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Article

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OPERATIONS, INFORMATION & TECHNOLOGY | RESEARCH ARTICLE

Influences of E-commerce Adoption on Sales performance among Agrochemical Input Dealers in the Ghanaian City

Benjamin Nyarko¹, Nicholas Oppong Mensah², Kofi Agyenim Boateng^{3*} and Anthony Donkor³

Purpose: This study assessed the effect of E-commerce on sales performance of agrochemical input dealers in the Greater Accra Region of Ghana.

Design/methodology/approach: The study utilized both primary and secondary data. 10 Primary data was collected with semi-structured questionnaires to a sample of 125 respondents, consisting 105 adopters and 20 non adopters (E-commerce). Secondary data was collected from Ghana Agri-Input dealers association (GAIDA), Environmental protection Agency (EPA), libraries and through the internet. The propensity score matching (PSM) was used to analyse the effect of E-commerce on sales performance.

Findings: The adoption of E-commerce resulted in about GH¢ 11,456.07, GH¢ 10,317.62, GH¢ 11,176.68, GH¢ 11,025.37 increase in sales revenue for the monthly estimates whilst for the quarterly estimates the amount increased by GH¢ 40,690.29, GH¢ 36,089.43 GH¢ 39,538.42 and GH¢ 38,921.03. The result are suggestive that adopters of E-commerce are largely offered avenues distinct from the traditional marketing to attract customers and reduced necessary operational costs involved in sales. Thus, expanding firms' "reach" without compromising "richness" however, the decrease might be attributed to barriers to the effective and efficient implementation of E-commerce by agrochemical industries within the region.

Originality/Value: As E-commerce is an ongoing new trend that is predicted to be a crucial alternative to the use of market place centered on geographical location, and further aid in sales performance, there is the need for an insight into the effect of the adoption of E-commerce on sales to be established within the agrochemical industry.

Subjects: Internet & Multimedia - Computing & IT; Business, Management and Accounting; Information Technology

Keywords: E-commerce; propensity score matching; agrochemical; input dealers; average treatment effect

1. Introduction

Electronic commerce—E-commerce for short—adoption continues to attract the attention of research enthusiasts from all manner of academic and practical standpoints to demonstrate the significance of the concept as a piece of innovative technological phenomenon (Jank and 2022 Shmueli, 2006; Melnik and Alm 2002; Xiao and Benbasat, 2007; Xiao, Wu and Hu 2018; Liu et al.

PUBLIC INTEREST STATEMENT

The crucial significance of electronic commerce practices among agrochemical dealers has been overlooked by scholars over the years. However, if for anything, the global pandemic in COVID-19 has reinforced the need for stakeholders in the agricultural sector to have a rethink about the vital importance of E-commerce. Doing this rethink should be crucial as it makes it possible to focus on areas that were hitherto not popular and hence remained an uncharted territory for agrochemical dealers in the sale of their products. This situation can no longer continue as the study suggests that the idea (from the findings) that firms that employ E-commerce practically deepen their business penetration and at the same time introduce techniques of mass customization that meets particular customer needs and desires. Meeting these needs and desires provides the opportunities for extending market reach into new marketing space, which has no correlation to physical presence in a geographical space.

2021; 2015; Fuller et al. 2022; Misra, Mahajan, Singh 2022). By E-commerce, we draw on an understanding of the concept supplied as the use of the Internet to facilitate, execute and process business transactions that business transactions “involve a buyer and seller and the exchange of goods or services for money” (DeLone & McLean, 2004 p. 31–32). Drawing on Yacob et al. (2021 p. 244; cf. Kalakota & Whinston, 1997) and consistent with the ideals of business to consumer (B2C) model, E-commerce adoption involves “buying, selling, or advertising information, products, and services through computer networks”. Scholars have had the occasion to emphasise the capabilities of E-commerce on the performance of online retailers (Fuller et al., 2022), alleged transparency in business to consumer transactions (Wang et al., 2019), handling E-commerce disruptions with information technology (IT)-led innovations (Xiao et al., 2019), among others. In addition to this some, studies have touted E-commerce platforms for its customer relationship management capabilities with regard to the way it affords first mover benefits in conditioning low entry barriers (see, for example, Wang et al., 2016).

A number of possible favorable dispositions result in the adoption of E-commerce. Such favourable dispositions include convenience, widened scope of economic activity, flexibility in electronic buying and selling operations, broadening appeal of the Internet, increased intensity of the handset culture, prohibitive cost in the acquisition of the brick-and-mortar shops, and so on (Laudon & Laudon, 2021; Rentenbank, 2015). These activities encourage the practice of anytime anywhere that makes it feasible for participants to engage in digital transactions with minimal hindrance in E-commerce trading operations. The minimal hindrance has reinforced the rising popularity of E-commerce. And the rising popularity has extended the application of E-commerce to the sale of agricultural inputs.

