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Agricultural information systems acceptance and continuance in rural communities: A consumption values perspective

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ABSTRACT

This study unearths the different configurations of user motivations that foster success in Agricultural Information Systems (AIS) acceptance and continuance among small-holder farmers in rural communities in a developing economy. Anchored on the fact that significant proportions of the world's poorest live in sub-Saharan countries characterized by small-holder agriculture, the study explores the multiple pathways that result in AIS acceptance and continuance while revealing the necessary and sufficient conditions that are required to achieve a given outcome. Using the consumption values theory and fuzzy set qualitative comparative analysis (FsQCA), the findings reveal three AIS user typologies namely extrinsic, intrinsic, and hybrid motivated users. The results further reveal that AIS usability, farmer group and family support, together with the inspiration of joy, hope and trust are motivating factors for the attainment of success in AIS acceptance and continuance. The study provides foundational knowledge on how development actors can use AIS as interventions to improve Agri-food outcomes among rural dwellers in the global south.

1. Introduction

Information and Communication Technology (ICT) solutions are increasingly being applied in various sectors in emerging economies as means of driving development [1–3]. This phenomenon is largely described as ICT4D (Information Communication Technologies for Development) with its associated off-shoots such as e-commerce for development [4], and mobile technology for development [5]. In recent times, ICT solutions have been applied to increase financial inclusion [7], create sustainable livelihoods [8,9], and promote food security [9,10] of rural populations. Interventions usually targeted at promoting food security also tend to factor in the creation of sustainable livelihoods for rural dwellers to improve their living conditions and alleviate poverty. Evidence from scholarly studies has supported the impact of ICT in driving development in emerging economies [4,9,12] by addressing information asymmetry, communication barriers and deplorable economic situations that existed amongst dwellers [13]. For example, in a study conducted in China, a sizeable number of rural-dwelling populations were emancipated from poverty through the development of a community-owned e-commerce ecosystem that brought economic empowerment to the community [4]. Despite the emancipatory nature of such ICT-based interventions [12], there are situations where some of these interventions fail in the goals for which they were set out to achieve [14]. For this reason, Alhassan and Adam [15] express the absence of a consensus within scholarly studies on the expected transformative outcome of ICT solutions targeted at development. Note that, while significant investments are being made into ICT4D in developing countries, their success rates remain relatively low. Venkatesh et al. [14] report that about 85% of ICT4D interventions fail to realize their expected program outcomes. However, the underlying conditions that result in the success or failure of ICT4D initiatives still remain a matter of contention in the literature [14,16].

In view of this, there have been calls for studies that elaborate on the dynamics that lead to the success or otherwise of such ICT-driven interventions [17,18]. In response to the call, there have been some research works aimed at gaining some level of understanding into the dynamics that engender success in ICT-driven interventions especially in developing countries [4,7,20,21]. For example, the study by Karanasios and Slavova [12] sought to understand the strategies employed by development agents in ensuring successful agricultural information transfer to rural residents in Ghana who are involved in farming as a means to improving production and livelihoods. Other studies have sought to investigate strategies being utilized by development actors and agents to promote success in these interventions. For instance,

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Venkatesh et al. [14] in a study conducted in India established that utilizing hybrid governance approaches for digital interventions between the local government and development actors in rural areas tends to yield better success rates than homogeneous governance structures involving only one of the stakeholders. Similarly, Li et al. [4] found that utilizing hybrid development approaches (top-down and bottom-up approaches) for introducing digital solutions into a rural Chinese community led to increased Agricultural Information Systems (AIS) adoption and utilization rates which resulted in a reduction in poverty levels. Whiles these two studies focused on development and governance strategies, Karanasios and Slavova [12]; investigated the strategies through which impact can be gained with information delivery, and found that the use of legacy technologies (such as radio, mobile vans, etc.) and farmer networks proved more effective than the use of sophisticated digital solutions.

We hypothesise that despite strategies that provide approaches to AIS adoption, they often fail to capture the underlying motivation of the intended users. Therefore, to better curtail the shortfalls of ICT-driven interventions, one needs to better understand the behavior of the intended users in order to present solutions that can be readily embraced and continued. Karanasios and Slavova [12] recommended studies that would capture the views of agricultural practitioners to better understand the dynamics involved in engendering success in such interventions. There exists an abundance of IS-related studies that seek to capture user behavior with respect to ICT solutions [4,16] with such studies highlighting the relevance of context to the attributes defining the outcome of the phenomenon. User behaviour with respect to Information System solutions, has been found to be a critical determinant in the success or failure of the solution [22,23]. In addition, extant literature posits that drivers of user behaviour can be gleaned from the values that they form concerning the artefact or service under consideration [24–26]. Serenko et al. [25] noted that in individual-oriented ICT solutions (solutions meant to serve individual benefits rather than organizational goals), users tend to form personalized values that drive their behaviour. Jung [24] describes this as a value-oriented approach to understanding user behaviour while the traditional models used to study such phenomenon, such as the Technology Acceptance Model [27]; Marangunić & Granić, 2015) considers users as passive responders to technology [24]. With respect to ICT4D solutions, users adopt these solutions based on values they perceive they can receive from the use of such ICT-oriented solutions and hence requires a better understanding of these values to help foster its acceptance and continued usage. This creates the need to better understand the underlying motivations for which rural farmers in a developing country context decide to accept and/or continue using a given AIS.

Based on the aforementioned, this study investigates the value factors that drive user behaviour for acceptance and continuance of AIS interventions. The study specifically seeks to answer the question of "What values drive user acceptance and continuance in AIS usage in rural settings?" This is achieved through the theoretical lens of the Consumption Values Theory (CVT) [26]; a theoretical perspective in information systems research; and fuzzy set qualitative comparative analysis [28,29]; a fast-rising methodological approach in the information systems research field. The methodological approach provides a means of unearthing the different combinatorial values that exist among AIS users that contribute to their behaviour towards acceptance and continuance of such interventions. Consequently, the study makes three significant contributions. Firstly, it unearths the multiple pathways through which acceptance and continuance of AIS can be achieved within similar contexts. Secondly, it presents different user typologies based on the value orientation towards which development actors can tailor AIS projects to foster success. Finally, the study unearths the core values that are of importance to the acceptance and continuance of AIS.

