

Digitalisation And Productivity of Smallholder Farmers

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Abstract – Digitalisation is an emerging global trend for the development of agriculture through information technology platforms. Small-holder farmers are central to food security and agricultural development, while globalisation and system integration continue to pose challenges in terms of sustainable outputs. Technology has become a necessity to keep farmers in the loop about the changing dynamics of agriculture productivity. A sample size was obtained using the method of empirical saturation. A participatory, deductive, and exploratory approach were employed to examine the effects of digitalisation on the productivity of small-holder farmers using a localised digital module in the Northern region of Ghana. Exploratory research was deemed suitable due to the evolving nature of the study under contention. The study revealed that small-scale farmers use digitalisation to get information about their farm management and market trends. Digitalisation has positive impacts on the yield of the farmers and partially solved the problem of food security in the research area. The study concluded that digitalisation supports the improvement of small-scale farming productivity by increasing their access to information. It also increases the general household wellbeing in terms of improved income level but partially solves the problem of food security. The paper recommends specialised digital training for small-scale farmers who require digital information to carry out their activities. Furthermore, network operators should extend coverage to the hinterland to facilitate the operation of digital services for small-holder farmers.

Keywords: digitalisation, food security, productivity, Information technology, smart phone, COVID-19 and development

1. INTRODUCTION

Digitalisation has become a subject of considerable interest in the global society. This is in view of its relevance in addressing social and economic problems and contributing to the development of communities and societies. In the agro-food-industry, digitalisation is also expected to contribute significantly to solve several challenges the sector is facing at this moment, such as the increasing food demand and the use of resources. In a rapidly changing technology-driven world, the lives of people and their economic activities are underscored by the information technology, internet and the gadgets with which they can access it (Adner, 2002).

With the challenges posed by COVID-19, it is imperative to trace and explore how productivity and career trajectories of employees change over their course of work lives and what matters in this post-COVID-19 era to define new success criteria for flexible work practices for successful work output (Yasin and Smriti, 2020). Innovative technologies can modify the dynamics and processes of individuals, institutions, and governments in varied dimensions (Liu, Zhang, and Chen, 2010). Technological changes pose new challenges and generate further opportunities for individuals, businesses, organisations, communities, and nations (Huang, Wu, and Chen, 2013). Balasubramanian, Fang and Yang (2021) reports that firms with Twitter accounts significantly outperform industry peers in corporate social responsibility rating under same industry characteristics. There is limited research in the application of digitalisation on agriculture development by small holder farmers and its prospects, especially in third-world countries.

Individuals, farmers, businesses and companies who have accepted the digital revolution still have ethical, social and economic concerns about the presence of digital space in their lives, work, businesses, and

organisations. These concerns are born out that information as a digital asset must be explored and utilised without limited access and affordability. Has the digital revolution been accepted and used as a new drive in social and economic development discourse? The effects of digitalisation particularly information technology on individuals, businesses and organisations cannot be overlooked. Therefore, the paper examined the effects of digitalisation on the productivity of small-scale farmers using a localised digital module in the Northern region of Ghana. The main question for the paper is how does information technology affects the productivity of small-scale farmers in Northern region of Ghana?

Digitalisation and sustainable food system

Food sustainability strongly relates with climate change, food insecurity and scarcity of water (FAO 2016; El Bilali, and Mohammad, 2018). Responding to these challenges would bring a global change in food sustainability to the farmer. Respective to these global challenges, digitalisation has helped by way of improving yields of crops, adding value to crops and in the improvement of food security in the global system. This calls for the need to push digital technology beyond the scope of traditional agriculture practices, but rather be strongly embedded in the food systems (Berti and Mulligan, 2015). Research on employing digitalisation in food processing has been highlighted among global researchers (Raheem, Shishaev and Dikovitsky, 2019). The need to employ the digital system in other local systems has become so significant to the development of the food value chain of the small holder farmer in less developed regions.