E-commerce practices in the sale of agricultural inputs seem to have been receding into the rear-view mirror of contemporary scholarship; hence, the argument elsewhere is that “E-commerce remains an as yet under-developed ... within farm inputs” and to be sure “E-commerce has been slow to take off in farm inputs (Taylor, Kennes and Lefroy, 2020 p.1). However, given the fact that E-commerce in agricultural inputs popped up onto the academic scene just over two decades ago (insert ref), it is difficult to overlook the resurgence and momentum the subject is gaining and gathering in contemporary times. The reasons that get assigned to the dormant nature of E-commerce in agricultural sale input practice—and by logical extension in research—is the seasonal nature of the business model that characterises agricultural input, unorganized market structure as well as habits. These undesirable reasons notwithstanding the global nature of the COVID-19 disease has brought to the limelight the urgent and crucial need for taking a second look at E-commerce and sales performance, especially in matters of agricultural input. Taking this second look is legitimate for a couple of justified rationalities.

First, the literature is not up to date with the practice of E-commerce with respect to sales performance in the age of global COVID-19 pandemic. It is appropriate to rethink and the consideration of others has also contributed to the E-commerce debate by emphasizing the many meaningful benefits to a global economy that has become quite familiar with digital transactions in which E-commerce constitutes a significant segment. There are some difficulties connected with E-commerce practices nonetheless. These come in the form of, especially in much of the developing world, inadequate and weak information technology infrastructure on which reliable internet services for E-commerce thrives. Widening digital divide, lack of trust (Lee & Turban, 2001) terrible address systems coupled with dysfunctional identification schemes that continue to undermine the prospects of E-commerce in developing countries, including Ghana. These notwithstanding, some E-commerce enthusiasts have gone as far as to suggest the vital ingredients that establish the success of E-commerce practice in six various dimensions as “system quality, information quality, service quality, usage, user satisfaction and net benefits” (Ibid, p.34).

The ontological dimensions of E-commerce have various focused on innovation diffusion from the standpoint of small and medium businesses (Pease & Rowe, 2005) with particular emphasis on adoption. O'Reilly and Finnegan (2010) have emphasized inter-organizational networks in

electronic marketplace with a highlight of intermediaries. These sampled studies, significant as they look, leave the literature with a blind spot in the contemporary scenario where increasing agriculture practices in matters of agrochemicals and how they become embedded in electronic trading activities have assumed a notable attention from both practitioners and researchers. The heightened significance is worthy of academic investigation from not only from an epistemological perspective but also from an ontological orientation. Both the epistemological and ontological inclinations are justified for a couple of rationalizations. The E-commerce literature stands to gain from being enriched in a manner consistent with additional insight that underscores the broader frontiers of the subject. Last, but by no means the least, the agrochemical dimension has the potential of providing a watershed moment for diverse perspective on this new (relatively speaking) directions of E-commerce.

Agriculture has been a revolution from the early days of hunting and gathering to more sophisticated means of production (thus the use of machines, such as ploughs, harvesters, and tractors; to chemicals, such as pesticides, insecticides, herbicides and fertilizers) and marketing by the use of technology. Ghana's Agriculture sector forms 19.7% of the total Gross Domestic Product (GDP) as declared by FAO (2018). The central position of agriculture in Ghana's economy indicates that both greater general economic expansion and poverty alleviation could be induced by sector growth.

Rhoades et al., (2009), observed the point that the current trend in agriculture within the twenty-first century is more sophisticated than in previous times in history. Globally, the trends of Agriculture marketing for decades have been through the adoption of new technology or novel application of existing technologies employed in other industries. According to Edwards & Shultz (2005), the agrochemical input dealers' industry has developed comprehensively in only two generations. Agribusinesses are no longer concerned solely with farm operations today, but they involve a broader variety of acts, such as demand orientation. The application of E-commerce is increasingly being used in business. This has resulted in changes in ways of doing business and market structures. E-commerce is perceived to enable many industries and firms to obtain competitive advantages over their competitors by cutting cost and entering markets (Strzebicki, 2015).

E-commerce transactions are growing at a rate between 20 to 25% annually by great strides, suggesting a far-reaching shift in the expenditure patterns of human consumers (Jamsheer, 2019).

Improved productions and high yields associated with the introduction of agrochemicals have necessitated a continuous search for profitable markets beyond traditional markets. Accordingly (Ahmad et al., 2017), disclosed that, electronic markets are serving as an alternative means for farmers to market and sell their produce to buyers.

Numerous studies have explored the enormous potentials, and opportunities E-commerce provides to consumers and businesses globally. Among a few (Goldsmith & McGregor, 2008) studied the effect of E-commerce on customers, public policy, industry, and education. Jackie (2001) who further presented ethical issues that have emerged in the adoption process, reviewed the incredible rise in electronic commerce (E-commerce).