The study is conducted in the Sub-Saharan African Country of Ghana which is rapidly digitizing a number of its industrial sectors through the ICT for Accelerated Development Policy (Boakye et al., 2021; Ayakwah et al., 2021). In Sub-Saharan Africa, Agriculture alone accounts for 61% of the livelihoods of the population [30], with total dependent by the rural poor [31]. One can therefore argue that improving the means of agricultural production will not only inure to the benefit of the rural population, but will also bring about improvements in food security [32]. To achieve such improvements, AISs that offer services such as market information, information on good agronomic practices (extension information), pest and disease monitoring information, on-field monitoring information, and weather information are being gradually deployed in several developing economies [33]. In view of this, Ghana was adopted for this study as a result of its government's resolve to digitize its economy along various sectors including Agriculture. Since 2009, Ghana has introduced and supports a number of Agricultural-centred digitalization programs aimed at bringing efficiency into agricultural practices and thereby reducing poverty levels within the country [34]. Despite the digitization drive within the Agricultural sector in Ghana, adoption of AIS services still remains on the low amongst rural farmers who are often the intended target for these projects. The study therefore targeted the northern sector of the country because (1) it has the highest number of persons (mostly farmers) living in poverty, (2) has the highest levels of inequality in Ghana [35], and (3) has AIS sponsored projects either by government, non-governmental organizations (NGO) or produce aggregators among small-holder farmers. Incidentally also, the northern sector happens to be the largest recipient of aid programs in the country [36].

The rest of the study progresses by first presenting the theoretical underpinnings that guide the study. This is followed by a description of the methodology and a presentation of the results. A discussion of the results then follows with its associated implications. The conclusion section provides a summary of the study and future research directions.

2. Theoretical underpinning

The main theory used in the study is the Consumption Values Theory (CVT). Propounded by Sheth et al. [26]; the theory has been utilized as a predictor of choice-driven behaviour in a number of studies [37–40]. Within the IS discipline, CVT has been utilized to study user adoption [41,42] and user continuance behaviour [37,43] in different digital artefacts. These studies highlight the fact that a combination of consumption values drives user behaviour with respect to information system acceptance and continuance.

Prior to making choice-based decisions, consumers (users) assess the value they can derive from the use of any given option to inform their perception on which better maximizes their satisfaction. The perceptions that are formed about available options then drive the consumer's (user) choice behaviour. The CVT therefore posits that, "consumer choice behaviour is a function of multiple-choice values which make different contributions in different choice situations, and are independent of each other". These choice values are *functional, epistemic, emotional, social, and conditional*. Given any choice situation, a user's decision to associate (interact) or accept a given option will be driven by either one or a combination of the choice values. This means in some choice situations, a combination of these factors (not just a single value factor) may determine the choice behaviour of a user [24,26]. This combination of values is as described by Gonçalves et al. (2016), a "variety of attributes and higher-level abstractions" known as perceived values.

Users' motivation for using different solutions based on their value combinations (perceived value) may either be thought of as intrinsic or extrinsic. Extrinsically motivated persons are outward-looking and do not give much consideration to satisfying basic psychological needs which may cause them to engage in behaviours that result in separable consequences. In addition, extrinsic motivated persons consider economic analysis such as the search for worth [11,44,46]. On the other hand, intrinsically motivated persons consider behaviours that seek satisfaction from the engagement in the process itself and not ultimately

the outcome with a focus on personal growth, personal relationships, and community involvements [11,44,46] which seek to satisfy some basic psychological needs. To this extent, functional and conditional values are categorized as extrinsic values while social, emotional, and epistemic values, are considered as intrinsic values.

In this study, functional values which seek utilitarian or physical performance from an alternative [26] are operationalized as *usability and information quality* [47]. Information quality is significant in the post-acceptance stage since users become exposed to information at this point. Conditional value comes into play when a specific situation faces the choice maker and is operationalized in this study as *donor and* technical support. The categorization of these two as extrinsic values is based on their outward seeking approach which focuses on the search for worth from utilizing these services. Social value takes into consideration the association with particular social groups, and is operationalized as *farmer group and family* support [48]. The emotional value seeks the arousal of affective states and is operationalized as *joy, hope and trust* in using these services while epistemic which seeks novelty and knowledge is operationalized as *novelty* and *knowledge*. Social, epistemic, and emotional values are classified as intrinsic due to their personal growth and community interaction orientation. The outcome variables are sourced from the IS Continuance Model also known as the Expectation-Confirmation Model [49,50]. Confirmation, which is defined as "Users' perception of the congruence between expectation of AIS service use and its actual performance" [49] is operationalized as the *point of acceptance* since it measures the outcome related perception associated with the behaviour [27]; Marangunić & Granić, 2015) as expected of most acceptance measuring models. Continuance intention which measures the intention to use AIS services [49–51] is utilized as *continuance*.

3. Methodology

3.1. Data collection

The population for the study was rural farmers in Ghana who have been introduced to AIS. Data collection took place in 4 rural areas where farmers are familiar with the AIS offered by Agrocenta (https://agrocenta.com/), the leading aggregator in the catchment areas. Located within two of the northern regions of Ghana being the Upper East and the Northern Regions, the towns that met the inclusion criteria for the study sample were Mpaha, Mirigu, Nasia, and Yinduri. Data was collected using a survey questionnaire consisting of two parts. The first part captured the demographics of respondents, and the second part measured respondents' perceptions of the constructs being understudied using a five-point Likert Scale graded from strongly disagree to strongly agree with neutral as the midpoint. Questionnaires were interpreted to some respondents since they were prepared in English. Given that most farmers in the selected areas are illiterates, we conducted two pilot tests and two pre-tests to increase the level of understanding of respondents towards the study.

