

Full Length Research Paper

Adoption of electronic commerce by agribusiness small medium enterprises in the upper east region of Ghana

Selorm Omega*, Selorm Akaba, and William Ghartey

Department of Agriculture Economics and Extension, School of Agriculture, College of Agriculture and Natural Sciences, University of Cape Coast, Ghana.

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Technological evolution has triggered more advanced market-based approaches to the transfer of goods, services, and information. In Ghana, Agribusiness small-medium enterprises' electronic commerce adoption is concentrated in Accra and Kumasi. This study spotting the research gap in Agribusiness small-medium enterprises' electronic commerce adoption selected the Upper East Region for the study. The study is centered on examining e-commerce adoption by agribusiness small-medium enterprises' and the preferred electronic commerce applications adopted by Agribusiness small-medium enterprises' in the Upper East region of Ghana. A simple random sampling technique was adopted for the study. The results of the study show that 91% of agribusiness had adopted electronic commerce for their operations with the major observation that being electronic commerce environment is good for business. The major barrier to adoption was the high cost of adoption of electronic commerce applications. Owner experience, observability, benefits from electronic commerce, trialability and years in business were all found to be factors influencing agribusiness small-medium enterprises' adoption of electronic commerce. Furthermore, the results also indicated that Agribusiness small-medium enterprises in the Upper East region use electronic commerce applications mostly for customer relation management and interorganisation system. In conclusion to the study, electronic commerce adoption was observed to be rising among agribusiness small-medium enterprises in the Upper East region but the greatest hurdle to their adoption was the high cost of adoption of these applications. The study, therefore, recommends that financial institutions, electronic commerce application manufacturers, and the government should collaborate to subsidy the cost of these electronic applications to agribusiness small-medium enterprises.

Key words: Adoption, e-commerce applications, agribusiness SMEs, preference.

INTRODUCTION

The widespread introduction of technologies into everyday life and business has become unprecedented over the last decade. For businesses, e-commerce has become a

playground as it offers a tremendous opportunity for the growth and development of businesses (Ya-ping, 2012). In 1995, 27 years ago, the first official e-commerce

*Corresponding author. E-mail: selorm.omega@stu.ucc.edu.gh.

transaction was made on the Auction web of a broken laser pointer for an estimated \$14.83 (International Trade Centre, 2016). Now, e-commerce has spread across companies globally and is leading to an unprecedented evolution in businesses. In Europe, figures from 2005 showed that e-commerce trading has increased from \$6 billion to \$ 230 billion, whereas the USA alone witnessed growth in the same period from \$31 to \$291 billion. The majority of revenue from e-commerce trading generated was from business-to-business (B2B) transactions (Kiong, 2004). According to Moore (2018), e-commerce performance in the business sector will be growing worldwide. E-commerce's main participants; the sellers, brokers, buyers, and transaction handlers are often dispersed across locations. According to Abu-Bakar and Rohaizat (2004), these actors hardly see one another in the transaction process.

Various definitions have been coined for E-commerce. Common among them include; Chong (2008) as the process of buying and selling goods over the internet. Rainer and Cegielski (2011) defined it as "the process of buying, selling, transferring or exchanging of products, services, and information via computer network including the internet".

Alrawashedh (2018) also defined "e-commerce as a process of integration of all company's processes, activities, and services towards buying and selling of products and exchange of information and funds with the company's partners via computer networks and electronic technologies". The increasing number of e-commerce applications in current times has led to the definition constantly changing to accommodate these changes. E-commerce is redefining the relationship between suppliers and customers as market-sensitive commodities are being released to need-based customers at the right time, and ensuring efficient allocation of the resource by suppliers (Kiong, 2004). Javalgi and Ramsey (2001) hold that e-commerce has caused a paradigm shift in the concept of market competition by making smaller businesses compete with more prominent and large market holders for market shares for quality and accessibility. Early researchers classified e-commerce into business and consumer interaction flow, while current researchers have acknowledged the increasing role of government as a market player. No matter the classification made by researchers, the basic underlining framework entails the direction of trade interaction. Hence, the generally accepted types are; Business to Consumer (B2C), Government to Consumers (G2C) Consumer to Consumer (C2C), Business to Government (B2G), Business to Business (B2B), Consumer to Government (C2G), Consumer to Business (C2B), Government to Business (G2B), and Government to Government (G2G).

Furthermore, the e-commerce adoption process is dynamic rather than static. This dynamism, according to

literature, is due to the adoption processes and factors influencing the adoption process (Alrawashedh, 2018). For example, according to Brand and Huizingh (2008), the size, resource capacity, and knowledge of a firm can cause a big business to skip or combine multiple stages of the adoption channel, while the small business will have to follow along logical sequence to adopt e-commerce of any form fully.

On the other hand, Agribusiness Small and Medium Enterprises (SMEs) around the globe have served as a reliable option for international economic development. There has been no concrete definition for the concept of Agribusiness SMEs, as more authors have tried to use size, capital, and asset holdings, the number of people employed and turnover level to define the concept as other authors add the method of production and the legal status. In Ghana, the commonly used criterion for defining Agribusiness SMEs is the employee number in the enterprise (Abor and Quartey, 2010). This criterion is also supported by the Ghana Statistical Service's (GSS, 2007) framework, which defines small-scale enterprises as those with less than ten (10) employees and medium and large-sized enterprises as those with more than ten (10) employees. In this study agribusiness, SMEs will be defined as agriculture businesses that are engaged in economic activities that are related to farming from production through to marketing.

