

Socio-economic factors affecting social media use for agricultural information by extension agents in the Northern Region of Ghana

William Anim-Dankwa^{1*}, Francis Kwabena Obeng² and Clement Yaw Lamptey³

¹PhD Candidate, Department of Agricultural Innovation Communication, Faculty of Agriculture, University for Development Studies, Nyankpala, Tamale, Ghana.

²Associate Professor, Department of Agricultural Innovation Communication, Faculty of Agriculture, University for Development Studies, Nyankpala, Tamale, Ghana.

³Lecturer, Department of Agricultural Innovation Communication, Faculty of Agriculture, University for Development Studies, Nyankpala, Tamale, Ghana.

*Corresponding author. Email: wadankwa@gmail.com; Tel: +233 266565860.

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ABSTRACT: This study explores the influence of socio-economic factors on the use of social media by Agricultural Extension Agents (AEAs) in the Northern Region of Ghana. In this context, such dynamics are underexamined. Social media has emerged as a transformative tool in agricultural communication, facilitating knowledge sharing and improving productivity. Employing a mixed-method cross-sectional design in 2022, the study surveyed 120 AEAs using a multi-stage sampling approach and conducted focus group discussions and interviews with 12 purposively selected officers. Data was analysed using descriptive statistics and multinomial logistic regression with Stata software. The findings indicate that Facebook, WhatsApp, and YouTube are the most frequently used platforms by AEAs for sourcing and disseminating agricultural information. Nonetheless, traditional media—such as face-to-face interaction, radio, and print—remain important due to their reliability and accessibility in rural settings. Socio-economic factors significantly influenced social media use among AEAs. A higher number of assigned farmers ($\beta = 0.513$, $p < 0.01$) and marital status ($p < 0.05$) were positively associated with social media adoption. Conversely, higher educational attainment ($\beta = -1.153$, $p < 0.05$) and monthly income ($\beta = -0.582$, $p < 0.05$) negatively affected usage. The study concludes that while AEAs actively utilise social media in their professional roles, socio-economic constraints shape their engagement levels. It recommends policy measures including digital capacity-building, improved internet infrastructure, and integrating digital and conventional communication tools. These interventions are essential for enhancing agricultural extension effectiveness and boosting regional productivity.

Keywords: Adoption, dissemination, extension officers, farmers, Ghana, information sourcing, social media.

Abbreviations: AEAs, Agricultural Extension Agents; ICTs, Information Communication Technologies; MNL, Multinomial Logistic Regression; MoFA, Ministry of Food and Agriculture; SM, Social Media.

INTRODUCTION

Access to timely and appropriately packaged information is key to success. Adequate information provides opportunities to plan effectively and control various decision-making situations. The deployment of information communication technology tools and the internet has provided a new revolution in information provision,

changing the communication landscape and how people relate globally, primarily through social media.

Social media (SM) is the new form of digital communication, influencing people from all walks of life, from social, business, academia, and the political world. The influence has reached this far, particularly with the

invention of convenient tools such as cell phones. Information gathered via SM using cell phones became popular (Iqbal and Bhatti, 2020) and has been embraced worldwide. The influence of SM keeps increasing exponentially and has transformed communication from the personal to the political level. It has caused social and political revolutions. The 2009-2010 Arab Spring in the Middle East and some African countries became viral globally on Twitter (X) and Facebook (Moldovan, 2020; Korotayev *et al.*, 2022). India's 2014 general elections saw another history of humongous social media campaign, making it capable of raising awareness and shaping public opinion (Newman *et al.*, 2015). Information and communication technologies have been claimed to disseminate agricultural extension information more comfortably, faster, and with improved precision (Steinke *et al.*, 2021; Goyal, 2011; Karthikeyan, 2012; World Bank, 2023). These ICT tools are easy to use and are increasingly applied in agriculture (Ayim, 2022; Saravanan and Bhattacharjee, 2016). These tools allow agricultural communities to learn and exchange information through platforms like Facebook, WhatsApp, YouTube, LinkedIn, Telegram, X (formerly Twitter), Wikis, Instagram, and blogs. Messages are sent through texts, images, pictures, audio, audio-visuals, and web links (Andres and Woodard, 2013). Social media provides farmers and Extension agents opportunities to co-create content and promotes co-learning among them (Habiyaemye, 2020; Jackson *et al.*, 2009). Additionally, content development is quicker via SM than traditional mass media extension communication channels (Fuess, 2011).