3.2. Participants

Study participants were selected using a Stratified Random Sampling method with the four selected areas namely Mpaha ($n = 13$), Mirigu ($n = 60$), Nasia ($n = 25$), and Yinduri ($n = 31$) as the strata. Participants included farmers that were using or had used AIS to support their farming activities. Persons who had no knowledge of AIS were not included in the study. A total of 145 respondents took part in the study. However, 16 of the responses were excluded from the data analysis because they were uncompleted. This resulted in 129 valid responses. The number of valid responses meets the minimum requirement of 2^K cases (respondents) expected of FsQCA methodology [28]. The "K" represents the number of conditions being assessed as leading to the outcome, which in the case of this study, represents the five ($K = 5$) values proposed in the CVT. This puts the minimum valid responses required at $2^5 = 32$. Since valid responses were 129, we had more than enough cases for the analysis. The demographic distribution of respondents is as presented in Table 1. The characteristics of respondents do not differ much from rural characterizations captured across multiple studies and reports. Respondents were mostly uneducated (55.81%) with a significant few attaining basic education at either the junior high or senior high school levels (26.36%).

This points to the limitation most respondents may have in basic reading, writing, and communication in any language other than their local language [48]. This is evident in their use of feature phones (65.12%) and third parties (friends, families, and extension officers) as a means of using AIS services as opposed to smartphones and tablets (13.18%). The dominant use of call-in extension services (54.26%) further highlights the alternatives available for farmers to adopt as against using texting options (20.16%). The gender distribution has more men than women which is also characteristic of most occupations in Ghana [52]. While the population of Ghana is mostly dominated by the youth with persons under 25 forming almost 57% of the population, it was realized that there was very little percentage difference between youth respondents and older persons. This highlights the increasing drift of the youth away from agriculture which is becoming a dominant theme in sub-Saharan Africa due to its unattractive nature in its current form.

3.3. Data collection instrument

The study is based on the theoretical perspective of the CVT with

Table 1
Demographic profile.

Variable	Levels	Frequency	Percentage
Age	18–24 years	6	4.65%
	25–34 years	29	22.48%
	35–44 years	32	24.81%
	45–55 years	29	22.48%
	55+ years	33	25.58%
Gender	Male	76	58.91%
	Female	53	41.09%
Education	No Formal Education	72	55.81%
	Primary	12	9.30%
	Junior High	27	20.93%
	Senior High	7	5.43%
	Tertiary	11	8.53%
Number of Years Farming	1–4 years	9	6.98%
	5–9 years	23	17.83%
	10–14 years	30	23.26%
	15–19 years	18	13.95%
	20+ years	49	37.98%
Services Used	Call-In Extension Service Only	38	29.46%
	Market Information Services Only	19	14.73%
	Text Extension Service Only	10	7.75%
	Call-In Extension and Text Extension Services	12	9.30%
	Call-In Extension and Market Information Services	13	10.08%
	Market Information Services and Text Extension Services	3	2.33%
	Call-In Extension, Market Information and Text Extension Services	34	26.36%
Medium used	Feature Phone	84	65.12%
	Smart Phone	16	12.40%
	Mobile Tablet	1	0.78%
	Third Party	28	21.71%
Frequency of Use	Daily	23	17.83%
	Few times a week	26	20.16%
	Few times a month	80	62.02%
Years of Using Service	Less than 1 year	4	3.10%
	1–2 years	16	12.40%
	2–3 years	44	34.11%
	3+ years	65	50.39%

constructs adopted from the Information Systems (IS) Continuance Model [49]. The CVT's five (5) values are operationalized in this study as follows: *information quality and usability* as functional values; *farmer group and family* support as social values; *joy, hope and trust* as emotional values; *knowledge and novelty* as epistemic values; and *donor and* technical support as conditional values. The selection of these specific characterizations of the consumption values is based on Mäntymäki et al.'s [37] opinion of CVT offering a framework for value selection which has to be tailored to specific study contexts. In Table 2, we define value characteristics that are particular to AIS usage in order to capture the overarching values that are of importance to the study context. From the IS Continuance Model, the confirmation and continuance intention constructs are adopted for this study with confirmation representing the "point of acceptance" of the technology.

The composite reliability of the constructs was tested using the lavaan package in R version 3.6.2. The results attained ranged from 0.935 to 0.630 with information quality scale items under the post-acceptance conditions scoring the highest result of 0.935. Novelty and knowledge scale items under the post-acceptance conditions scored the least of 0.630. Composite reliability values of scale items that fall below the 0.60 threshold are considered to have lower reliability [53]. In this study, all the values attained exceeded the 0.60 threshold and therefore scale items used in measuring the constructs had an acceptable to high level of reliability. The summary of the composite reliability values of the various constructs is summarized in Table 3 below.

3.4. Fuzzy set qualitative comparative analysis (FsQCA)

The FsQCA methodology supports researchers to obtain linguistic summaries from data associated with a given set of cases in specific contexts [54]. The FsQCA methodology introduced by Ragin [28,29] complements the limitations that are experienced with Multiple Regression Analysis (MRA) and Structural Equation Modelling (SEM) [55]. This is achieved through the FsQCA's ability to combine the strengths of a case-oriented study (qualitative studies) by assessing the complex causality within cases and the strengths of the variable-oriented study (quantitative study) by assessing multiple cases [29,55]. The foundational principles of the method are drawn from fuzzy logic, set theory and Boolean reduction [28,56,57] from which an analytical tool is presented to help explain the complex conditions that contribute to a given outcome. The FsQCA methodology provides multiple pathways that can result in a given outcome and offers the necessary and sufficient conditions that are required to achieve a given outcome [57]. In contrast to MRA research studies which presents variable net effect solutions to outcomes, FsQCA is able to identify other possible variables that influence an outcome in the small number of cases within which these variables exist [57,58].

Table 2
Constructs and literature source.