Also, Agribusiness SMEs are mostly individual or family-owned businesses with fewer networks (Triandini et al., 2013). The fewer network has proven that such an enterprise has high immunity against global economic turbulence and is a driving force to development, due to their adaptable and elastic nature. With these characteristics, financial institutions are still reluctant to fund them due to their poor asset base. The inadequate asset of these Agribusiness SMEs gives them the leverage to quickly adopt opportunities for innovations and recognize early changes in market strategies. In most developing countries, including Ghana, SMEs including Agribusiness SMEs employ about 45% of the country's labour force (Amoah, 2018). According to Chittithaworm et al. (2011), the performance of Agribusiness SMEs has a close link with the performance of the economy. Agribusiness SMEs also have the role of developing a more inclusive sustainable food system that is responsible for sales of inputs, agriculture product production, and distribution.

According to Bank Negara Malaysia (2005), SMEs must improve their capacity and efficiency in order to manufacture high-quality products at a competitive price, taking into account the role of e-commerce. Accordingly, some authors like Jansen-Vullers and Reijers (2004), Sandy (2006), and Dos Santos and Peffers (1998) have shown that Agribusiness SMEs are continually looking for better and optimal ways of implementing and incorporating e-commerce into their business activities

(Jahanshahi et al., 2011).

Lately, there has been much concern about several Agribusiness SMEs leaving the industry in Ghana, including the Upper East Region. Current statistics in Ghana show that Agribusiness SMEs lack knowledge of how e-commerce investment could improve their business performance in achieving their targets (Gharegozi et al., 2011; Kabanda, and Brown, 2010). As a result, they lag behind larger enterprises in terms of e-commerce adoption, utilization, and other potentials (Zaied, 2012). Chong et al. (2001) added that the low adoption rate and usage of e-commerce are due to inadequate financing. Hence, the main reason why Agribusiness SMEs need to adopt and use e-commerce is to increase their resource base for expansion (Al-Alawi and Al-Ali, 2015). Studies (Wachira, 2014; Fillis et al., 2003; Daniel and Wilson, 2002; Hughes and Wood, 2000) have revealed that those enterprises that embrace the crux of e-commerce and fully adopt it have profited more from its sustainable application.

Although Ghana is still trying to meet up with the swift progression of e-commerce, the progress in itself has been uneven across the 16 regions of the country. Agribusiness SMEs adopt e-commerce applications based on their availability, the number of people using them, price, returns to be generated, and life span. There still is an indication of the lack of equitable distribution of e-commerce applications over the country. This is because the increasing rate of progress so far has been in Accra and Kumasi, the two largest populated cities in the country.

This leaves a significant gap in the extent of growth of e-commerce among SMEs outside Accra and Kumasi. This gap needs to be addressed if the country is to adequately access gains made in e-commerce adoption by SMEs. This study aims to provide empirical literature to fill the void in identifying factors that influence the adoption of e-commerce by SMEs outside the two major e-commerce cities of Ghana. Also, however, this paper will be limited solely to:

1. Ascertain the association between Agribusiness SMEs e-commerce adoption rate and their socio-economic characteristics.
2. Examine the benefits and barriers to e-commerce adoption by Agribusiness SMEs
3. Determine factors influencing the e-commerce adoption rate of Agribusiness SMEs, and
4. Examine the e-commerce applications mostly used in the study area.

This research is important because it examines the numerous ways that e-commerce might aid agribusiness SMEs in their operations. Hence, this study will help new Agribusiness SMEs interested in learning and using e-commerce to see the experiences and practices of others.

Also, how viable and sustainable their Agribusiness SMEs will be when e-commerce is adopted. The research will be relevant to investors by helping them to have insight into the extent to which various e-commerce applications are available to Agribusiness SMEs in the study area. Furthermore, this study will deliver a consistent framework for government and policymakers to formulate strategies that will improve the evolution and development of e-commerce in the Upper East region in particular as well as Ghana at large. This research will also add to the corpus of knowledge in Ghana about agribusiness SMEs and e-commerce.

This paper will be divided into five sections, namely; introduction (this section will talk about the background to the study, objectives, and significance of the study), materials and methods (talks about the study area, research design, sampling procedure, instrumentation, data analysis and model specification), results and discussion of study findings and conclusions. Additional information provided in the structure of the paper includes the ethical approval and participation, conflict of interest and reference.

MATERIALS AND METHODS

Study area

With an approximate land area of 8842 square kilometres, Ghana's Upper East region is located in the northern part of the country. It is located between latitudes 10°30'N and 11°N and longitude 0° and 1° West. According to the Ghana Statistical Service (2021), the population of the area is 1,301,226, with 74.6% rural folks. The region has only 48.1% of the population to be literate. The contribution of the region to the country's population is 4.2% and labour force of 78.9%. Its dependency ratio in 2000 stood at 99.2%, with 74.5% of the population being self-employed in agriculture (mainly; guinea-corn, beans, maize, groundnut, Tomatoes, sorghum, Onions millet, and also poultry and Livestock).

Research design

The cross-sectional survey design was adopted for the purpose of this study. The survey design was created to aid in the generalisation of the study to a broader population from a sample, allowing for inferences about the study's population characteristics (Creswell, 2011). Furthermore, it is economical and allows for the smooth and quicker collection of data and its analysis (Fowler, 2002). The cross-sectional design of this study assisted in determining the relationship between e-commerce adoption and the factors that influence it.

Sampling procedure

The study's participants were all owners of agribusiness SMEs in Ghana's Upper East Region. In general, larger sample sizes are preferable to smaller sample sizes when choosing sample sizes for research. The rationale for this is that the larger the sample size, the smaller the sampling error, and the more likely the sample is representative of the entire population. When the sample is chosen

at random, however, this assumption holds true. The study resorted to the use of Yamane's (1967) formula to determine the appropriate sample size as follows:

$$n = \frac{N}{1 + Ne^2}; \quad n = \frac{171}{1 + 171(0.05)^2} = 120$$

Where, N= the study Population; e = Error Margin; n = the study sample size

The random sampling technique was used to select 120 respondents after the Yamane formula was used to estimate the suitable sample size. However, the study was only able to successfully retrieve 100 completed questionnaires representing 83.3% of the total questionnaire administered. Agribusiness SMEs used included input dealers, agriculture product sellers, and businesses that combine both.