Taylor & Owusu (2012) studied Ghanaian Handicraft Exporters 'Factors Impacting Internet and E-Commerce Adoption. However, previous research on E-commerce in the Agrochemical industry is scanty, though research has a similar study has been conducted in Agri-food (De koster 2002; Batte and Ernst, 2007; Machfud and Kartiwi, 2013; Zapata et al., 2013). As E-commerce is an ongoing new trend that is predicted to be a crucial and alternative to the use of market place centered on geographical location, there is the need for an insight into the effect of the adoption of E-commerce on sales to be established within the agrochemical industry. E-commerce serves as a level playing field for firms, cooperatives and medium-sized

enterprises (SMEs) to compete in the global marketplace without obtaining a marketplace, and for regional companies and communities to engage simultaneously across international boundaries in social, economic and cultural networks (Mary-Anne, 1998). Our contribution in this paper is threefold. First, we review, analyze, and synthesize the body of literature reporting empirical studies of E-commerce over the last decade. Based on that, and motivated by the research gap mentioned, we provide further insights on sales performance by employing the propensity score matching tool to draw inference on both adopters and non-adopters of E-commerce. Third, and, most importantly, we provide recommendations regarding where the focus should be in terms of how feasible all stakeholders and agencies could help facilitate the implementation and adoption of E-commerce in the agrochemical industry.

2. Literature—E-commerce in view

2.1. Contemporary electronic commerce in practices

The African continent has had its rapid growth of internet connection in the last decade. This exponential increase in internet access has led clients and manufacturers to see the benefits of ecommerce, with the key motivating driver for online business being convenience (Ibam et al., 2018). Thereport by UNCTAD (2018) indicated that though there has been twice the number of internet users in Africa, the region still has the lowest population of internet users. Despite the lack of reliable ICT data in Africa, the UNECA SCAN-ICT project carried out in six African countries including Ethiopia, Ghana, Morocco, Mozambique, Senegal, Uganda found that 81% of the companies surveyed had internet connectivity, 35% had a web presence, and only 16% were interested in E-commerce in the case of Ghana (INIIT, 2003). Aida et al., (2005) suggested that about 65% of ICT businesses do not have an internet presence, and 84% have no interest in E-commerce. The introduction of E-commerce altered business transactions within the continent, resulting in creating an avenue for African entrepreneurs to tap into the international society's vastly larger markets with ease. The introduction of electronic payment systems (mobile banking, payment application) and means (such as Paypal, Visa card, MoMo transactions, etc.) by African banks has bridged the transaction of goods and services gap in trade and payment methods between the African continent and the world at large (KPMG, 2016).

2.2. E-commerce in Ghana

Ghana's rank on International Telecommunication Union and the United Nations Conference on Trade and Development's Digital Index was 6th in Africa though Ghana was 21st in Africa in 2006 (UNCTAD, 2006, 2018). The significant rise in rank can be attributed to the increased internet penetration. In 2017, 58% of the population ages 15 and above owned either a financial institution account or a mobile money service account (Ministry of Communications, 2019). Also, 39% of the population were internet users: an incredible increase from 3 out of 100 Ghanaians in 1999 (ITU, 2007). Ghana was recorded to have had 45 secured internet servers per 1 million people. The index report further concluded by indicating that Ghana's Postal reliability index scores 53 (UNCTAD, 2018). According to Eshun and Taylor (2009), the Network Readiness indicates a nation's preparedness to engage in the benefit derived from ICT had Ghana among the 23 African countries in the top 100. A report suggesting that the adoption of ICT has the tendency to enhance business operations and position business to remain competitive.

E-commerce leverages digital information technology by substituting human labor and physical capital employed for electronic mediums (i.e. devices, internet, applications, etc.) in some exchange activities. The current trend for exchange (i.e. buying and selling) over the Internet has been adopted by all wired countries agricultural sector (Mueller, 2016). Within the Ghanaian society, E-commerce platforms could be under two broad themes namely: the communication platforms and the transaction platforms. Platforms like the Jumia, Jiji, Tonaton, Ali express, Amazon, Facebook, and Instagram are viewed in this context as the communication platforms. These platforms serve as an avenue for publicity (thus, advertisement, promotions, and customer enquiries among others).

The transaction platforms however are two distinct platforms, namely, the mobile money platform and the banking applications. Telecommunication firms generate the mobile money platforms. Examples are the Mtn MoMo, Airtel Tigo Cash, and Vodafone cash. Banking Applications are an extension of banks in a mobile view where clients can access banking services right at the comfort of their location with having to move to any banking facility. Examples are the Fidelity App, Zenith App Ecobank App, among others.

These are extensively being used for commerce-related activities, such as advertisement, transactions and communication (KPMG, 2016; Ministry of Communications, 2019; Zurek, 2019)

2.3. E-commerce in agriculture

There have been successful E-commerce applications in Agriculture. Sales of agricultural goods in 2015 crossed 69.55 billion (Yuan) on the Ali website, according to Alibaba's agricultural ecommerce white paper (2015). In 2014, 762,100 traders of farm products were recorded. However, 97.73% of supermarket outlets accounted for 900,000 in 2015. Both Foodtrader.com and Produce.online websites represent more than 13,000 farmers, packers, suppliers, dealers, importers, exporters, and supermarket stores representing 180 countries. Foodtrader.com offers its clients electronic distributor systems, expert consultancy for the industry, and solutions for worldwide buying and ordering (Costopoulou & Karetsos, 2001). The Bolero E-commerce program also provides a standard international portal that helps general importers and exporters, banks, customs, and shippers to connect with each other seamlessly and provide safe transactional services for agricultural-related firms. Locally, Agrocentra, a Ghanaian market network for large off-takes, such as feed suppliers and breweries with over 15,000 smallholder farmers. The Bono Ahafo (BA) Agro Market Online in the Bono area is currently being set up to establish a wider market for farmers to tackle post-harvest losses in the country.¹