Construct	Source (s)	Example Likert Item
Information Quality (Functional)	[41,74]	"Information is easily interpretable"
Usability (Functional)	[27,61, 82]	"Interacting with the service is clear and understandable"
Farmer group and Family Support (Social)	[26,61]	"Using the service improves people's perception of me"
Joy, Hope and Trust (Emotional)	[26]	"I am hopeful of good outcomes when I use the service"
Novelty and Knowledge (Epistemic)	[26]	"I am able to gather facts to support my decision making"
Donor and Technical Support (Conditional)	[26]	"I use the service because I don't have to pay for it"
Confirmation/Acceptance	[6,51]	"The usability of the system is better than I expected"
Continuance Intention	[6,51]	"I will continue using the system in the near future"

Table 3
Composite reliability of construct scale items.

Construct	Pre-acceptance Composite Reliability	Post-acceptance Composite Reliability	Outcome Variables Composite Reliability
Information Quality	N/A	0.935	N/A
Usability (Functional)	0.859	0.874	N/A
Farmer Group and Family Support (Social)	0.900	0.891	N/A
Inspiring Joy, Hope and Trust (Emotional)	0.887	0.874	N/A
Ability to provide Novelty and Knowledge (Epistemic)	0.787	0.630	N/A
Donor and Technical Support (Conditional)	0.783	0.830	N/A
Confirmation/Acceptance	N/A	N/A	0.831
Continuance Intention	N/A	N/A	0.881

The FsQCA methodology was adopted in this study to allow for the identification of all possible combinations of user values (consumption values) that influence acceptance and continuance behaviour in the context of AIS in rural Ghana. Multiple studies in the information systems discipline have identified a number of possible attributes that drive user behaviour in the adoption and continuance of information systems [22,59–61]. These attributes are either intrinsically or extrinsically motivated [46,62] and vary based on the study context [16]. To this end, it is important to understand the possible combinations of conditions that are necessary to engender user acceptance and continuance in Agricultural-oriented ICT4D projects to ensure success within the context of a developing country. The FsQCA approach which progresses through calibration, truth table evaluation, and logical minimization, was applied to unearth the multiple pathways that satisfy the objectives set out for this study. The FsQCA 3.0 Software was used to analyse the data through the required steps of the FsQCA approach.

In FsQCA procedure, calibration is often described as the most important step [57] and involves the rescaling of measures to fuzzy scores between 0 and 1 [28]. The calibration was achieved by using the maximum (full-membership score), average (crossover point) and minimum (full non-membership score) of the individual constructs to determine the set membership score (fuzzy set score) using the calibrate function in FsQCA Software 3.0. The membership scores used for each construct based on the defined points are listed in Table 4 below. The calibration was followed by the truth table evaluation. A truth table is a logical table that shows outcomes from all possible combinations of the input factors (Schneider & Wagemann, 2012). This was achieved through the truth table analysis in FsQCA 3.0 which yielded 32 rows of possible combinations. The truth table was narrowed down to the conditions that best lead to the outcome [56] by setting the frequency cut-off value to be greater than 1 case [28]. This means that only cases that had 2 or more representations were included for the next stage of the analysis. Also, a consistency cut-off point of 0.90 was set in order to ensure that cases that had a significant level of reliability were kept. According to Ragin [28]; a consistency that is > 0.75 and closer to 1 has a higher reliability. Logical minimization takes place through Quine—McCluskey algorithm applied in FsQCA software and achieves this through a predefined set of counterfactuals based on empirical evidence (Schneider & Wagemann, 2012).

4. Results and discussions

4.1. FsQCA findings for acceptance

The FsQCA findings of the configurations for acceptance of AIS are presented in Table 5 together with the pathways that explain the

Table 4
Data calibration membership cut-off points.

Construct	Full Non-Membership Score	Crossover Point	Full Membership Score
Pre- Acceptance Conditions			
Usability (Functional)	1.75	3.92	5.00
Farmer Group and Family Support (Social)	1.40	3.90	5.00
Inspiring Joy, Hope and Trust (Emotional)	2.00	3.89	5.00
Ability to provide Novelty and Knowledge (Epistemic)	2.20	4.00	5.00
Donor and Technical Support (Conditional)	2.00	3.86	5.00
Post-Acceptance Conditions			
Information Quality	2.17	3.97	5.00
Usability (Functional)	2.25	4.01	5.00
Farmer Group and Family Support (Social)	2.20	3.94	5.00
Inspiring Joy, Hope and Trust (Emotional)	2.00	4.02	5.00
Ability to provide Novelty and Knowledge (Epistemic)	2.80	3.98	5.00
Donor and Technical Support (Conditional)	2.00	3.82	5.00
Outcome Variables			
Confirmation/ Acceptance	2.00	4.01	5.00
Continuance Intention	1.67	4.06	5.00

Table 5
Acceptance pathways.

Configurations	Solutions				
	1	2	3	4	5
Usability (Functional)	●	●	⊗	⊗	⊗
Farmer Group and Family Support (Social)	●	⊗	⊗	●	⊗
Joy, Hope and Trust (Emotional)		⊗	⊗	⊗	●
Knowledge and Novelty (Epistemic)	●	⊗		⊗	⊗
Donor and Technical Support (Conditional)			●	⊗	⊗
Consistency	0.899	0.901	0.912	0.929	0.921
Raw coverage	0.751	0.437	0.429	0.407	0.402
Unique Coverage	0.305	0.010	0.018	0.016	0.017
Overall Consistency	0.851				
Overall coverage	0.866				

Note: Black circles (●) indicate the presence of a condition whiles circles with (⊗) indicate the absence of a condition. Large circles indicate core conditions and small circles indicate peripheral conditions. Blank space indicates a "don't care" condition.

outcome of AIS acceptance. Core or peripheral conditions may be either present, negated, or absent with no influence on the solution [57]. For every pathway, the consistency and coverage values are presented. The overall coverage and consistency for the identified pathways are also further presented. Consistency is expected to be greater than 0.75 which was achieved in all pathways as well as the overall solution. Consistency is the degree that a relationship has been approximated, while coverage evaluates the empirical relevance of a consistent subset [57,63]. The overall solution coverage can be likened to the R-squared value in regression analyses which indicates the extent to which acceptance may be arrived at from the defined configurations, while overall consistency is similar to correlation showing the strength of the solution [57]. The overall coverage of 0.866 shows that a significant proportion of the acceptance outcome is explained by the five solution pathways. Each solution pathway's empirical relevance is also addressed in FsQCA through the raw and unique coverage. The raw coverage explains the extent of the outcome that is explained by a given solution pathway, while the unique coverage explains the extent of the outcome that is exclusively explained by a given solution pathway [63].