Instrumentation

Closed and open-ended questions were used to obtain the primary data for the study. Primary data provide more accurate and dependable information. The research instrument's face and content validity were assured through a pre-test study prior to data collection to assist correct unclear questions, and it was also checked by an expert in the field. A face-to-face approach to data collection was used. Averagely, a completed questionnaire lasted 20 min.

The questionnaire was then used to extract information on the following topics from respondents. Part one focused on the socio-economic characteristics of the agribusiness SME owners. It included the age, gender, and location of the business, annual revenue, the scale of operation, marital status, educational level, years in business, the type of Agribusiness SME, and source of funding.

The second part of the survey asked agribusiness SME owners if they had adopted e-commerce in their operations. The response was captured as "yes" implying the owner has adopted e-commerce and "no" implying the owner has not adopted e-commerce. Within part two, respondents were also asked questions on the determinate of adoption thus; compatibility, complexity, observability, relative advantage, and trialability. The determinate of adoption was measured on 10 points Likert scales from 1 to 10 indicating the extent of agreement (0 not applicable).

Part three focused on the benefits and barriers to e-commerce application usage. On a scale of one to five, the benefits and barriers to e-commerce adoption were assessed on a Likert scale. 1 indicated least agreed as 5 indicated very high agree. 0 indicated not applicable.

The last part asked if they had used a list of e-commerce applications ranging from marketing to customer services. The listed e-commerce applications were then converted into six (6) categorisations based on literature.

Data analysis

SPSS version 21.0 and STATASE 13.0 were used to analyse the data collected. The data collected from the study areas were entered, cleaned, and analysed based on the various objectives as follows:

Objective 1: Ascertain the association between agribusiness SMEs' e-commerce adoption rate and their socioeconomic

variables: descriptive statistics, Fisher exact test, and probit regression analysis were used for the analyses. The Fisher exact test was performed to see whether there is a significant relationship between socioeconomic characteristics and adoption. The Fisher exact test was used because the results obtained from the analyses revealed that some cells had less than 5 expected counts. Therefore the fisher's exact test with exact sig. (2 sided) was displayed in place of the ideal chi-square values. Descriptive statistics (mean, standard deviation, and pie chart) were used to describe the distribution of adoption and the contribution of adoption indicators to the study.

Objective 2: Examining the benefit and barriers to e-commerce adoption: Kendall's coefficient of concordance and descriptive statistics were used to analyse the data. This was to help rank the benefits and barriers agribusiness firms faced in their operations when using e-commerce. The median ranking of the barriers indicated that values less than 3 meant low agreement, equal to 3 – moderate agreement, and above 3- high agreement.

Objective 3: Examine the factors that influence e-commerce adoption of Agribusiness SMEs: The variables that influence agribusiness SMEs e-commerce adoption were discovered using a probit regression analysis. Probit regression was used because the dependent variable had a binary outcome (Yes/ No). The independent variables were either categorical, continuous or a combination of both. The analysis followed Pallant (2005) recommendation of collapsing variables with limited numbers to avoid the problem of a small sample with a large number of predictors causing the result not to converge. Table 1 presents the operational definition for the variables used;

Objective 4: Examine the e-commerce applications mostly used: analysed using the Kendall's coefficient of concordance to rank e-commerce applications used by Agribusiness SMEs. Kendall's coefficient of concordance test was used to help find e-commerce applications mostly used based on rank.

The Wilcoxon sign rank test was also performed in the study to match the various e-commerce applications used by Agribusiness SMEs.

The test was essential to calculate the difference between the set of pairs and also reveal if these differences were statistically significant. The Bonferroni adjustment is a correction test that requires each test's p-value to equal alpha divided by the number of tests. Thus, this process was done by dividing the alpha value of 5% (0.05) by the number of compared (15) groups. Thus, $.05/15 = .003$, hence critical value was obtained. It implies that there was a .003 error margin associated with the Wilcoxon sign rank test, which was corrected by the decision rule, the p-value should be less than .003 to accept the pair as statistically significant.

The Bonferroni test was employed as an adjustment to avoid data from looking statistically significant when it is not. Table 2 indicates the studies' classification of e-commerce.

Model specifications

Probit regression

The probit regression follows the inverse standard normal distribution assumption. The probit model, also known as the probit regression, is most commonly used to model dichotomous or binary outcome variables. The probit model's probability is expressed as a linear combination of predictors. In this study, the dependent variable was captured as adoption of e-commerce with the

Table 1. Operational definitions of variables for binary logistic regression.

Variable	Definition
Dependent Variable	
e-commerce adoption	E-commerce adoption was a categorical variable. 1- Yes, 0-No
Independent Variable	
Age	Age was collected as a continuous variable measured in years.
Gender	Gender was captured as a categorical variable with 0- Female and 1- Male
Marital Status	Marital status was captured as a categorical variable. 0- Unmarried 1- Married
Educational Level	The educational level was captured as a categorical variable. 0- No formal education 1- formal education
Years in Business	Years in business was collected as a continuous variable measured in years
Business Location	Business Location was captured as a dummy variable. 0- Rural 1- Urban
Benefit of e-commerce	Measured on a continuous scale
Barriers to e-commerce adoption	Measured on a continuous scale
Source of funding	The Source of funding was a dummy variable. 0-Own savings 1- Loan
Scale of Enterprise	The scale of the enterprise was captured as a categorical variable. 0- small scale 1- Medium scale
Annual Revenue	Annual revenue was a continuous variable measured in Ghana Cedis
Relative advantage	Measured on a continuous scale
Complexity	Measured on a continuous scale
Observability	Measured on a continuous scale
Compatibility	Measured on a continuous scale
Trialability	Measured on a continuous scale

Source: Omega, Field Survey (2019)

response being 1-Yes and 0-No. The probit link function was utilized with the parameters determined using the Maximum Estimation Technique (MLE). The selection of the MLE for this study was to help select parameters, which give the highest probability of predicting e-commerce adoption. The probit model was specified as;

$$Y^* = \sum_{k=1}^k B_k X_k + \epsilon, \epsilon = IN(0, \theta) \tag{1}$$

Y^* is an unobserved latent continuous variable.

