anomaly (user discontinuance of technology after its initial acceptance). Technology acceptance model (like TAM and DoI). TAM, which predicts user intention based on perceived usefulness and attitude, cannot explain this anomaly satisfactorily, unless either or both determinants change from positive to negative from pre-acceptance to post-acceptance phases. Because satisfaction was the stronger

predictor of continuance intention relative to post-usage usefulness in this study, users dissatisfied with technology use (due to disconfirmation of expectation) may discontinue use, despite having positive perceptions of its usefulness. In other words, dissatisfaction, and not perceived usefulness, is the necessary condition for IS discontinuance.

Confirmation was a stronger predictor of satisfaction than post-usage usefulness in this study. Conceptualizing this construct and validating its effect on technology continuance intention (via satisfaction) suggest that user perception of technology acceptance may also be adjusted by their extent of confirmation.

IT self-efficacy was found to have the significant relation with the post-usage usefulness ($\beta=0.178$, $p<0.00$). Self-efficacy indicates respondent's confident in using various ICT tools. An individual with high level of confident in operating different devices enable them to grow more desire for get more service like GEO-POTATO.

Satisfaction is the strongest predictor of continuance intention followed by post-usage usefulness. Satisfaction is a transaction-specific short-term affect based on the immediately preceding usage experience. Satisfaction leads a user to continue use of any service or repurchase it. Satisfaction is the strongest predictor ($\beta=0.456$ and $p<0.00$) of continuance intention use of GEO-POTATO. So this support our first hypothesis, users' level of satisfaction with GEO-POTATO use is positively associated with their continuance intention. On the other hand,

Post-usage usefulness reflects a long-term, transaction-invariant belief aggregated from prior usefulness perception. Post-usage usefulness is the second strongest predictor ($\beta=0.303$ and $p<0.00$) of continuance intention use of GEO-POTATO service. This support our third hypothesis users' GEO-POTATO continuance intention is positively associated with their post-usage usefulness.

Disconfirmation (β=0.458 and p<0.000) is the only contributor of the e satisfaction. R^2 value of disconfirmation and satisfaction is 0.392 and 0.656 respectively. This support our second hypothesis users' extent of disconfirmation is positively associated with their satisfaction.

With IT self-efficacy disconfirmation is another contributor of the post-usage usefulness. Path coefficient value of disconfirmation to post-usage usefulness is 0.696 and the R^2 value of post-usage usefulness is 0.584. This support our fourth hypothesis users' extent of disconfirmation is positively associated with their post-usage usefulness of GEO-POTATO use.

IT self-efficacy (β=0.178** and p<0.01) is contributor of the post-usage usefulness after disconfirmation. This supports our fifth hypothesis users' IT self-efficacy is positively related to their GEO-POTATO post-usage usefulness.

User support is the only contributor of the disconfirmation. Path coefficient of user support is 0.626. This support our sixth hypothesis User support service has positive relation with the disconfirmation.

Table 4.11 shows that there is positive relation between post-usage usefulness and satisfaction. Path coefficient of post-usage usefulness to the satisfaction is 0.409 which support our seventh hypothesis users' Post-usage usefulness of GEO-POTATO is positively associated with their satisfaction.

CHAPTER V
SUMMARY, CONCLUSION AND RECOMMENDATIONS

The aim of this study was to understand continued use of GEO-POTATO service. The study adopted a theoretical approach and based on one of the well accepted extended models of ECT (Bhattacherjee, et al., 2001) incorporating with the concept of user support, this study proposed a model which. Data were collected using a cross-sectional survey methodology and analyzed by PLS-SEM using Smart PLS v2.0 M3. In this chapter, the summary of this study was presented.

5.1 Summary of the Findings
The major findings of the study are summarized below:

5.1.1 Selected factors influencing the continued use of GEO-POTATO service
5.1.1.1 Post-usage usefulness

Majority (70.5%) of the respondents agreed with the post-usage usefulness of the GEO-POTATO service while 18.1% were undecided and 3.8% were strongly agreed Almost 74% respondent agreed with the post-usage usefulness of this service. They got disease alert beforehand.

5.1.1.2 Disconfirmation

Almost 67% of the respondents were agreed with the disconfirmation. They get benefitted by getting GEO-POTATO. They could manage the crop loss and disease. While 26.7% respondent were undecided.