Pathway 1 indicates that acceptance of AIS can be achieved through a high usability, high perception of farmer group and family support, and high ability to promote knowledge and novelty among service users. Pathway 1 is constituted of both extrinsic and intrinsic motivated values with intrinsic value motivations having greater presence than extrinsic motivated factors. **Pathway 2** indicates that acceptance of AIS can also be achieved in situations where there is minimal farmer group and family support, minimal perception of inspiring joy, hope and trust, and minimal ability to promote novelty and knowledge when there is a perception of high usability among service users. Pathway 2 highlights a solely extrinsic value motivation (usability) solution requiring the absence of intrinsic values (social, emotional and epistemic) in order to attain acceptance. Conditional values which are also extrinsic may or may not be present to achieve acceptance.

Pathway 3 indicates that acceptance of AIS can also be fostered in situations where there is minimal usability, minimal farmer group and family support and minimal perception of inspiring joy, hope and trust when the service has a high perception of good technical and donor support. Pathway 3 highlights an extrinsic motivated pathway that focuses more on the existence of an enabling environment for the use of the service. **Pathway 4** suggests that AIS acceptance can also be attained in situations where there is minimal usability, minimal perception of inspiring joy, hope and trust, minimal ability to promote knowledge and novelty, and minimal perception of technical and donor support when there is a high perception of farmer group and family support. Pathway 4 is an intrinsic motivated pathway that has its reliance on social influence to foster user acceptance. **Pathway 5** suggests that AIS acceptance can also be attained in situations where there is minimal usability, minimal farmer group and family support, minimal ability to promote knowledge and novelty, and minimal perception of technical and donor support when there is a high perception of inspiring joy, hope and trust. Pathway 5 represents a pathway of persons who take their decisions based on emotions and are therefore an intrinsic motivated pathway.

From the analysis of the Acceptance outcome, the FsQCA revealed five causal pathways that lead to the outcome. The parsimonious solution that was attained revealed high perception of usability + high perception of farmer group and family support + high ability to inspire joy, hope and trust + high perception of donor and technical support = acceptance of AIS.

4.2. *Value pathways for acceptance*

The value combinations that drive user acceptance resulted in five distinct pathways. These pathways may however be condensed into three major considerations; extrinsic value motivated pathways, intrinsic value motivated pathways and hybrid value motivated pathways. These are further discussed as follows.

Extrinsic oriented values are represented by Pathways 2 and 3 which are reliant on extrinsic values such as functional values and conditional values. These pathways emphasize the worth-seeking attitudes of the users influencing their acceptance of AIS. Pathway 2 is representative of persons that focus largely on the utilitarian ability of the service, i.e. the service's ability to support the execution of certain tasks or work requirements [64]. This is centred on the usability of the system which plays an important role among the rural folks [65]. The dominant use of the feature phone among farmers requires that services take on a simplified approach [12] in its usage, which affirms the option of the call-in extension as the dominantly used service. Farmers require that these services are able to provide them evidential outcomes within a

given time period and would discontinue if such services fail to do so [66]. These groups of users therefore seek simplified solutions that can support their farming activities to yield positive results within a stipulated amount of time. With these set of users, one must focus on ensuring that the service has the ability to meet their needs in terms of task performance, giving very little focus to other values such as its provision of agricultural knowledge or its use amongst other farmer group members.

Pathway 3 in relation to acceptance revealed a set of users who would accept the service based on the existence of some pre-defined conditions. Provision of donor support and good technical support for the services result in the acceptance of AIS solutions among groups of users. Farmers who fall under this pathway often rely on development actors to make provisions that support the use of the service which may include payment of service charges involved in the use of the service. These users are likely to reject such services if in the introduction of the solution they have to make financial commitments to its usage. Again they are those who require that there is good technical support from the service to answer to their enquiries concerning the service. These can be thought of as the facilitating conditions [61] that will lead to user's acceptance of the service. In this respect, factors like service enrolment fees being borne by donor agencies or development actors and as well the existence of good technical support for the services are required.

Pathways 4 and 5 highlight the sets of users that have intrinsically motivated orientations towards the acceptance of AIS services. These set of users are those that seek to satisfy basic psychological needs through the use of the service and do not focus on outward outcomes such as worth but rather on considerations that lead to personal growth or community interaction [44,46]. Pathway 4 represents a social oriented pathway with these groups of persons being more inclined to use the service when members of their farmer groups or close relations believe they should use the service. Social influence [61] which is a dominant theme amongst most rural and agricultural oriented ICT studies [12,65,66] is characteristic of these users and plays a central role in the acceptance of using AIS services.

Pathway 5 represents a set of users that seek affective states from their use of these solutions. Emotional seeking goals are predominantly present in hedonic digital services and often absent in functional-oriented services [67]. In AIS there seems to be the need to arouse some level of emotions that include hope, joy and trust for the service as a means of better promoting its acceptance amongst these set of users. This means that the service being able to assure them of good outcomes and being able to inspire some level of happiness in its usage is a good starting point to enrol these set of users unto such services.

The hybrid value motivated pathway is one that combines both intrinsic values and extrinsic values to its acceptance and is represented by Pathway 1. These sets of users are not only focused on the utilitarian capacity of the services but also the involvement of farmer groups and family support for utilizing the service. The service should also be able to inspire some emotions of trust and positive outcomes through the use of the service in order to ensure the successful acceptance of these AIS. This represents a complex mix of both the extrinsic factors that look at outward indicators of worth (which includes the technical and donor support received) and intrinsic factors which focus more on personal growth, involvement in a community and personal relationships [46,62].

4.3. FsQCA findings for continuance

The findings for continuance as derived from the FsQCA are presented in Table 6. The overall consistency for the identified pathways was 0.833 which is greater than the threshold of 0.75 and has a coverage of 0.908 signifying the extent to which the pathways identified explain the outcome of continuance of AIS.