As a result, the dummy variable Y was observed and determined as follows:

$$Y = \begin{cases} 1, & \text{Yes} \\ 0, & \text{No} \end{cases} \tag{2}$$

The likelihood that $Y = 1$ is the point of reference.

For $Y = 1$, this will follow as;

$$\begin{aligned} \text{Prob}(Y=1) &= \text{Prob}(\sum_{k=1}^k B_k X_k + \epsilon > 0, \\ &= \text{Prob}(\epsilon > 0 - \sum_{k=1}^k B_k X_k) \end{aligned} \tag{3}$$

Because the probit function is based on the cumulative normal distribution function, then;

$$= 1 - \Phi(\sum_{k=1}^k B_k X_k) \tag{4}$$

Summary;

$$Y = \ln\left(\frac{p}{1-p}\right) = \sum X_i \beta + \epsilon \tag{5}$$

Where, $Y = \begin{cases} 1, & \text{Yes} \\ 0, & \text{No} \end{cases}$, and X_i = independent variables in Table 2; ϵ - Error term.

Kendall's coefficient of concordance

Kendall's coefficient of concordance, which is a non-parametric statistic, is generated by the Friedman test normalization. When measuring the level of agreement among respondents on a Likert scale, Kendall's coefficient of concordance is preferred. Kendall's coefficient of concordance has a response of 0 for no agreement and 1 for total agreement. The level of agreement of agribusiness SME's regarding barriers impacting their adoption and the extent of use of e-commerce applications was studied using Kendall's coefficient of concordance. Kendall's concordance coefficient is defined mathematically as;

$$W = \frac{12S}{m^3(n^3-n)-pT} \tag{6}$$

Where S stands for the sum of squares from the row sum of ranks.
 n - The number of objects considered
 p - The number of judges therein
 T -correction factor for ranks that are tied

Therefore, $S = \sum_{i=1}^n R_i^2 - SSR$ (7)

$T = \sum_{k=1}^m (t_k^3 - t_k)$ (8)

Table 2. Types of e-commerce Application.

e-commerce application	Description	Researcher
Advertisement	<ol style="list-style-type: none"> 1. Displaying company information and the products/services offered 2. Advertising on a third party website 	Block et al. (1996), Soh et al. (1997), Ainin and Noorismawati (2003), Kiong (2004), Zaid (2012), Addo (2012), and Pembi (2016)
Market research	<ol style="list-style-type: none"> 1. Research on consumers' preferences 2. Research and evaluation of new suppliers 3. Research on competitors' 	Arie et al. (1995), Block et al. (1996), Kotler (2001), Johnson (2003), Kiong (2004), Smith and Chaffey (2005), Addo (2012), Zaid (2012), and Pembi (2016)
Customer relation management (CRM)	<ol style="list-style-type: none"> 1. Customer Support Service 2. Online help- Frequently Asked Question (FAQ) 3. Handling customers feedback/queries online 4. Online application/registration 	Fatimah et al. (2000), Turban et al. (2002), Ainin, and Noorismawati (2003), Kiong (2004), Zaid (2012), Addo (2012), and Pembi (2016)
Inter-organisational system (IOS)	<ol style="list-style-type: none"> 1. Personalised e-mail communication 2. Coordinating procurement with suppliers online 	Kiong (2004), Addo (2012), Zaid (2012), and Pembi (2016)
Business performance	<ol style="list-style-type: none"> 1. Processing sales orders from customers' online 2. Tracking incoming and outgoing goods delivery (shipment, courier service online) 	Fahri and Omar (2001), Oakes (2002), Turban et al. (2002), Johnson (2003), Kiong (2004), Zaid (2012), Addo (2012), and Pembi (2016)
Payment System	<ol style="list-style-type: none"> 1. Mobile money 2. Electronic Fund Transfer (EFT) 3. Online credit card processing 4. Smart cards and Prepaid cards 	Block et al. (1996), Wong and Zoltowski (1997), Zwass and Kendall (1999), Fatimah et al. (2000), Kiong (2004), Addo (2012), Zaid (2012), and Pembi (2016)

Source: Omega, Field Survey (2019)

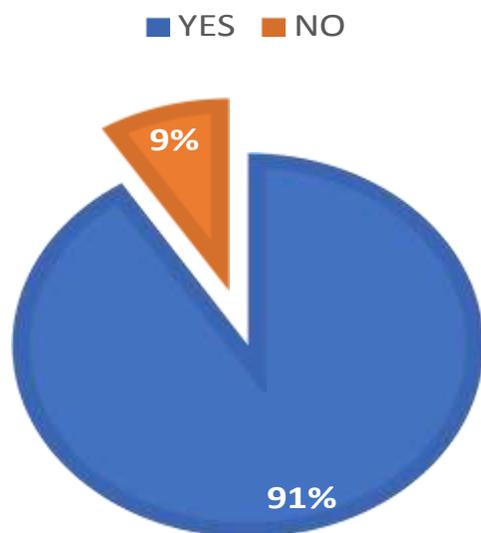


Figure 1. E-commerce adoption distribution. Source: Omega, Field Survey (2019)

t_k – the number of ranks that are tied in each of the k of m groups

RESULTS

Objective 1: Examine the relationship between e-commerce adoption and socio-economic characteristics of agribusiness

Adoption of e-commerce among Agribusiness SMEs

From Figure 1, it was revealed that 91% of agribusinesses had adopted e-commerce for their operation. Only 9% had not adopted e-commerce for their business. This indicates that e-commerce is seen as a vital tool for agribusiness operations.