2.4. Impact of E-commerce adoption on sales revenue

Given the growth of E-commerce in recent years, there remains the question of whether firms increase their revenue with its adoption. As pointed out by Duch-Brown et al. (2017) the introduction of online channels has resulted in a significant unit of consumers who views online commerce as more effective and convenient. However, through their marketing units, organizations have struggled to measure the exact contribution of their marketing activities on the return on investments (ROI). Shahjee (2015) work suggested the idea that Indian marketers with good E-commerce presence make successful sales in international markets. The study emphasizes the point that, the impact of E-commerce on sales revenue is directly related to the successful application of E-commerce systems and strategies approved by the firms target audience. However, Lorca et al. (2019) indicated that, companies E-commerce immediately experience increase in their profitability even though they practice, E-commerce seems to have no significant influence on revenue growth.

Also, Bakos (2001) reveals that consumers are increasingly relying on information collected online to research a lot of purchases that are concluded over traditional "bricks and mortar" channels (traditional market), especially for high value durable goods, such as electronic and automobiles. Dogan (2013) used sales as an indicator to analyze the return on assets and observed that firms with greater volumes of resources take advantage of employing mechanisms that result in efficient utilization of resources in relation to sales activities, such as marketing, promotions, advertisement among others. The use of E-commerce emerged as one possible tool for effective utilization of resources in sales activities.

Furthermore, Duch-Brown et al. (2017), noted market expansion effect as a result of sales of products online due to the opportunity of allowing retailers to expand their sales. However, the study revealed considerable sales diversion due to the availability of easily accessible

information on product diversity. It was further disclosed that E-commerce's role in expanding markets and increasing revenue turnout would only have a substantial negative effect when policies and measures are not appropriate to overcome potential barriers to E-commerce usage. Bergendahl (2005) outlines five mechanisms by which cross-channel integration affects firm sales growth we deduced. These include higher consumer conversion rates, improved trust, greater opportunities to cross-sell, increased customer loyalty and the loss of unique channel features. However, there are cases where substantial online revenues are associated with an equally large reduction in offline revenues. Bergendahl (2005) argues that there is substantial switching between traditional and online channels and that online distribution extends customer base in order to sell more thereby creating an avenue for an increase in sales. Consistent with the foregoing notion, Cao and Li (2005) indicate that sales through E-commerce improve sales and expand customer reach.

Tandoh and Mensah (2020) note that pinpointing the exact marketing communication activity that is solely responsible for bringing in the results has always proven to be a herculean task for marketers. The same is true with social media communication and advertising, thus the online distribution channel sways from some traditional sales, but it also activates consumers who find the online channel more appealing.

Similarly, Jelassi and Leenen (2003) contend that the adoption of E-commerce should be reflected in an increase in sales. This is because investment in online distribution is to extend the customer base to enhance sales. Therefore, online distribution becomes a means to grow by attracting new customers who would not have been possible through traditional marketing. To conclude, despite the importance of their absolute amount, sales through E-commerce present only a tiny percentage of the total sales (Pedro, Javier de Andres, & Julita, 2019). Therefore, the increase in total sales caused by the adoption of E-commerce might be invisible. Citing France as an example based on findings from Pedro et al. (2019), more than 50% of the firms that adopted B2C electronic commerce did not increase their sales.

3. Methodology

3.1. Study area

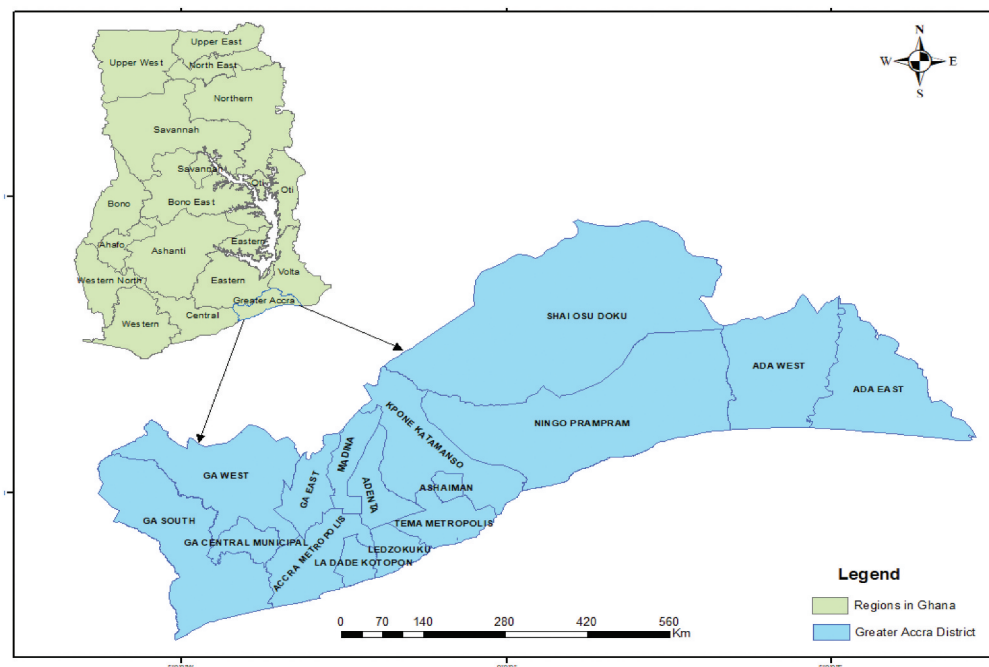
The Greater Accra region of Ghana was the study area for this research. The region is home to the headquarters of the National Communications Authority and the headquarters of major telecommunications and network operators, such as MTN Ghana, Vodafone Ghana and AirtelTigo. Arguably, the network services on which electronic commerce activities rely are more favorable there than the rest of the country.