Pathway 1 indicates that continuance of AIS can be achieved in situations where there are minimal perception of information quality, minimal perception of usability, and minimal perception of technical and donor support. At the same time, there must be a high perception of farmer group and family support as well as high perception of inspiring joy, hope and trust among service users. Pathway 1 represents a solely intrinsic value motivated pathway requiring the minimal appearance/absence of extrinsic value factors to trigger the intention to continue using the service. **Pathway 2** indicates that continuance of AIS can also be achieved in situations where there is minimal perception of information quality, minimal perception of usability, minimal perception of technical and donor support when there is a perception of high ability to promote knowledge and novelty among service users. This set of users represent those that are seeking knowledge and/or novel outcomes through their engagement with the service and are therefore intrinsically motivated.

Pathway 3 indicates that continuance of AIS can also be fostered in situations where there is high perception of information quality, high perception of usability, high perception of farmer group and family support, high perception of inspiring joy, hope and trust, and a high ability to promote novelty and knowledge amongst service users. Pathway 3 indicates a set that values both intrinsic and extrinsic value factors in their continuance intention towards the service. This pathway shares a similar extrinsic and intrinsic characterization with Pathway 4. **Pathway 4** indicates that continuance of AIS can also be fostered in situations where there is high perception of information quality, high perception of usability, high perception of farmer group and family support, high ability to promote novelty and knowledge, and a high perception of technical and donor support amongst service users.

Pathway 5 suggests that AIS continuance can also be attained in

Table 6
Continuance pathways.

Configurations	Solutions						
	1	2	3	4	5	6	7
Information quality (Functional)	⊗	⊗	●	●	⊗		⊗
Usability (Functional)	⊗	⊗	●	●	●	⊗	●
Farmer Group and Family Support (Social)	●		●	●	⊗	⊗	●
Joy, Hope and Trust (Emotional)	●	⊗	●		⊗	●	●
Knowledge and Novelty (Epistemic)		●	●	●	⊗	⊗	⊗
Donor and Technical Support (Conditional)	⊗	⊗		●	⊗	⊗	⊗
Consistency	0.923	0.948	0.968	0.973	0.982	0.933	0.994
Raw coverage	0.395	0.394	0.695	0.653	0.403	0.406	0.405
Unique Coverage	0.005	0.006	0.018	0.006	0.013	0.006	0.010
Overall Consistency	0.833						
Overall coverage	0.908						

situations where there is minimal perception of information quality, minimal perception of farmer group and family support, minimal perception of inspiring joy, hope and trust, minimal ability to promote knowledge and novelty, and minimal perception of technical and donor support when there is a high perception of usability amongst service users. These set of users in Pathway 5 are interested in the ability to use the said service to accomplish given tasks making it an extrinsically motivated pathway leading to continuance. Characteristically different from Pathway 5 is Pathway 6 which is focused on intrinsic values that depend on arousing emotions amongst users to lead to continuance intention amongst service users. **Pathway 6** suggests that AIS continuance can also be attained in situations where there is minimal perception of information quality, minimal perception of usability, minimal farmer group and family support, minimal ability to promote knowledge and novelty, and minimal perception of technical and donor support when there is a high perception of inspiring joy, hope and trust amongst service users. **Pathway 7** indicates that continuance of AIS can be attained under high perception of usability, high perception of farmer group and family support, and high perception of inspiring joy, hope and trust despite the existence of perceptions of minimal information quality, minimal ability to promote novelty and knowledge, and minimal technical and donor support amongst service users. Pathway 7 much like Pathways 3 and 4 has both extrinsic and extrinsic value factors influencing the intention to continue using the service.

From the analysis of the continuance outcome, the FsQCA revealed seven causal pathways that lead to the outcome. The parsimonious solution that was attained revealed high perception of usability + high perception of farmer group and family support + high ability to inspire joy, hope and trust + high perception of ability to promote novelty and knowledge = acceptance of AIS.

4.4. Value pathways for continuance

Continuance pathways resulted in seven (7) different solution pathways that contribute to the outcome. These pathways much like those under the acceptance outcome may be summarized under three major considerations: *extrinsic value* motivated pathways, *intrinsic value* motivated pathways and *hybrid value* motivated pathways. These are further discussed below.

For the extrinsic motivated pathways, only one pathway falls under this categorization when considering the continuance of AIS services, and shares significant similarities with Pathway 2 from the acceptance outcome analysis. Pathway 5 represents these set of users who focus largely on the utilitarian aspects of services to influence their acceptance behaviour of AIS. These users continue using the service based on the usability of the service and its support of their work activities. Such users find the service to be easy to use and hence use it in supporting their work activities for the positive outcomes they seek. These set of users require that focus is placed on ensuring that the service has the ability to meet their needs in terms of performing a given task. These groups of users can be described as utilitarian users [64] whose motivation for using these services is for functional benefits [26].

Pathways 1, 2 and 6 can be categorized as users that have intrinsically motivated orientations towards the acceptance of AIS services. Pathway 1 represents an emotional-social influenced pathway that can cause the service to thrive despite the absence or minimal occurrence of all other value factors. The characteristics of this group is one that requires that one appeals to them not only through social influences which may include their farmer groups and families but as well must consider the emotional inclination of inspiring positive outcomes and building trust when using the service. Continuance can be inspired amongst this group when they realize an improvement in their personal livelihoods and as well those of their farmer group members who are equally using the service. Their focus will be on the joy and happiness that these AIS solutions can generate amongst their farmer groups and as well the ability to maintain the trust component in using the service.

Pathway 2 represents a set of users that are seeking epistemic value when using the AIS service. These groups of people either use the service because of the novelty of the service or the ability to discover new knowledge to apply in their work activities [37]. These group of users can be described as knowledge-seeking users [68] focused on building their capacities for farming and ultimately improving their outcomes through the utilization of the service. This is an intrinsically motivated pathway since it is focused on personal development and growth of the users [46,68].