Fisher exact test of e-commerce adoption and Socio-economic factors

In Table 3, the association between the adoption of e-commerce by Agribusiness SMEs, and socioeconomic variables were analysed. The results revealed that not all

m- the number of groups considered

Table 3. Fisher exact test of socio-economic factors and agribusiness SMEs' adoption of e-commerce.

Socio-economic characteristics	Adoption of e-commerce		Fisher exact test
	YES	NO	
Age			
<36	51	5	0.683
≥36	39	4	
Gender			
Female	31	5	0.277
Male	60	4	
Marital status			
Unmarried	34	4	0.727
Married	57	5	
Educational level			
No formal Education	1	2	0.021*
Formal Education	90	7	
Years in business			
<4	87	4	0.382
≥ 4	8	1	
Business location			
Rural	6	2	0.152
Urban	85	7	
Source of funding			
Own savings	45	6	0.488
Loan	46	3	
Scale of enterprise			
Small scale Enterprise	67	9	0.109
Medium-scale Enterprise	24	0	
Annual revenue			
Less than GHC 1000	21	5	0.049*
Greater than GHC 1000	70	4	
Total	91	9	

*p> 0.005.

Source: Omega, Field Survey (2019)

socioeconomic variables of the study had a significant association with e-commerce adoption. For age, it was revealed that respondents less than the age of 36 years (51) adopted e-commerce than respondents above 36 years (39). The Fisher exact test value of .683 indicates that there was no statistically significant association in the adoption levels among respondents aged 36 and below. For gender, male respondents (60) adopted e-commerce

more than female respondents (31). The Fisher exact test value of 0.277 indicates there was no statistically significant association between male and female owners in the adoption of e-commerce for their agribusiness SME operations. For marital status, it was revealed that married respondents (57) were more likely to adopt e-commerce than unmarried respondents (34). The Fisher exact test value of 0.727 indicates that the level of

Table 4. Determinants of adoption.

Indicator	Mean	SD	Rank
Relative advantages	7.5086	1.51001	1
Complexity	7.4750	1.61316	2
Observability	7.3838	1.73683	3
Compatibility	7.1711	1.91098	5
Trial-ability	7.2780	1.73314	4

Source: Omega, Field Survey (2019)

adoption between married and unmarried respondents had no statistically significant association. On the educational level, persons with formal education (90) adopted e-commerce more compared to persons with no formal education (1). The Fisher exact test value of 0.021 indicates a statistically significant association in the level of adoption between persons with formal and persons with no formal education. For years in business, Agribusiness SMEs with less than 4 years (87) in business adopted e-commerce more than Agribusiness SMEs with 4 years or more (8) in business. The Fisher exact test value 0.382 showed no significant association in the level of adoption between Agribusiness SMEs with less than 4 years in business and Agribusiness SMEs with four years and above in business. For, business location, this study showed that Agribusiness SMEs in the urban (85) adopted e-commerce more compared to Agribusiness SMEs in the rural area (6). The Fisher exact test value of 0.152 demonstrates that there was no statistically significant association between respondents' adoption levels in urban and rural locations.

For the source of funding, it was revealed that the respondent who start operations with their savings (45) tend to have less level of e-commerce adoption as against respondents that collects loans to start (46). The Fisher exact test value of .488 showed that there was no significant association between respondents that takes loans and respondents using their savings. Results on the scale of the enterprise revealed that Agribusiness SMEs classified as small-scale enterprises (67) were much more likely to adopt e-commerce than Agribusiness SMEs classified as medium-scale enterprises (24). The Fisher exact test value 0.109 indicates that levels of adoption of Agribusiness SME classified as small-scale enterprise and medium-scale enterprise had no statistically significant association between them. For annual revenue, it was shown that respondents that earn more than GHC 1000 annually (70) were much more likely to adopt e-commerce than those who earn less than GHC 1000 annually (21). The Fisher exact test value of 0.049 indicates a statistically significant association existing between the level of adoption of respondents that earn more than GHC 1000 annually and

respondents that earn less than GHC 1000 annually.

Determinants of adoption

The study used Roger's (1962) theory of innovation diffusion indicators. The theory holds that for adoption to be possible, technology should meet the following conditions; relative advantages (useful), complexity (ease of use), observability, compatibility (adaptable) and trialability. The results in Table 4 indicate that the ability of an e-commerce application to meet the adoption indicators will mean a high likelihood of the agribusiness SME adopting the e-commerce application. The result revealed that the most considered attribute of e-commerce applications by agribusiness owners was the relative advantage of the application. This was followed by complexity, observability, trialability and compatibility respectively. The result indicates that agribusinesses are interested in adopting e-commerce applications that offer more than existing ones.

Objective 2: Examine the barriers and benefits of e-commerce adoption

Benefits of e-commerce

Table 5 revealed the benefits agribusinesses SMEs obtain from the adoption of e-commerce for their operations. It shows that the overall benefit from e-commerce use by agribusiness SMEs is moderate. This indicates that agribusinesses are not enjoying the full benefit of using e-commerce for their operations. The most significant advantage gained through the deployment of e-commerce applications is that the 'e-commerce environment is beneficial for business' (2.82). This was followed by 'My SME is now competitive thanks to e-commerce' (3.03), 'Low cost of business' (3.22), 'Business support network is high' (3.27), 'Increase access to market' (3.35), 'Government support for firms has increased as a result of e-commerce' (3.45) with the least being 'Easy access to credit' (3.54).

Table 5. Benefits of e-commerce.