2. METHODOLOGY

Study design

The study adopted a case study design and employed both qualitative and quantitative data collection approaches in achieving the study objectives. Exploring the impact of digitalisation on small-holder farmers required expert knowledge to achieve empirical results, which would be more focused on depth rather than trends. The focus was based on ideographic rather than generalisations.

The study used descriptive statistics approach and a deductive and exploratory approach to examine the effects of digitalisation on the productivity of small-scale farmers using a localised digital module in the Northern region of Ghana. Exploratory research was deemed suitable due to the evolving nature of the study under contention. Typically, exploratory research consists of secondary research and qualitative data collection (Yin, 2003). The study also employed the method of empirical saturation in the determination of the sample size, and consequently, saturation was arrived at the 27th person. Hence, 27 respondents were interviewed for the study. In line with the ideology of Creswell (1998), he posits that when heterogeneity and saturation are assumed as the centre piece of a study, interviewing 15 respondents ± 10 is enough to generate sufficient data, capable of supporting a valid interpretation or inference. Evidence from the responses of these 27 people was enough to obtain results about the effects of digitalisation on the productivity of small-scale farmers. It is important to note that other bodies of qualitative research have employed similar methods of saturation in arriving at sample sizes.

For instance; the method of saturation was employed by Bunyamin et al. (2019) to determine the sample size in their study to assess the declining rate of share and locus bean tree densities in the Northern Region of Ghana. Consequently, their study attained saturation at the 23rd person. Also, Anafo and Guba (2017), in their study about assessing the impact of land reforms on the livelihoods of land users, employed the method of saturation.

Key informant interviews

Leaders and specialists in digital agriculture were the focus of the day. These interviews were conducted purposely to gain more insight into the use of digital services and how such practices have benefited the agriculture production chain among farmers in the research area.

Samples statistics and liners regression model

The study also employed quantitative variables in determining some specific themes of the study. The researchers were of the view that quantitatively determining and representing categorical data such as the socio-demography and the numbers of the specific types of agro-businesses participants engage in, could

easily be determined by simple trends of percentages. Furthermore, determining the influencing factors to digitalisation knowledge could be easily done using a linear regression module.

3. RESULTS AND DISCUSSION

Digitalisation has restructured the mode of the modern buyer and the channels of interaction with businesses. In the pre-modern era, buying was influenced by massive advertisements. Today, conventional networking is paving the way for a more innovative and creative ways of marketing. The cycle of trading in small holder farmers have changed beyond the space of the local market system of physical interaction, haggling, and bargaining. According to Kutsuri et al. (2019), traditional model networking has been replaced by dynamic network structure, where feedback is effective, client loyalty is high, and interpersonal communication is widely practiced.

The Distribution of Livestock and Birds

The study investigated the distribution of livestock and birds among participants. The investigation was limited to the most preferred livestock species reared domestically in the study area. As a result, the sheep, goat, and local fowl were used in the study. It is also important to note that the interdependence of livestock and plants is viewed within the context of biological cycles of matter and energy cycles (Karbo and Agyare, 2002). Small-holder farmers have witnessed an increase in engagement in small ruminant production by small-holder farmers. It was revealed that 14 respondents engaged in sheep production, 10 respondents engaged in the production of the local fowl; and 3 respondents were engaged in the production of goats. The result is represented in figure 1 below.