3.2. Sampling of respondents

The study employed the quantitative approach towards the collection of data. A multi-stage sampling approach was used in this study consisting of purposeful sampling and plain random sampling. The Region where the study was carried out was purposively selected. However, a simple random sampling technique was used to select the agrochemical firms for the study. Furthermore, the study was carried out using a single cross-sectional strategy, meaning that the data was only collected once from a subset of respondents (Malhotra & Birks, 2007).

Study Area

Data used for this study was obtained mainly from primary sources. This study used questionnaires in soliciting data from registered Agrochemical Input Dealers in the Greater Accra Region to obtain data for the assessment of the effect of the adoption of E-commerce on sales revenue. The target population for the purpose of this study consists of all registered Agrochemical Input Dealers in the Greater Accra Region.



The sampling size of 125 from the general population of agrochemical dealers in the Greater Accra Region was obtained using the Slovin's formula. This formula is adopted because the population is finite.

The Slovin's formula for calculating sample size can be expressed as:

$$n = \frac{N}{1 + Ne^2}$$

Where; n = sample size

N = Population size

e = Margin of error (5%) = 0.05

Total number of registered Agrochemical dealers within the Greater Accra Region by Ghana Agri-Input Dealers (GAIDA) was estimated to be around 182

Therefore; $n = 182 / 1 + 182 (0.05^2)$

$n = 125$

This implies that the number of registered agrochemical dealers used for the study is 125.

Due to the scope of work based on the spatial distribution pattern for respondents' location, the researcher team went around the Greater Accra Region to gather the necessary data from respondents. The data was collected in two forms, namely, the online version with which only the main research had access to monitor progress from the team members. The use of this

approach was influenced by the worries of the COVID-19 disease, and the second form was the administration of hard copy questionnaires that some respondents personally requested by the respondents for their convenience. Data cleaning and the treatment of missed values were carried out prior to statistical review.

3.3. Method of data analysis

The impact of E-commerce on sales revenue was examined by the use of the economic model propensity score matching (PSM) via the average treatment effect on the treated (ATT) estimation technique. Even though the PSM is known to be robust in impact assessment, it is susceptible to biases if the model has observed attributes. To check and address this possible limitation, the authors adopted the Rosenbaum Sensitivity analysis to check for the robustness of the PSM model. The statistical tool STATA version 14.0 was used to run the analysis. Based on the literature and related studies, the most commended results from PSM are:

The Average Treatment effect on Treated (ATT): This underscores the effect of E-commerce on the sales performance of those who actually use E-commerce (received the treatment).

ATT is specified as:

$$ATT = EP(X)|D = 1\{E[Y(1)|D = 1; P(X)] - E[Y(0)|D = 0; P(X)]\}$$

The outcome variables used in this study in determining the effect of adoption of E-commerce on sales performance are economic variables (Sales). The outcomes expected are stated as; E-commerce adoption increases income of adopters, shall boost in sales of adopters, improves on transaction cost, E-commerce adopters are more likely to spend on technology (thus, devices, platforms, applications and technical skills).

4. Results and discussion

The average age of respondents is 37 years with a range of 20–66 years. The mean ages of adopters and non-adopters are 37 and 38 years, respectively. The majority of respondents were males (55%). The number of users of E-commerce (adopters) had the major gender group been males with a 60% score whilst non-users of E-commerce (non-adopters) had females being majority with a 70% score. Respondents can be considered to fall within the economically active group since it is known that economically active class age ranges between 15 and 64 years (GSS, 2014). The lowest age was 20 years. Sixty-three percent (63%) of respondents were single. With respect to non-adopters and adopters, the percentage score was 70% and 62%, respectively. The married respondents constituted 36%. Both adopters and non-adopters had obtained education in one form or the other. In terms of educational level of attainments, it was revealed that 23% had obtained basic education whilst another 23% had moved on to obtain secondary education with 51% obtaining a degree or more. The highest educational qualification for Adopters was Postgraduate level whilst that for non-adopters of E-commerce was degree. Most firms have been operating either for 6 years or above with just 38.4% of the firms operating for less than 5 years. About 91% of the firms were operating within the Micro and Medium firm category according to the National Board for Small Scale Industries (NBSSI) classification of firm sizes. Furthermore, the study employed ICT literacy as another characteristic to help determine respondents' level of engagement in terms of ICT tools and related technologies presumed to have the tendency to influence E-commerce adoption. From the table about 67% of the respondents fell between medium and high, indicating that the presence of ICT was common among respondents.