Benefits	Mean	SD	Rank
e-commerce environment is beneficial for business	2.82	1.46	1
My SME is now competitive thanks to e-commerce	3.03	1.37	2
Government support for firms has increased as a result of e-commerce	3.45	1.34	6
Low cost of business	3.22	1.25	3
Easy access to credit	3.54	1.25	7
Business support network is high	3.27	1.31	4
Increase access to market	3.35	1.27	5

5- Not applicable 4-Low 3-Medium 2- High 1-Very High Composite: mean- 3.23 SD-1.13.
 Source: Omega, Field Survey (2019)

Barriers to e-commerce adoption

Table 6 shows the barriers to agribusiness e-commerce adoption. It was revealed from the model summary that the model was significant at $p < 0.05$ with a chi-square value of 108.884. The level of agreement indicated by Kendall's W revealed that there was a 21% level of agreement by respondents on the barriers affecting their e-commerce adoption. 'Cost of e-commerce adoption is high (2.50)' was the biggest obstacle to adoption, according to the median value observed. This was followed by 'E-commerce infrastructure is lacking (2.00)', 'internet security issues (3.00)', 'online marketing and sales lack popularity (3.00)', 'lack of understanding of the advantages of e-commerce (4.00)' and 'Information from e-commerce is not useful (4.00)' respectively. This implies that e-commerce applications needed for agribusiness operations are expensive for Agribusiness SME owners to adopt and the infrastructure to support their adoption is lacking.

Objective 3: Factors influencing the e-commerce adoption rate of Agribusiness SMEs

The factors influencing agribusiness SME adoption of e-commerce are shown in Table 7. The probit regression model summary revealed that independent variables used for the study adequately explain the dependent variable e-commerce adoption ($Wald\ chi^2(15) = 67.05$). This was further confirmed by the significance of the model at $p > 0.005$. In-depth looks at the significant factors that influence e-commerce adoption revealed that experience owner in business, benefit of using e-commerce, observability, Trial-ability and years in business are all significant.

Table 7 shows that as agribusiness owners' experience with e-commerce grows, their adoption of e-commerce declined marginally by 335. This reflects the fact that business owners feel they have better knowledge of the

market and can make high returns without e-commerce use.

This could also be due to the fact that experienced agribusiness operators already have customers and hence do not perceive the value of e-commerce. When it comes to the benefits of using e-commerce, it was discovered that because the benefits are minimal, agribusiness owners' likelihood of adopting e-commerce dropped by 6.9%.

This could be attributed to the rationality of agribusiness owners, which holds that business owners will invest in technologies that give optimum returns than add to cost. On the observability of e-commerce applications, it was revealed that as e-commerce application observability improves the likelihood of adoption decreases by 2.95%.

This indicates that despite the benefits of e-commerce being visible to business owners, they would not still be willing to adopt it. This could be attributed to factors such as the high cost of adoption, poor knowledge of the use of the technology, and even the adoption attitude of agribusiness owners.

Lastly, as the trialability of e-commerce applications increases, the chance of agribusiness owners adopting e-commerce increases by 10.8%. This indicates that if e-commerce applications use and risk involved are demonstrated to agribusiness owners, adoption can be improved. This is because agribusiness owners are mostly deterred by the price, and risk involved in adopting technology.

Objective 4: Examine e-commerce applications usage

Table 8 shows that the overall median score for agribusiness owners' use of e-commerce applications was 1.625. This means that e-commerce applications used by Agribusiness SMEs with a median score more than the overall median are the most used application. The use of e-commerce applications for Market research

Table 6. Barriers to e-commerce adoption.

Barriers	Mean ranks	Mean	SD	Median value	Rank
Online marketing and sales lack popularity	3.72	3.31	1.25	3.00	4
lack of understanding of the advantages of e-commerce	3.79	3.38	1.33	4.00	5
Internet security issues	3.06	2.89	1.29	3.00	3
E-commerce infrastructure is lacking	2.90	2.77	1.28	2.00	2
Cost of e-commerce adoption is high	2.89	2.72	1.30	2.50	1
Information from e-commerce is not useful	4.66	4.03	1.10	4.00	6

Kendall's W - 0.218 χ^2 - 108.884 df- 5 Asymp, Sig- 0.000 5- Not applicable 4-Low 3-Medium 2- High 1-Very High.
Source: Omega, Field Survey (2019)

Table 7. Factors influencing Agribusiness SMEs adoption of e-commerce.

Variable	dy/dx	SE
Age	0.0007	0.0022
Annual revenue	0074	0.0376
Gender	0.0218	0.0366
Marital status	-0.07368	0.0677
Business location	0.0448	0.0422
Experience	-0.33375*	0.1188
Benefit	-0.0687*	0.0186
Barriers	0.0359	0.0239
Source of fund	0.04472	0.0368
Relative Advantage	0.0187	0.0188
Complexity	-0.01630	0.0164
Compatibility	0.00668	0.0186
Observability	-0.0290*	0.0117
Trialability	0.1081*	0.0575
Years in business	0.0980*	0.0325
Model Summary		
Prob > chi2	0.000	
Wald chi2(15)	67.05	
Number of obs.	100	

*p>0.010.

Source: Omega, Field Survey (2019)

had a median value of 1.33 showing that the number of Agribusiness SMEs which used e-commerce applications for market research was less than the overall median (1.625), while e-commerce applications used for CRM (4.66), was greater than the overall median value (1.625). The significance level of the model was .000, which is less than the alpha value of 5%. Hence, the overall model was significant. It is further supported by the chi-square distribution value of 131.923. This value indicates that the categorisation of e-commerce applications is different from each other. Implying, that Agribusiness SMEs used e-commerce applications for specific purposes.

The Wilcoxon sign rank test showed that the pairing of Market research* customer relation management had a difference of -6.050, and this was statistically significant. The adjusted Bonferroni test affirmed the association. Similarly, statistically significant association results were witnessed for market research against the Inter-organisational system (-6.276) and business performance (-4.573). While, Market research* payment system had no statistically significant association (-1.164) (Table 9).