5.1.1.3 IT self-efficacy

69.5% respondents agreed they can use the GEO-POTATO service. They have the ability to perform according to service without the help of other. Only 4.8% respondent cannot understand or cannot perform without the help of others because of their lack of education.

5.1.1.4 Satisfaction

Almost 75% of the respondents satisfied with the service of the GEO-POTATO. They would recommend other to get GEO-POTATO service. Only 8.6% and 16.2% respondent were disagree and undecided with GEO-POTATO service.

5.1.1.5 User Support

Almost 50% of the respondents think the service quality is very high and responsive. They think that people working in the support service is technically competent, while 36.2% respondent thinks service quality is medium.

5.1.1.6 Continuance intention

Majority (86.7%) of the respondents agreed to continue use of GEO-POTATO and they like to get more like this service for other crop disease. They very much like to know about the other cropping information.

5.1.2 Results of the theoretical model

There were seven hypotheses were proposed in the model. All the hypothesis were found to be statistically significant. A summary of the findings of the proposed hypotheses are presented as follows:

5.1.2.1 Contribution of Satisfaction to the continuance intention

Satisfaction was proposed as the predictor for the continued use of GEO-POTATO service. It was found to be significant predictor of continuance intention. Path co-efficient of satisfaction to continuance intention is 0.456. Satisfaction and post-usage usefulness both antecedent combined explained 50.7% variance of continuance intention. Data in descriptive analysis reported that almost 75% of the respondent satisfied with the service of GEO-POTATO.

5.1.2.2 Contribution of Post-usage usefulness to continuous intention

Post-usage usefulness proposed as the variable for the continued use of GEO-POTATO service. It was found to be significant predictor of the continuance intention. Path coefficient of the post-usage usefulness to the continuance intention is 0.303. Data in descriptive analysis reported that 78% of the respondent were agreed to post-usage usefulness of the GEO-POTATO service.

5.1.2.3 Contribution of Disconfirmation to Post-usage usefulness

Disconfirmation proposed as the independent variable which found to be significant relation with post-usage usefulness. Path coefficient of the disconfirmation to the post-usage usefulness was found 0.696. IT self-efficacy and disconfirmation both antecedents combined explained 58.4% variance of post-usage usefulness. Data in descriptive analysis reported that 70% of the respondent agreed they have reduced crop damage and use less agricultural input due to use of GEO-POTATO service

5.1.2.4 Contribution of Disconfirmation to Satisfaction

Disconfirmation proposed as the independent variable which found to be significant relation with satisfaction. Path coefficient of the disconfirmation to the satisfaction found 0.696. Disconfirmation and post-usage usefulness both antecedent combined explained 65.6% variance of satisfaction. Data in descriptive analysis reported that almost 75% of the respondent satisfied with the service of GEO-POTATO.

5.1.2.5 Contribution of Post-usage usefulness to Satisfaction

The relation between Post-usage usefulness to satisfaction found statistically significant. Path coefficient of post-usage usefulness to the satisfaction found 0.409. Data in descriptive analysis reported that 78% of the respondent were agreed to post-usage usefulness of the GEO-POTATO service. Data in descriptive

analysis reported that almost 75% of the respondent satisfied with the service of GEO-POTATO.

5.1.2.6 Contribution of IT self-efficacy to Post-usage usefulness

The relation between IT self-efficacy to the post-usage usefulness found statistically significant. Path coefficient of IT self-efficacy to the Post-usage usefulness found 0.178. Data in descriptive analysis reported that almost 70% of the respondents have the ability to understand and perform the GEO-POTATO service.

5.1.2.7 Contribution of User support to Disconfirmation

The relation between user supports to disconfirmation found statistically significant. Path coefficient of user support found 0.178. User support is the predictor of the disconfirmation. User support explained 39.2% variance of disconfirmation. Descriptive analysis reported that 50% of the respondent agreed that user support of GEO-POTATO service is high while 36% respondent they received medium support service.