4.2. The effect of E-commerce on sales revenue

Table 2 presents the impact of E-commerce on sales. Four matching algorithms were estimated for the impact of E-commerce of sales namely, nearest neighbor matching, stratification matching, radius matching, and kernel matching. From Table 1, the result is indicative of, the ATT on total value of sales increased by GHS 11456.07, GHS 10317.62, GHS 11176.68 and GHS 11025.37 for the nearest neighbour matching, stratification matching, kernel matching and radius

matching respectively. The result is suggestive of the view that adopters of E-commerce are largely offered avenues distinct from the traditional marketing to attract customers and reduced necessary operational cost involved in sales. Thus, expanding firms' "reach" without compromising "richness" (Evans & Wurster, 2000). Other findings by Chappell and Feindt (2002); Akoh (2001); Windrum & DeBerranger (2002), further indicate that the results might be attributed to the fact that E-commerce adoption has led to a reduction of marketing, administrative and operational costs that indirectly leads to more returns since expenditure meant for such duties are reduced due to the introduction of E-commerce. This finding however contradicts the study by (Marshall et al., 2000; N, 1999) which indicates a wide gap between anticipated and actual achievements from E-commerce systems. Furthermore, as to whether the effect of the increase is as a result of E-commerce adoption or not cannot be proven otherwise since the exact contribution of a marketing service in this instance E-commerce solely responsible for bringing in the result has always proven to be a herculean task for marketers (Tandoh & Mensah, 2020).

Further, the Rosenbaum Sensitivity analysis was deployed to analyze the robustness of the results from the PSM estimates of (Table 2). The critical gamma levels (τ) shown in the appendix represent the limits to which the causal inference of the adoption effect would be considered questionable. The lower and upper limits of critical gamma levels of 1.0 and 2.5 rule out the possibility of the presence of unobservable characteristics that could affect the estimated treatment effects, predicting being fairly numb to hidden bias.

The test statistic (t) is significant at 1% that is < 0.001

NB: Average Treatment Effect on the Treated (ATT). 1 = GHS 1.00 (Figure 1 and 2)

Table 3 and 4 presents the impact of E-commerce on sales. Four matching algorithms were estimated for the impact of E-commerce on sales, namely, nearest neighbor matching, stratification matching, radius matching, and kernel matching.

From Table 3, the result is indicative that, the ATT on total value of sales increased by GHS 40690.29, GHS 36089.43, GHS 39538.42 and GHS 38921.03 for the nearest neighbor matching, stratification matching, kernel matching and radius matching, respectively.

The effect is indicative of the idea that firms using E-commerce theoretically expand their business penetration and at the same time introduce techniques of mass customization that meet particular customer needs and desires (Alemayehu, 2002). Malone et al., (1989) also states that computer networks of knowledge and connectivity increase the speed and expense of the communication of the same information device. It can be deduced from the findings that enterprises that employ the networking capacities that underlie E-commerce have the potential to enable an increase market reach, which is possible only when the visibility of firms are increased. E-commerce adoption serves to reduce or eliminate the tendencies of intermediaries who use their power and influence in the markets to make excessive profits off firms (Robin, 1984). However, Pare (2002) argues that the idea of efficiency gains promised by E-commerce is far-fetched and overlooks the lack of core capabilities. Hempel and Kwong (2001) and Ho and Chen (1999) further argue that there is mismatch between the culture embedded in E-commerce with Odedra-Straub (2003) that reinforces the above and opines that the opportunity imperative undermines the resource and local infrastructure realities of developing countries' businesses.

The results however indicate that E-commerce adoption has a tendency to help increase sales of firms, however, drawing conclusions in terms of return on investment (ROI) is more speculative than conclusive. This is due to the fact that organizations through their marketing units have from time past struggled to adequately measure the exact contribution of their marketing activities on the return on investments (ROI) (Tandoh & Mensah, 2020).

Table 1. Sociodemographic characteristics

	ADOPTERS FREQ PER (%)			NON-ADOPTERS FREQ PER (%)		TOTAL SAMPLE FREQ PER (%)	
GENDER							
MALE	63	60		6	30.0	69	55.2
FEMALE	42	40		14	70.0	56	44.8
AGE							
15–24	9	8.6		3	15	12	9.6
25–34	51	48.6		4	20	55	44.0
35–44	22	21.0		6	30	28	22.4
45–54	14	13.3		6	30	20	16.0
>55	9	8.6		1	5	10	8.0
MARITAL STATUS							
SINGLE	65	61.9		14	70	79	63.2
MARRIED	40	38.1		6	30	46	36.8
EDUCATIONAL LEVEL							
BECE	21	20		8	40	29	23.2
WASSCE	24	22.9		5	25	29	23.2
DEGREE	47	44.8		7	35	54	43.2
POST GRADUTE	10	9.5		0	0	10	8.0
OTHERS	3	2.9		0	0	3	2.4
EXPERIENCE (YEARS)							
1–5	38	36.2		10	50	48	38.4
6–10	51	48.6		7	35	58	46.4
11–15	5	4.7		1	5	6	4.8
>15	11	10.5		2	10	13	10.4
TOTAL	105	100		20	100	125	100