Furthermore, the advertisement had a negative association with the other e-commerce applications. Moreover, all of the other e-commerce applications had a

Table 8. The rank of e-commerce applications used by Agribusiness SMEs.

e-commerce application	Mean	Standard deviation	Mean rank	Median value
Market research	1.4967	0.33667	2.59	1.33
Advertisement	1.5850	0.33375	3.20	1.50
Customer relation management	1.7733	0.27981	4.40	2.00
Inter-organisational system	1.7550	0.24355	4.45	1.75
Business performance	1.6900	0.33919	3.81	1.67
Payment System	1.4650	0.30364	2.55	1.50

n= 100 $\chi^2= 131.923$ Asymp. Sig = 0.000 Overall Median =1.625.
Source: Omega, Field Survey (2019)

Table 9. Wilcoxon sign rank test for e-commerce applications.

e-commerce Application	Z Score	Asymp. Sig	Bonferroni adjustment (p < 0.003)
Market research*_Advertisement	-2.746	0.006***	No significant association
Market research*_Customer relation management (CRM)	-6.050	0.000***	Significant association
Market research*_Inter-organisational system (IOS)	-6.276	0.000***	Significant association
Market research*_Business performance	-4.573	0.000***	Significant association
Market research*_Payment System	-1.164	0.244	No significant association
Advertisement*_Customer relation management (CRM)	-5.985	0.000***	Significant association
Advertisement*_Inter-organisational system (IOS)	-5.202	0.000***	Significant association
Advertisement*_Business performance	-3.300	0.001***	Significant association
Advertisement*_Payment System	-2.905	0.004***	No significant association
Customer relation management (CRM)* Inter-organisational system (IOS)	-0.847	0.397	No significant association
Customer relation management (CRM) * Business performance	-2.935	0.003***	No significant association
Customer relation management (CRM) * Payment System	-6.521	0.000***	Significant association
Inter-organisational system (IOS)* Business performance	-2.220	0.026***	No significant association
Inter-organisational system (IOS)* Payment System	-6.757	0.000***	Significant association
Business performance * Payment System	-5.178	0.000***	Significant association

n = 100, *p < 0.05.
Source: Omega, Field Survey (2019)

significant association with advertisement with the Bonferroni adjustment, confirming the significant association except with the payment system. This implies that the level of association between payment and advertisement was not statistically significant ($p < 0.05$). Customer relation management * inter-organisation system was seen (-0.847) not to have significant association. Customer relation management * payment system had a statistically significant association. However, customer relation management *business performance although were significantly associated in the Wilcoxon test and the level of significance being equal to the critical value, it was still not significant. Inter-organisational system and business performance were statistically significantly associated ($p < 0.05$); this was not. Lastly, the inter- SMEs in the region prefer e-commerce applications for customer relation management (CRM)

and Inter- organisation system (IOS).

E-commerce application for Market research and Payment system was revealed to be the least preferred.

DISCUSSION

Objective 1: Ascertain the association between Agribusiness SMEs e-commerce adoption rate and their socio-economic characteristics

Adoption of e-commerce among Agribusiness SMEs

The majority of agribusinesses had adopted e-commerce, according to the study's findings. A similar study by Sujatha and Kartthikeyan (2021a) in their work "determinants of e-commerce adoption: Evidence from

small and medium-sized enterprises in India”, found that 90.9% of SMEs had adopted e-commerce. However, another study by Sin Tan et al. (2009) reported that the adoption of e-commerce in Malaysia was low due to high-risk levels and technical challenges. Additionally, Wanyoike et al. (2012) study on “ICT attributes as determinants of e-commerce adoption by formal small enterprises in urban Kenya” showed that the adoption of e-commerce by businesses was moderately high. While, Grandon and Pearson (2004) on “E-commerce Adoption: Perceptions of Managers/Owners of Small and Medium Sized firms in Chile” revealed that e-commerce adoption rate in Chile was 74.5%. This demonstrates that e-commerce adoption is not fairly dispersed across geographical areas.

Socio-economic factors and E-commerce adoption

Using the Fisher exact test, the results on e-commerce adoption and socio-economic characteristics revealed that only educational level and yearly income had a significant relationship with e-commerce adoption. The findings of the study agreed with that of Govinnage and Sachitra (2019), who discovered that e-commerce users' educational level and income level have a significant association with e-commerce adoption. Sharma, Gupta, and Khanna (2019) further claimed that e-commerce users' age, gender, income, and educational level had a significant association with e-commerce adoption.

Objective 2: Examine the barriers and benefits of e-commerce adoption

Benefit of e-commerce

The result showed that e-commerce application offers an Environment that is good for business. Similar studies by Xu et al. (2008), Quayle and Christiansen (2004) and Mustafa and Beaumont (2004) point to the fact that e-commerce adoption provides enabling environment for businesses to grow. They argued that e-commerce is a more convenient and cost-effective way of doing business since it allows customers and providers to conduct business online for simpler product acceptance, processing, and payment. Kartiwi (2010) also reported that e-commerce had led to the reduction of mundane paperwork and improved integrity mechanisms, which has reduced internal inefficiencies.

Barriers to e-commerce adoption

According to the findings of the study on e-commerce adoption obstacles, ‘Cost of e-commerce adoption is

high’ had the most significant disadvantage. The findings were in line with those of Ocloo et al. (2020) in their study on e-commerce adoption in Ghana. Their study revealed that in Ghana the major barrier to adoption was the high cost of operating an e-commerce application. They attributed this to the high costs of operating such applications, as well as the high costs of purchasing internet subscriptions to support them. The high cost of adoption was also identified as a major impediment to e-commerce adoption in Uganda by Ibrahim, Turyakira, and Katumba (2019). The high cost of installing these e-commerce applications contributed to the high adoption cost.