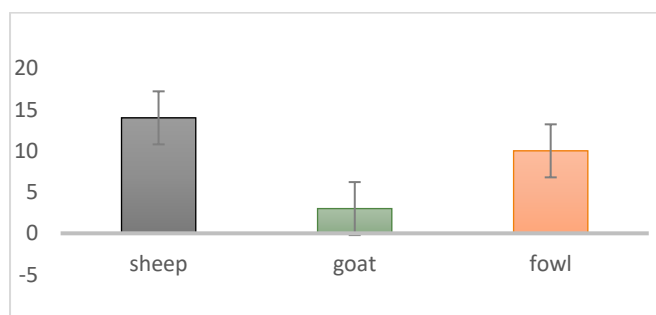


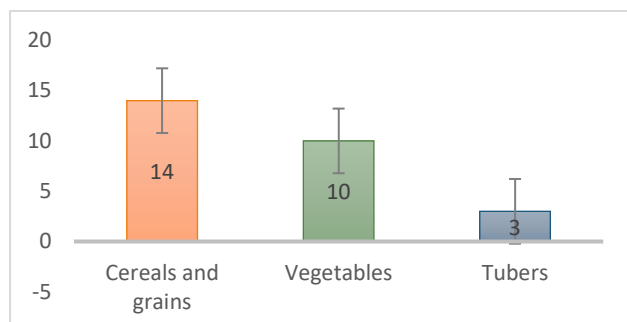
Figure 1: Ruminants and bird production of respondents

Source: Author's construct

Types of crops

Staple crops and vegetable production are common among small-holder farmers in the northern part of Ghana. The interdependence of crops and animals in a biological and economic cycle has strengthened and eased the production cycle of the agriculture value chain. Added to this, the nutritional benefits of producing vegetables, livestock, and staple crops have been highlighted so much in contemporary research (Muthoni and Nyamongo, 2010). The study found out that 14 respondents engaged in the production of cereals and grains (rice, maize, sorghum, and millet). 10 respondents key informants, respondents mentioned that they employ social media in the marketing of their farm produce to a majority of their customers whose locations are far away. They added that social media platforms are easily used in product marketing when both the farmer and the customer have some level of formal education, which can help them to read and write on social media platforms, and also understand customer demand based on the same social media platform. Respondents in the focus groups added that social media platforms increase their customer base. *We are able to reach out to customers beyond our local environment and also get other opportunities and knowledge through employing digital services in our small-scale farm businesses.* Interviews conducted with key informants unpacked the realities of the major themes discussed during the focus group discussions. The impact of education on the employment of digital services in their small-scale farming activities has developed heightened focus among respondents during the semi-structured interviews. Respondents were of the view that education enhances the individual's ability to read, write, and understand basic concepts. As a result, the individual's ability to interpret information to produce a meaningful outcome improves. A key informant noted that the *entire concept of digitalisation is*

education-centred. So, if you are not educated enough to read and write, your ability to reach out to a wider customer base is limited (personal interviews, August, 2022).



Source: Author's construct

Influencing factors to knowledge about digitalisation

The Statistical package for Social Sciences version 16 was used in the study to analyse data on small-holder farm businesses' knowledge of digitalisation. Using the linear regression model to analyse the outcomes of the responses, the study unpacks the realities of the factors that influence the knowledge of digitalisation. The confidence interval was 95%, allowing 5% significance. It was realised that the frequency of mobile phone usage significantly (*sig. 0.05*) affects the knowledge of digitalisation. This implies that the more a small-holder farmer engages in the use of a mobile phone, the more likely the person gains expanded knowledge about digital services; which can improve the business. This is in line with Kutsuri et al. (2019), who mentioned that a digital economy strengthens economic relations between subjects for simplification, accelerates the work of people, enhances transparency, and increases the need for skilled workers. Table 4.1 indicates the influencing factors.

Table 4.1. Factors that influence the digital knowledge of small holder farmers

			95% Confidence Interval for B	
Model		Sig.	Lower Bound	Upper Bound
1	(Constant)	0.122	-0.271	2.142
	Type Of Mobile Phone	0.728	-0.38	0.536
	Frequency Of Mobile Usage	0.054	-0.566	0.028
a. Dependent Variable: Knowledge of Digitalisation				