Pathway 6 represents a purely emotional driven set of users much like the set of users of Pathway 5 under the acceptance outcome. This is a purely emotional driven pathway representing an intrinsically motivated user group that will continue the service upon this being satisfied. These set of users will seek for the service to inspire happiness and hope of good farming outcomes and also for the service to foster a sense of trust in its usage. This serves as a good motivation for users to continue the use of these AIS services.

Three (3) out of the seven (7) pathways fall under the hybrid value motivated pathways. This further highlights the variety of value attributes that can influence users continuance intention [24,26,69], representing how these independent value attributes can be constituted amongst individuals to form complex value orientations that influence their decision making. These pathways may however be categorized as extrinsic-biased hybrids or intrinsic-biased hybrids. Extrinsic biased hybrid users are constituted by Pathway 4. These users are influenced by a combination of functional values, social values, epistemic values and conditional values. Emotional value is seen to have very little significance in influencing the continuance intention amongst these set of users and may be a result of its moderating effect on the other value attributes identified in extant literature (S. N [70]. This pathway sees a set of users that have a complex construction of values that drive their decision making. In effect, farmers of this nature may require beyond the acceptance stage that there is continued donor support for the use of the service within a farmer group setting whiles maintaining the service's usability and information quality.

Pathway 3 and Pathway 7 are more intrinsically biased hybrids that focus more on personal growth, community involvement and personal relationships as opposed to the outward looking functional and conditional values. This is because central to these pathway configurations are the farmer group and family support and the inspiration of joy, hope and trust amongst users of these services. Farmer based groups which form the social networks of most farmers [12] plays a significant role in continuance since in some cases it forms the basis for accessing information from the service as highlighted through respondents use of third party sources (colleague farmers and extension officers) to support their tasks. Emotional value which is seen to play a significant role in mobile communications [71] is relevant amongst this intrinsic hybrid sets of users since their experience over the service in acquiring positive outcomes allows them to further develop affective states that influence their continuance intention. These hybrid pathways show the complex formation of values which are consistent with the view of Sheth et al. [26] that consumption values contribute in varied degrees in different choice situations highlighting here the mix between extrinsic values and intrinsic values that influence the continuance intention of AIS users. Table 7 presents a summary of the user typologies.

Table 7
Typologies of Users based on Value Configurations.

	Acceptance	Continuance
Extrinsic Value Motivation	Pathway 2, Pathway 3	Pathway 5
Intrinsic Value Motivation	Pathway 4, Pathway 5	Pathway 1, Pathway 2, Pathway 6
Hybrid Value Motivation	Pathway 1	Pathway 3, Pathway 4, Pathway 7

4.5. Central values to foster acceptance and continuance

Parsimonious solutions suggest that high usability, high farmer group and family support, high inspiration of joy hope and trust, and high presence of technical and donor support are core value conditions that influence user behaviour when it comes to the acceptance of AIS services. Core conditions as presented by the parsimonious solution for continuance of AIS services also revealed high usability, high farmer group and family support, high inspiration of joy, hope and trust, and high perception of promoting knowledge and novelty. High usability, high farmer group and family support, high inspiration of joy, hope and trust appeared as core conditions for both acceptance and continuance outcomes. These conditions can therefore be seen as being central to the acceptance and continuance of AIS services amongst farmers in Sub-Saharan Africa. Usability serves as a functional value of an extrinsic nature that is core to promoting acceptance and continuance of AIS services. This is because increased usability allows farmers to easily relate with such interventions to support their work activities. Poor usability may affect the utilization of such interventions when introduced amongst rural farmers.

Farmer group and family support has been found to be a strong value that drives user behaviours not only in developing country contexts but as well developed countries [72,73]. In Ghana, farmers support each other in their farming activities and share beneficial solutions and technologies amongst themselves to help improve their production outcomes. Martey et al. [74] highlights the relevance of farmer groups and farmer based organizations as they serve as channels for implementation of technological advancement by development actors amongst rural farmers [75]. This value therefore holds a central role and justifies its existence as a core condition in both acceptance and continuance outcomes. Joy, hope and trust are emotional values that farmers seek in order to support their decision-making with respect to continuance or acceptance. This is because expectations of positive outcomes, combined with a trusted service to achieve this which inspires happiness amongst its users will result in their inclination to either accept or continue the use of the AIS solution.

Presence of Technical and Donor support is core to acceptance since such interventions are initiated by these donors or development agencies and beneficiaries tend to be more accepting of these solutions when they are presented as such. This is missing under the core conditions for continuance since users now shift their attention to the search for knowledge and novel approaches to solving their problems than being reliant on the donors who initiated these services.

4.6. Validation of findings

The robustness of findings attained in this study was investigated using the suggestion of Skaaning [76] for FsQCA studies. Two out of the three approaches were used to ensure that findings were robust enough and will not be subject to significant changes in the event of a change in respondents. The first validation approach that was applied was the adjustment of calibration thresholds in the full membership, full non-membership, and crossover point thresholds. This meant the qualitative breakpoints [28] were redefined by decreasing the original defining threshold values. The values were adjusted with values ranging between 0.1 and 0.2 and the analysis was carried out with the FsQCA 3.0 Software. The results attained were similar to those attained using the original thresholds which suggest a strong significance of the results obtained.

The second approach used was the adjustment of the consistency threshold. The original consistency used to attain the results stood at 0.90 which in itself presents the significance of the results. To test the robustness of the findings, adjustments were made to the consistency threshold where consistency was set to 0.85 and 0.80 to test if there would be changes in the results obtained. Both consistency levels applied returned similar results as obtained for the 0.90 consistency threshold establishing the significance of the study findings.