Objective 3: Factors influencing Agribusiness SMEs adoption of e-commerce

The study showed that agribusiness SME owners' experience, benefit from e-commerce use, observability, Trialability and years of business were significant factors that influence the adoption of e-commerce. Taufik et al. (2020) reported that the good experience of consumers of e-commerce influences e-commerce significantly because the ability of the consumer to operate an e-commerce device has the potential to motivate the consumer to purchase other devices. However, this study supports the findings of Hossain et al. (2022), Ahmad et al. (2015), and Pearson and Grandon (2005), who found that as SMEs' experience grows, they become less willing to push for e-commerce adoption, owing to consumer goodwill and market understanding. Agyapong (2018) held that the benefit that a customer of e-commerce is likely to derive from the device goes a long way to determining his adoption of the device or not. Suryani and Subagyo (2011) also asserted the benefit of e-commerce in determining the level of adoption, and use. They went on to suggest that the motivation for using said e-commerce has a big impact on adoption. Sujatha and Karthikeyan (2021b) reported that a major determinant of SME adoption was the observability and Trial-ability of the e-commerce device. They discovered that e-commerce trial-ability resulted in a 28.1% chance of adoption, whereas observability resulted in a 29.4% chance of SMEs adopting e-commerce. E-commerce adoption had a statistically significant association with the number of years in business and the source of finance for the business. Thus, the age of business does determine if an Agribusiness SME is going to adopt an e-commerce application or not. Interestingly, most of the businesses in the study area were less than 4 years implying that SME development and operation were on the rise in the study area. These findings are consistent with Autio (2005), Anderson and Leinbach (2007), Stinchcombe (1965), Hymer (1976) and Zahra (2003) that ‘the longer the years in operation of business gives a business the advantage

to the acquisition of research over time, hence the tendency to adopt new technologies like e-commerce application'. Another factor is the source of funding. Whether the business owner starts with his capital or takes a loan, it does not influence his adoption of new technology. According to Tseng et al. (2006), Lee and Denslow (2005), Islam et al. (2008) and Riyanti (2004), they recognized that the problem of Agribusiness SMEs is not just the source of funding but their ability to secure the funds for their activities.

Objective 4: e-commerce applications mostly used in the study area

The majority of Agribusiness SMEs used e-commerce applications for customer relation management, such as online help, frequently asked questions, online product updates, online handling of customer feedback, online application, and registration, and allowing a customer to contact a sales officer, according to the grouping of e-commerce applications. This assertion is inconsistent with Turban et al. (2002); Fatimah et al. (2000) and Ainin and Noorismawati (2003), that most Agribusiness SMEs prefer e-commerce applications in customer relation management because the business wants to stay in touch with their customers, which create trust, and assure the costumers of quality. It is also a way of helping the business in forecasting. On the other head, fewer respondents used e-commerce applications as a means of the payment system. Agribusiness SME owners preferred physical cash payment to electronic payment. Most agribusiness SMEs in developing countries have yet to completely profit from the use of e-commerce in payment, according to Wong and Zoltowski (1997), Block et al. (1996), Fatimah et al. (2000), and Kendall (1999). Although the introduction of mobile money payment has been introduced across developing countries, its adoption remains a challenge for Agribusiness SMEs due to service charges and the unwillingness of both parties to pay for the charges.

Conclusion

The study's goals were to look at the factors that drive Agribusiness SMEs' acceptance of e-commerce, the benefits of e-commerce, and the barriers to e-commerce adoption, as well as discover how Agribusiness SMEs in Ghana's Upper East region use e-commerce applications. Literature on the state of e-commerce adoption in Ghana, in general, was unearthed, with the literature revealing that e-commerce adoption was concentrated in Accra and Kumasi, the country's most populated areas. Agribusiness SMEs in the country are small and young and are mostly into agriculture input

dealing and output sales. Few also engaged in both the sales of input and selling at the same time. Others are the middle agent who links producers to buyers as their business, but this group was not considered in the study due to them mostly not being stable in their operations.

The findings of the study on the adoption of e-commerce by agribusiness SMEs in Ghana's Upper East Region revealed that the study area has a high degree of e-commerce adoption. The adoption of e-commerce was strongly linked to the educational level and yearly revenue of agribusiness SMEs. The fact that the e-commerce environment was good for business was the most important benefit of e-commerce to the respondents, but the high cost of adoption of this e-commerce remains the key barrier. The owners' experience, the benefit obtained from e-commerce, years in operation, and the observability and trial-ability of e-commerce applications were all factors that influenced agribusiness SMEs' e-commerce adoption. The majority of Agribusiness SMEs use e-commerce applications that deal with customer relation management, according to the findings. This shows that Agribusiness SMEs are more concerned about the relationship they build with their customers. While, the result also showed that the least used e-commerce application by Agribusiness SMEs payment systems.

The findings imply that agribusiness SMEs should consider diversifying their use of e-commerce applications, as relying on only one application would not provide the desired results (this will offer the Agribusiness SMEs the opportunity to increase their revenue margin). They should also consider investing in more complex e-commerce applications and rethinking (redesigning) their marketing strategy in order to reach a bigger number of customers and boost their profit margin. The government can use Agribusiness SMEs development as a means of poverty reduction in the study area and other parts of the country by lending helping hands to the sector in the form of loans, improving e-commerce infrastructure, and training. With beneficiaries expected to improve their business position and employ others.

In a nutshell, understanding the factors that influence agribusiness SMEs' decision to use e-commerce would aid in the establishment of policies that will support the growth and development of e-commerce by the government and other policymakers and hence helping Agribusiness SMEs to tap into new markets while creating jobs. Although the study provided results relevant to the objective of the study, the study was faced with limitations like; the difficulty of getting respondents to answer the questionnaire and the difficulty involved in getting back the questionnaires. The study population was smaller than the study expected. This also reduces the sample size intended for the study. The names of Agribusiness SMEs obtain from the registrar of companies in the study area were not the same as those

observed on the ground, as most of them had collapsed and some were not registered. This meant finding some Agribusiness on our own.

ETHICAL APPROVAL AND PARTICIPANTS' CONSENT

The study sought official ethical clearance from the University of Development Studies (UDS). The consent granted was part of the ethical requirements for postgraduate studies from which this paper was obtained. Additionally, respondents used for this study were duly informed before the start of the study. Respondent confidentiality was ensured at all levels of the data collection.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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