There are platforms worldwide where extension officers have employed social media to influence and impact farmers by providing agricultural innovation technologies and information, including Nigeria, Kenya, India, and South Africa. Olaitan *et al.* (2017) reported in Nigeria that multiple extension workers employed social media for their research conducted in Kwara state. In Kenya, online platforms such as the Mkulima Young Farmers Facebook page assist in disseminating information and enrolling youth in farming (Irungu *et al.*, 2015). A Twitter handle was also created to support the Facebook page content of the Mkulima Young Farmers (Bhattacharjee and Raj, 2016).

According to the data analyst site Datareportal (Datareportal, 2020), there are more than 20.06 million internet users in Ghana, or 69% of the population. Of this number of internet users, 7.4 million are social media users. Additionally, nearly 38.9 million cell phone connections are active, a trend reported in Africa (Hootsuite, 2020). It has been argued that agricultural extension relies primarily on information sharing between its personnel, farmers, and various other stakeholders (Raksha *et al.*, 2017). Due to this, to ensure that information reaches and meets farmers' ever-evolving needs, MoFA must embrace modern methods such as social media. This is because Agricultural and rural development communication is based on access and

exchange of information between extension agents and the broader society in Ghana (Atinaf *et al.*, 2023; Annor-Frempong *et al.*, 2006).

While SM is generally thought to enhance data collection and information dissemination, mobilize individuals, and connect people in agriculture, it is not clear whether the utilization of social media is affected by socio-economic factors such as age, sex, level of education, monthly incomes and experience which have been understood as key variables affecting technology use. Also, it does not necessarily imply that agricultural Extension Service Agents benefit from social media technology in the northern region of Ghana as they do elsewhere.

There is little literature on the impact of socio-economic factors on extension workers' utilisation of SM. Also, little information is available in Ghana on the use of social media for agriculture in the literature, particularly on how demographic characteristics affect the use of SM and the gains it brings to extension workers and farmers. This study, therefore, seeks to assess how AEAs in the Northern Region of Ghana use social media to source and disseminate agricultural information, with the view to improving agricultural extension service delivery. The study will help close the information gap and help the public, researchers, policymakers, and government agencies obtain maximum benefits from SM to improve agricultural extension service delivery for accelerated production and development. Therefore, the objectives of this study were to evaluate the information sources of Agricultural extension workers and to assess the socio-economic determinants that affect the utilisation of social media by agricultural extension workers in the Northern Region of Ghana.

This study highlights the growing significance of social media in communication, learning, and mobilisation, particularly in agricultural research and extension services. Social media enhances knowledge sharing and interactive engagement, aiding researchers, professionals, and policymakers. The research will help policymakers to understand how socio-economic factors affect usage patterns, improve agricultural extension services, bridge the research-farmer gap, and support policy formulation. Integrating social media into agricultural extension activities will enhance service delivery, empower farmers, and optimise productivity. The study will potentially help to widen the scope for further study and to throw more light on the key issues affecting the adoption and use of social media among agricultural extension agents in the northern region of Ghana

LITERATURE REVIEW

Agricultural extension

Agricultural extension has been defined as the application of scientific research and knowledge in agriculture through

the education of farmers. Agricultural extension is generally defined as the "delivery of information inputs to farmers" (Yanfika *et al.*, 2024; Sulandjari *et al.*, 2022). According to Hasanudin (2022), agricultural extension integrates various views into five objectives: transmitting knowledge from researchers to farmers, advising farmers on decision-making, educating farmers to choose the same kind in the future, allowing farmers to articulate their objectives and possibilities and achieve them, and introducing desirable agricultural advances (rural guidance). According to Anandajayasekeram *et al.* (2019), it does not rule out shifting capacity to train, develop human resources, and increase local capacity, for instance, in integrated pest management, market intelligence, farm management, and negotiation of financial, input, and market services. The total ensures and enhances rural people's farming and living status. The Department of Agriculture under MoFA has extension workers in all 16 Regions of Ghana and all 16 districts in the northern region.