4.7. Value typologies and implementation strategy

Three distinct user typologies have been identified for AIS based on their value orientations for acceptance and continuance. These different user groups will definitely require different implementation strategy focus that development actors may need to address to ensure that AIS interventions attain higher rates of success in developing country contexts. When considering extrinsic value motivated users, development actors must focus on utilitarian and supportive strategies to ensure that success of such projects is achieved. Such utilitarian and supportive strategies is as highlighted by Li et al. [4] where the solutions provided enabled rural farmers to sell their farm produce on e-commerce websites with the support of local champions and government entities. The existence of these strategies helped ensure the success of these interventions since they were able to fulfil the needs of the rural farmers whiles requiring minimal efforts from their end to use such services since it received support from other parties. In the Ghanaian context, the utilitarian aspect will have to focus on the provision of services that support the production and trading needs of the rural farmers whiles the supportive aspect will consider the existence of donor support with the associated resources which will include providing sponsorship and ongoing technical support for the use of these AIS services.

In the case of intrinsic value motivated users, focus should be placed on strategies that foster communal approaches, inspiring positive emotions and affinity for AIS services usage, and continuous adaptations that allow for personal growth of the rural farmers. The communal relevance of inspiring acceptance of AIS service users cannot be overemphasized. Rural farmers are drawn to accept AIS services when they have positive perceptions of having support of their farmer groupings and their families as well. They are also drawn to accept these services when they perceive it improving their social standings amongst their peers [45]. This has been highlighted as a significant contributor to acceptance and continuance of AIS services within African Countries such as Tanzania [77] and Kenya [19,79]. Vaidya [80] notes the importance of building trust amongst the users of such services as they develop some emancipatory expectations for their use of such services which tends to inspire hope and joy for their use of these AIS services. Continuous adaptations rely on the ability to provide novel and knowledge promoting aspects to the implementation of these services. In this scenario one must focus on providing new solutions continuously and providing information that builds on the knowledge of the users [81].

Hybrid value motivated users seek to satisfy a combination of intrinsic and extrinsic value factors which require that strategies that are oriented for such users fit those implemented for intrinsic as well as extrinsic motivated users. This means that development actors must select implementation strategies from both intrinsic inspired approaches as well as that for extrinsic inspired approaches. In implementing these strategies to satisfy the various user groups, it is important to consider the individual level, interpersonal level and community level [13] dimensions that affect implementation and is inherent in the intrinsic and extrinsic values held by users as individuals and as collectives in order to forge success with development oriented ICT interventions.

5. Implications of findings

The study findings have relevant theoretical and practical implications. Firstly, the findings complement the extant literature on ICT4D by presenting a value oriented study that can help unearth the various motivation factors that drive user behaviour with respect to ICT4D projects. These values can help researchers map out convenient strategies that meet the different value orientations of the different user groups. Secondly, the study unearths different typologies of users who have different motivations. User behaviour with respect to information systems have been found to have varied motivating factors [61] and this

study unearths a number of value configurations with their attendant characterizations which serve as a bedrock for further empirical studies to validate these user groups identified in this study. Thirdly, the unearthing of central core values such as usability (functional), farmer group and family support (social) and inspiration of joy, hope and trust (emotional) presents support for extant theorizations which include the relevance of functional values and social values or influence to acceptance and continuance behaviour. New knowledge is also created of the importance of emotional value outside of hedonic digital artefacts which are specifically designed for meeting emotional needs of users [37]. AIS which are often designed for utilitarian (functional) purposes have to inspire some positive emotions in users to support its acceptance and continuance use.

Practitioners who offer AIS services and developers of such interventions are presented with characterizations of different user groups which can occasion the implementation of different strategies to support the different user characterizations. Managers can rely on these findings to explore the different user groups and tailor-make solutions that will satisfy their motivations whether they be for personal growth, community influence or outward influence. Based on these combinations and categorizations, practitioners can better gain positive outcomes from their developed programs and reep the benefits they seek from the implementation of such programs.

Further, policy makers when developing policies for guiding the development and implementation of such services must consider the different categorizations of users and present policies that will inure to the benefits of all user groups. An important finding is the central and core role played by farmer groups and family support with respect to such interventions [73]. Policy makers can therefore develop policies that look to create social networks around the intended intervention in order to ensure that its acceptance and continuance are enhanced to lead to its success. Policies oriented at encouraging extended technical support and incentives (such as subsidized or prepaid services) should be rolled out to promote the use of these services amongst sections of users. The implementation of such policies along with the identified implementation strategies can present a more conducive environment for the attainment of success in AIS services acceptance and continuance. The findings in the study have ready implications for other countries especially those in sub-saharan Africa. This is because of similar rural small-holder farmer conditions prevalent in other African countries as shown in the case of Ghana.

6. Conclusion

This study draws on FsQCA as a methodology, CVT and Information Systems Continuance Model as theoretical lenses to unearth the combinatorial values that drive acceptance and continuance amongst AIS service users. Five pathways were realized for acceptance whiles seven pathways were realized for continuance. These pathways can be summarized into three user typologies that focus on their value motivations. Extrinsic value motivated users are those that seek outward gains from their use of the service whiles intrinsic users employ the service to satisfy some basic psychological needs. In the middle of these oppositely motivated users are those that combine both value sets to form hybrid value motivations. These group of people are those that seek both outward gains and basic psychological needs such as personal relationships, community interaction and self-growth in their pursuit of using these services. This presents new theoretical insights for understanding user motivations for development-oriented interventions and allows practitioners to develop tailored strategies to ensure positive outcomes from their development programs.

The study is limited in the following ways. In operationalizing the concepts of CVT, limited constructs such as information quality, usability were operationalized for functional values and were similar for the other values. Future studies can explore other values that exist within the context of AIS services in order to better develop an overarching theory. The study was also limited in the number of respondents and could be executed in a cross-country study to validate or otherwise present new findings across different regions to better enrich these findings.

Author statement

The authors confirm contribution to the paper as follows: Study conceptualization and design: Eric Afful-Dadzie and Samuel Lartey; Data collection and software: Samuel Lartey, David Clottey and Eric Afful-Dadzie; Analysis and interpretation of results: Eric Afful-Dadzie and Samuel Lartey Author; Writing- Original draft preparation: Eric Afful-Dadzie and Samuel Lartey; Reviewing and Editing: David Clottey, Eric Afful-Dadzie and Samuel Lartey. All authors reviewed the results and approved the final version of the manuscript.

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