(Continued)

Table1. (Continued)

	ADOPTERS FREQ PER (%)			NON-ADOPTERS FREQ PER (%)		TOTAL SAMPLE FREQ PER (%)	
FIRM SIZE							
<5 employees	40	38.1		19	90	59	47.2
6-29 employees	54	51.4		1	10	55	44.0
30-99 employees	8	7.6		0	0	8	6.4
100> employees	3	2.9		0	0	3	2.4
Total	105	100		20	100	125	100
ICT LITERACY							
Basic	29	27.6		12	60	41	32.8
Medium	49	46.7		5	25	54	43.2
High	27	25.7		3	15	30	24
Total	105	100		20	100	125	100

Source: Field survey, 2020 FREQ = frequency PER = percentage

Figure 1. Figure 1 above shows the Effect of e-commerce on monthly sales performance (Histogram of propensity scores for treated and untreated groups of respondents). Source: Author's Computation, 2020 (STATA 14.0 Software)NB: There is some fair balance in the densities of the propensity scores. Hence, the quality of the results is good.

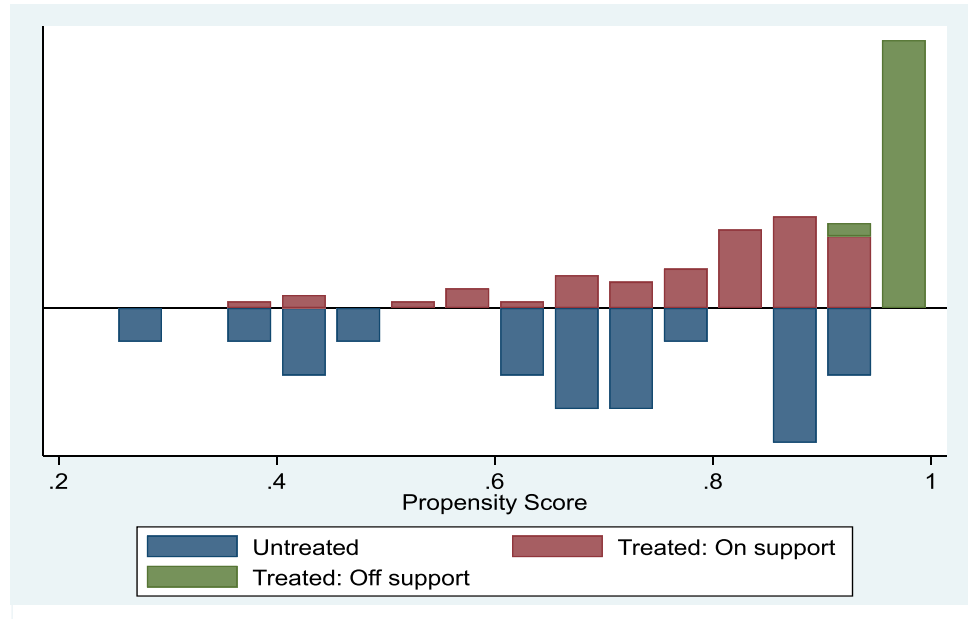
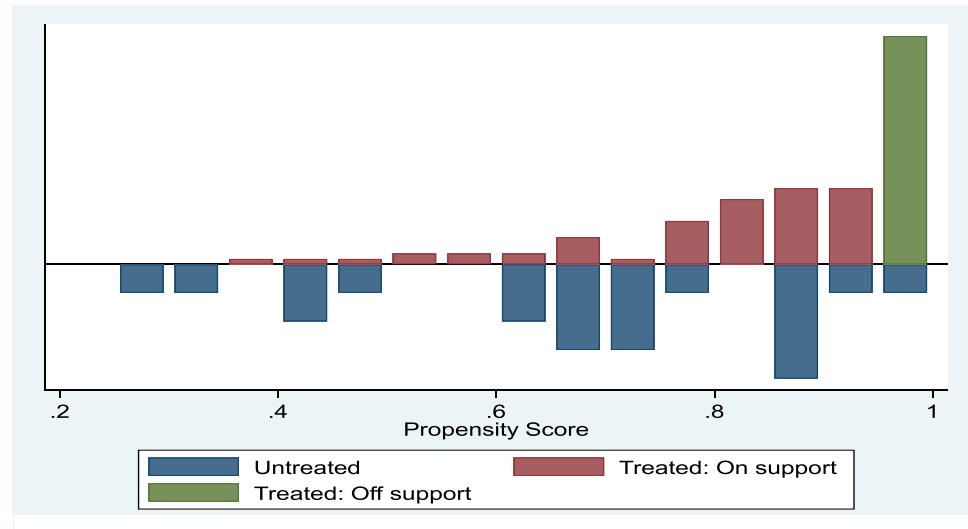


Figure 2. Figure 2 above shows the Effect of e-commerce on quarterly sales performance (Histogram of propensity scores for treated and untreated groups of respondents).Source: Computation, 2020 (STATA 14.0 Software)NB: There is some fair balance in the densities of the propensity scores. Hence, the quality of the results is good.