5.2 Conclusion
Findings of the present study and the logical interpretation of other relevant facts prompted the researcher to draw the following conclusions:

- ➢ Satisfaction variable significantly contributed to continued use of GEO-POTATO service. So it can be said that satisfaction is one of the most important factor predicting continuance intention. Therefore it could be concluded that the higher the satisfaction higher is the continuance intention.
- ➢ Post-usage usefulness significantly contributed to continued use of GEO-POTATO service. So post-usage usefulness is another important predictor

for the continuance intention. Therefore, it could be concluded that the higher the post-usage usefulness higher is the continuance intention.

➢ Both Post-usage usefulness and satisfaction have found significant relations. Post-usage usefulness has influence on the satisfaction. Therefore, it could be concluded that higher the post-usage usefulness higher is the satisfaction.

➢ Both Disconfirmation and satisfaction have found significant relations. Disconfirmation has influence on the satisfaction. Therefore, it could be concluded that the higher the disconfirmation higher is the satisfaction.

➢ Both post-usage usefulness and disconfirmation have found positive relations. So it could be concluded that higher the disconfirmation higher the post-usage usefulness

➢ IT self-efficacy and post-usage usefulness have found positively related. So higher the self-efficacy higher is the post-usage usefulness.

➢ User support and disconfirmation have found positive relations. Therefore, it could be concluded that higher the user support higher is the disconfirmation

5.3 Recommendation

On the basis of the findings revealed from the study, the following recommendations are put forwarded that might guide the policy formulation:

5.3.1 Recommendations for policy implications

➢ As therefore, more mobile phone-based service like GEO-POTATO should be launched to target groups. Number of mobile apps should also be increased and the contents provided through the apps should be more relevant and specified. Images and pictures those are provided in the apps should be clearer.

➢ The Ministry of Agriculture (MoA) and other institutions like DAE who undertaking agricultural extension services should promote the use of the

Internet and other modern ICT devices as source and share agricultural information and should mainstream e-extension within their operational set-up.

➢ IT-based service providers must comply with user's satisfaction and post-usage usefulness of a service. Strengthening user support service and providing training to increase user's self-efficacy beliefs are much needed for sustainability of this initiative.

5.3.2 Recommendation for further studies

➢ The study was conducted in Mushiganj district for the highest potato growing reason all over the country and GEO-POTATO service was only available in this area as well as Rangpur district. Therefore, repeating this study at Rangpur district and compare the findings would be effective and helpful for policy formulation.

➢ Once selection of the variables, this study considered factors from extended ECT model, such as disconfirmation, satisfaction, post-usage usefulness, continuance intention while added enablers deemed important to the research context, such as IT self-efficacy and user support. Age, education, service experience and farm size were controlled in this study. Therefore, future research might be undertaken to identify the moderators and their influence to technology, particularly IT use and acceptance for agricultural service delivery.

➢ Theoretically, this study have already made at least two contributions. First, adding up expectation-confirmation theory with well-known service quality model. Second, the theoretical approach and statistical tools used in this study were so far unique in the discipline of Agricultural Extension. In fact, this study combined the notion of two disciplines, Agricultural Extension and Information Systems, in a single study.

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APPENDIX A

Department of Agricultural Extension and Information System
Sher-e-Bangla Agricultural University
Dhaka – 1207

Interview schedule

On

"Assessment of GEO-Potato from Technology Acceptance Perspective"

Serial No…...

Name of the respondent: **Village:**

Upazila: **District:**

Disclaimer:

Please provide the following information. Your information will be kept confidential and will be used for research purpose only.

1. **Age:**
2. **Level of Education:**

        a) Cannot read and write
        b) Can sign only
        c) Did not go to school but Can read and write
        d) Attended up to ……………… class/passed

3. **Gender: Male/Female**
4. **Farm Size:**
5. **Farming Experience**: How long have you been engaged in farming? _____years.
6. **Post-usage Usefulness**: Please mention your degree of agreement or disagreement with the following statements.

Sl. No.	Items	Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
i.	I have experienced a higher yield of my farming after I start using Geo-Potato					
ii.	I noticed a significant decrease of my crop losses after I start using Geo-Potato					
iii.	Geo-Potato alerts me beforehand of disease					

Sl. No.	Items					
	outbreak to crop (e.g. potato) field					
iv.	I could adopt several control measures well in advance against diseases (e.g. late blight) by using Geo-Potato					
v.	Using of Geo-Potato requires me to use less agril. inputs (e.g. fertilizer, pesticide)					

7. **Disconfirmation:** Please mention your degree of agreement or disagreement with the following statements.