Public and private extension

Agricultural extension breaks into public and private extensions. According to Adegbola *et al.* (2013), the public financed and provided approximately 81% of extension services worldwide through civil servants. According to Anandajayasekeram *et al.* (2009), through public extension, governments fund, staff, or extend services by creating favourable policies and regulations that allow other providers to pursue various objectives that will improve service delivery to farmers. Kaur *et al.* (2024) opined that agricultural extension services cannot be replaced by just providing information to farmers on how to enhance their productivity. There is a need to add other services that enhance farmers' livelihoods. Therefore, the downward slide in various governments' ability to fund public extension has led to a need for private extension. Private Agri-Extension refers to transferring agricultural extension services from government organisations to private entities. This can include private corporations, non-governmental organisations (NGOs), farmer cooperatives, and other non-state entities. The reasons for private agricultural extension are varied. However, the key ones include - Limited Public Resources, efficient and Innovative, Market-oriented Approach, Increased accountability, Diversification of services, and globalisation and modernisation. Private Agri-Extension also refers to private training, employing or deploying extension officers from recognised institutions to beef up public extension service delivery (Lamptey, 2022). Despite the complementarity of the public and private agricultural extension, there are still challenges in service delivery, which, according to Osabohien *et al.* (2019), are principally information, organisation, and extension funding and delivery of agricultural extension. The second is funding

and delivery, which is of interest because of the reduced number of AEAs, primarily due to dwindling government funding.

Approaches

Agricultural extension services typically operate through several approaches, but I focus on three main approaches. These are extensionist-centred (top-down), The Farmer-led (participatory), and the accompaniment (hybrid) approaches. The top-down model is a traditional model that emphasises one-way technology and expert-led education. Professional extension agents disseminate improved seeds, cropping recommendations, and market information through this approach, often via lectures, demonstrations, mass media, or field days. With the participatory approach, farmers are empowered to set priorities, conduct on-farm experimentation, train peers, and evaluate innovations through platforms such as Farmer Field Schools, Farmer Research Committees, and participatory rural appraisal. According to Vidyawati *et al.* (2025), the participatory method helps farmers to define priorities, conduct on-farm experimentation, train peers, and evaluate innovations through platforms such as Farmer Field Schools, Farmer Research Committees, and participatory rural appraisal. This approach enhances technology adoption, gender inclusion, and sustainability, though it highlights persistent institutional, financial, and socio-cultural barriers to implementation. The hybrid approach synthesises the two above, where extension agents act as facilitators, supporting farmer-led processes rather than dictating them. This model blends technical guidance with community-driven experimentation and capacity building. Lukuyu *et al.* (2022) showed that the hybrid approach combined community radio programming with farmer field school sessions and culturally tailored comic books, effectively reaching diverse farmer groups. The results showed improved awareness and adoption of improved forage varieties, demonstrating that integrating flexible communication tools with hands-on methods enhances technology uptake and extension impact. This is what social media provides. Social media as a technology is helping to save time, help to reduce the distances covered by extension workers, though there are barriers to content, access, and digital literacy.

Social media

Briefly, social media are electronic virtual means of communication through which users can communicate, create, spread, store, and exchange information and ideas of any form (text, picture, video, etc.), which can be discussed, stored, and utilized by anyone in virtual networks and communities (Anyanwu, 2018). By this, social media refers to interacting with people who create,

share, consume, and exchange information and ideas in virtual communities and networks.