Further, the Rosenbaum Sensitivity analysis was deployed to analyze the robustness of the results from the PSM estimates of (Table 2). The critical gamma levels (τ) shown in the appendix represents the limits to which the causal inference of the adoption effect would be considered questionable. The lower and upper limits of critical gamma levels of 1.0 and 2.5 rules out the possibility of the presence of unobservable characteristics that could affect the estimated treatment effects, predicting being fairly numb to hidden bias. See appendix III for full computations

5. Conclusion and research implications

This paper assessed the effect of E-commerce on sales revenue by agrochemical input dealers in a Ghanaian city. The study seeks to understand the significance of employing E-commerce in sales related activities by agrochemical dealers. The empirical results show a positive and significant relationship between E-commerce adoption and the sale of agrochemical products. From the monthly and

Table 2. Monthly sales revenue

Estimation Method	ATT	Std. error	T-test	No. of treated	No. of control
ATT nearest neighbor matching	11,456.068	2116.414	5.413	103	15
ATT stratification matching	10,317.620	178.889	5.800	102	19
ATT kernel matching	11,176.681	2330.432	4.796	103	18
ATT radius matching	11,025.371	1869.577	5.897	103	18

Source: computation based on field data, 2020.

Table 3. Quarterly sales performance

Estimation Method	ATT	Std.error	T—test	No. of treated	No. of control
ATT nearest neighbor matching	40,690.293	11,225.509	3.625	103	15
ATT stratification matching	36,089.434	12,002.450	3.007	102	19
ATT kernel matching	39,538.418	6155.085	6.424	103	18
ATT radius matching	38,921.033	7672.576	5.073	103	18

Source: computation based on field data, 2020.

The test statistic (t) is significant at 1% that is < 0.001

NB: Average Treatment Effect on the Treated (ATT). 1 = GHS 1.00

Table 4. Table 4 represents the outcomes of the Hypothesis

Hypothesis	Status
H₀: E-commerce adoption has no significant effect on the sales on agrochemical dealers	Reject
H_A: E-commerce adoption has significant effect on sales on agrochemical dealers who adopt to the use of E-commerce	Accept

Source: Field survey, 2020

quarterly estimation on the average treatment effect on the treated, results indicate that E-commerce had a positive significant impact on sales revenue out. This is affirmative of the fact that businesses that employ E-commerce theoretically expand their business penetration and at the same time introduce techniques of mass customization that meet particular customer needs and desires, as well as extending market reach into new marketing space, which has no correlation to physical presence in a geographical space. On the other hand, non-users of E-commerce are going to be limited to or by their geographical location. E-commerce when applied effectively yields the appropriate results, and for that reason it is suggested that Agri-Input dealers association should intensify consistent training and education on the use of E-commerce to equip its members with the right skills and technological ability. Education and training programs when successively implemented by the Agri-input dealers association will further

improve the firms' performance in relation to sales since E-commerce will serve as an alternative marketing tool and space to help boost sales revenue.

The impact of sustainability and efficiency in the use of E-commerce is seen as a necessary mechanism to maintain the relevancy of E-commerce, for this reason, it is suggested for staff of agrochemical input firms to be properly trained and equipped in order to consistently keep firms updated on new innovative ways to implement E-commerce to suit the firm's preference. Compared with the traditional trade, E-commerce involves more departments, more complicated procedures, the applicable legal provisions and relevant provisions are also different, and for the reason it is justifiable to call on government and other stakeholders involved in the telecommunication and banking sector to introduce more practical E-commerce trade, tax system and other E-commerce related laws and regulations.

We further suggest that government should also strengthen the existing laws and regulations in terms of network security, information management, and intellectual property protection, among others to encourage the use of E-commerce in the agrochemical industry.

5.1. Future scope for research

It is suggested that future studies should consider other stakeholders involved in the agrochemical industry to gain in-depth understanding on the impact of E-commerce in the business operation. It would be worthy to see how, for instance, qualitative techniques of research can be applied to solicit views from farmers about their E-commerce adoption behavioural considerations and patterns.

A number of agrochemical input dealers exist in Ashanti, Bono, Bono East, and Ahafo regions restricting the study to Greater Accra region only gives insight to what happens in Greater Accra region, hence there is the need for further studies to be carried out in different regions to in other for generalizations to be made for all agrochemical input dealers in Ghana.

Furthermore, policy formulation on E-commerce regulations and laws within the context of the Ghanaian society are scanty. As E-commerce exists and keeps revolving at a fast pace with its prospects and troubles, there is the need for adequate research to be conducted in that regard.

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Trust is necessary for academics in educational institutions to achieve knowledge sharing. Trust reassure academics that sufficient and purposeful information is necessary for higher education institutions in achieving the desired academic excellence. Without trust of procedures, institutional processes, and colleagues, knowledge will not be shared effectively. Hence, Trust in Higher Educational Institutes, is necessary for knowledge to be shared and transferred of knowledge as it this becomes the basis for which academic communities" performs exceptionally and thrives.

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Notes

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