Sl. No.	Items	Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
i.	My experience of using Geo-Potato was better than what I expected					
ii.	I have perceived much benefits from using Geo-Potato than what I initially expected					
iii.	I have significantly reduced my crop losses by using Geo-Potato than what I initially expected					
iv.	I could manage crop diseases (e.g. late blight) better by using Geo-Potato than what I initially expected					

8. **IT Self-efficacy**: Please mention your degree of agreement or disagreement with the following statements.

Sl. No.	Items	Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
i.	I can use Geo-Potato application without the help of others					

Sl. No.	Items					
ii.	I can understand and perform my farm-related tasks as suggested by Geo-Potato without the help of others					
iii.	I am confident in my ability to use Geo-Potato application by my own					
iv.	I am confident in my ability to use other features of Geo-Potato application if added in future					
v.	I am confident in my ability to use a similar application like Geo-Potato					

9. **Satisfaction**: Please mention your degree of agreement or disagreement with the following statements.

Sl. No.	Items	Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
i.	I am satisfied with the service provided by Geo-Potato					
ii.	I am happy to use Geo-Potato for my farming					
iii.	I would recommend others to use Geo-Potato for their farming					
iv.	Using Geo-Potato is a pleasing experience					

10. **Users' Support:** Please mention your degree of agreement or disagreement with the following statements.

Sl. No.	Items	Very low	Low	Medium	High	Very high
i.	The service I have received from Geo-Potato support service was reliable					

Sl. No.	Items					
ii.	Support service was responsive					
iii.	People working in the support service were found technically competent					
iv.	Support service of Geo-Potato were found very helpful					

11. Continuance intention: Please mention your degree of agreement or disagreement with the following statements.

Sl. No.	Items	Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
i.	I intend to continue using Geo-Potato application for my farming					
ii.	I intend to continue using Geo-Potato application for getting other crop information					
iii.	I intend to continue using Geo-Potato for getting more production related information					
iv.	I intend to continue using Geo-Potato for receiving more information regarding crop diseases					

Thank you for participating in the study.

Name and Signature of the Enumerator with date.

Cell:

APPENDIX B
Cross Loading

	DCon	INT	SATIS	SE	Supp	UsF
Int1	0.561	**0.902**	0.620	0.309	0.398	0.587
Int2	0.578	**0.947**	0.624	0.293	0.378	0.606
Int3	0.564	**0.955**	0.638	0.298	0.427	0.610
Int4	0.581	**0.944**	0.678	0.251	0.431	0.615
SE1	0.269	0.320	0.349	**0.967**	0.051	0.370
SE2	0.258	0.296	0.336	**0.986**	0.002	0.343
SE3	0.277	0.296	0.356	**0.978**	0.009	0.355
SE4	0.270	0.311	0.360	**0.981**	0.020	0.367
SE5	0.266	0.278	0.339	**0.986**	0.032	0.368
dcon1	**0.903**	0.517	0.713	0.266	0.523	0.629
dcon2	**0.808**	0.534	0.670	0.233	0.500	0.581
dcon3	**0.888**	0.498	0.635	0.285	0.615	0.693
dcon4	**0.876**	0.572	0.636	0.167	0.535	0.683
satis1	0.706	0.623	**0.941**	0.327	0.537	0.678
satis2	0.719	0.655	**0.934**	0.300	0.522	0.718
satis3	0.725	0.650	**0.935**	0.359	0.529	0.720
satis4	0.717	0.643	**0.953**	0.351	0.575	0.704
supp1	0.588	0.374	0.523	0.031	**0.953**	0.630
supp2	0.629	0.417	0.575	0.010	**0.979**	0.645
supp3	0.600	0.461	0.577	0.014	**0.970**	0.625
supp4	0.612	0.439	0.555	0.039	**0.977**	0.625
usf1	0.647	0.604	0.689	0.342	0.548	**0.896**
usf2	0.664	0.581	0.662	0.345	0.544	**0.922**
usf3	0.606	0.538	0.613	0.393	0.548	**0.875**
usf4	0.593	0.521	0.625	0.316	0.550	**0.810**
usf5	0.626	0.462	0.560	0.136	0.558	**0.690**