Source: Author's construct

Digitalisation in food security

The study employed focus group discussion to settle on the general views of the participants about the impact of digitalisation on ensuring the availability of food at all times, food sufficiency at all times, and in a balanced form for the farmers and their households. These specific characteristics were deemed sufficient to obtain valid information on how digitalisation solves food security issues. Respondents were of the view that digitalisation has made food available to most farmers because new technologies are disseminated on digital platforms, such as televisions, radio stations, and mobile phones, which make it easy to adapt and implement on farms for improved yield. However, food sufficiency and the balance amount largely depend on the individual's financial capacity. The focus groups argued that small-holder farmers largely do not own farms where a complete diet can be carved out of the farm; rather, the requirement for capital to complement the available food basket in the farmer's household has always proven challenging to most households, especially all year round. Participants further argued that, in most instances, food shortages are a barrier for small-holder

farmers, especially during the dry season, when farming activities are dormant. In order to learn more about the peculiarities of the issue of food security, the study conducted semi-structured interviews to gather information about individual perceptions of digitalisation and food security. A respondent noted that *we are able to improve our yields through the knowledge acquired from digital platforms. However, we still struggle with sufficient income to support ourselves during the off season* (personal interview, August, 2022). Another respondent stated that the challenge of food availability even in the rainy season is far from being abated. *We are sometimes plagued with very low harvests during the rainy season, and barely get enough to sustain us for the season* (personal interview, August 2022). According to the responses in the survey, digitalisation has barely solved food security issues, but rather partially solved them.

Digitalisation on household income improvement

Using semi-structured interviews, the study further investigated emerging themes on the impact of digitalisation on household income improvement. Respondents gave different reasons why digitalisation substantially increases the income of households. Small-holder farmers compared the pre-digital times to the post-digital times and highlighted certain fundamental factors that have changed the narrative about access to agronomic information and information about current market trends. In line with key informant information, sourcing digital platforms develop an alert system about weather information, location of inputs for farm applications, information about consulting agencies, agriculture marketing institutions and platforms, and current and projected future market trends for staple foods, vegetables, and animals. A key informant is cited as saying that *digitalisation works for you from the first day of planting to the day your farm produce is liquidated* (key informant interview, August 2022).

Challenges of digitalisation on the operations of the small holder farmer

A semi-structured interview was conducted to acquire information about the respondents' views about the barriers to digitalisation. In effect, respondents were of the view that education or know-how, the cost of operating a digital system, and network fluctuation have to some extent affected the effectiveness of digitalisation services among small-scale farmers. In the field of education, an investigation into the educational status of small-holder farmers revealed a general-low education, with the majority (96.3 percent) unable to complete formal education beyond the second cycle level. This is more evident from a respondent who mentioned that *the majority of us make use of non-android phones. Since we cannot read and write, we therefore find it very difficult to access digital information since we don't even use phones with digital characteristics* (personal interview, August 2022). It is also important to note that once upon a time, digitalisation in agriculture was not a subject of intense competition among small-holder farmers. However, contemporary agriculture has raised the bar beyond the conventional approach.

4. CONCLUSIONS AND RECOMMENDATION

The study employed focus group discussion, semi-structured interviews, and key informant interviews to unravel the effects of digitalisation on small-scale farmers. The study reached certain conclusions based on the outcome of the results obtained from the major themes discussed within the coverage of the study. The study linked and drew relationships between education and digitalisation in small-holder farmer operations, the impact of digitalisation in business improvement, the impact of digitalisation on improving the general income of the household of the small-holder farmer. The study therefore concluded that digitalisation supports the improvement of small-scale farming businesses by increasing their access to information, thereby increasing their income portfolios, it also increases the general household wellbeing in terms of improved income level, but partially solves the problem of food security.

Accordingly, the study recommends that the government and other sector players should organise specialised digital training for small-scale farmers who require digital information to carry out their activities. Furthermore, network operators should extend coverage to the hinterland to facilitate the operation of digital services for small-holder farmers, and government and sector players should provide some level of funding for small-holder farmers to expand their businesses.

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