Social media characteristics that make them an accessible and worthwhile medium in development communication are their simple access using mobile phones, mass-personal communication, and mass-self communication to enable reception of new information, a high level of connectedness, likability, and content sharing across different platforms (Fraccastoro *et al.*, 2021; Hemsley and Mason, 2013).

Social media platforms

There has been a proliferation of media platforms in the northern region of Ghana, as is the case globally. According to Shalini and Priyadarsini (2024), the global digital platforms are dominating in the control of data, and the competence to capture and create information that can alter equal distribution of digital wealth and impede local value creation has been on the rise over the last few years. These platforms have been categorised as blogs, Microblogs, Wikis, content community sites, social networking sites, Internet forums, and Location-based social media (LBSM). However, the key platforms are WhatsApp, Facebook, YouTube, Instagram, LinkedIn, X (Twitter), TikTok, and Wikis. According to the social media marketing University site (The SMMU, 2025), the following are the social media platforms and their users.

1. Facebook: Over 3 billion monthly active users; versatile for text, images, video, groups, and live streaming
2. YouTube: 2.5 billion users; leading destination for long-form and short-form video content
3. WhatsApp: 2 billion users; dominant messaging app offering private, encrypted communication, media sharing, and Voice/Video calls.
4. Instagram: 2 billion users; image- and video-centric platform now emphasising Reels (short-form content) and Story features
5. TikTok: 1.6 billion users; short-form video pioneer with powerful AI-driven content discovery
6. Telegram: 800 million users; private messaging with channels and robust group features
7. X (formerly Twitter): 619 million users; text-driven platform emphasising real-time discussion
8. Snapchat: 750 million users; known for ephemeral messaging and AR filters.
9. WeChat: 1.336 billion users; China-based super-app combining chat, payments, and mini-programs
10. Pinterest, Reddit, Sina Weibo, and Douyin (China's TikTok equivalent) also maintain hundreds of millions of active users.

Private messaging apps such as WhatsApp, Telegram, and WeChat are increasingly preferred for intimate, secure group communication. In summary, the social media

ecosystem in 2025 is dominated by large, generalist platforms that offer diverse content and global reach, while niche and private messaging apps continue to grow in importance for specialised, private interactions.

Determinants of social media use

Several factors influence social media use among agricultural extension professionals, spanning demographic, educational, and infrastructural domains. Babasanya *et al.* (2020) identified age, gender, education level, social media awareness, and training as primary determinants, noting that younger and male officers were more likely to engage with social media platforms, a finding supported by Suchiradipta and Saravanan (2015) and Mensah (2017). Education facilitates social media use and enhances economic prospects and access to digital tools, as further validated by IICD (2006). Marital status also plays a role, with unmarried professionals showing higher usage due to greater resource flexibility (Babasanya *et al.*, 2020). In addition to awareness and digital skills, several constraints hinder adoption, including farmer illiteracy, which limits the utility of social media in knowledge transfer. Moreover, extension officers' reliance on traditional radio and television, coupled with low institutional demand for digital engagement and high internet costs, further impedes usage. Social media uptake among extension staff remains limited without institutional support, such as government-provided data or workplace Wi-Fi.

Theoretical framework

The study of social media use can be theoretically discussed under the various technology adoption models, as it involves the Diffusion of Innovation (DOI), the Theory of Reasoned Action (TRA), and the Technology Adoption Model (TAM). According to Guidolin and Mamfredi (2023), TAM is now one of the most utilised models to explain IT adoption. The model can be used to explain the adoption of social media by extension agents because it is used in other industries globally. Based on the model, technology adoption is stimulated by two major perceptions: perceived ease of use and usefulness. The two key variables – Perceived usefulness and perceived ease of use give rise to cause-and-effect associations that influence users' decisions on whether, when, and how to accept a new technology (Guidolin and Mamfredi, 2023). This formed the basis for the choice of TAM for this study.

Conceptual framework

The conceptual framework highlights key external variables influencing Agricultural Extension Agents (AEAs) in adopting social media, including socio-economic

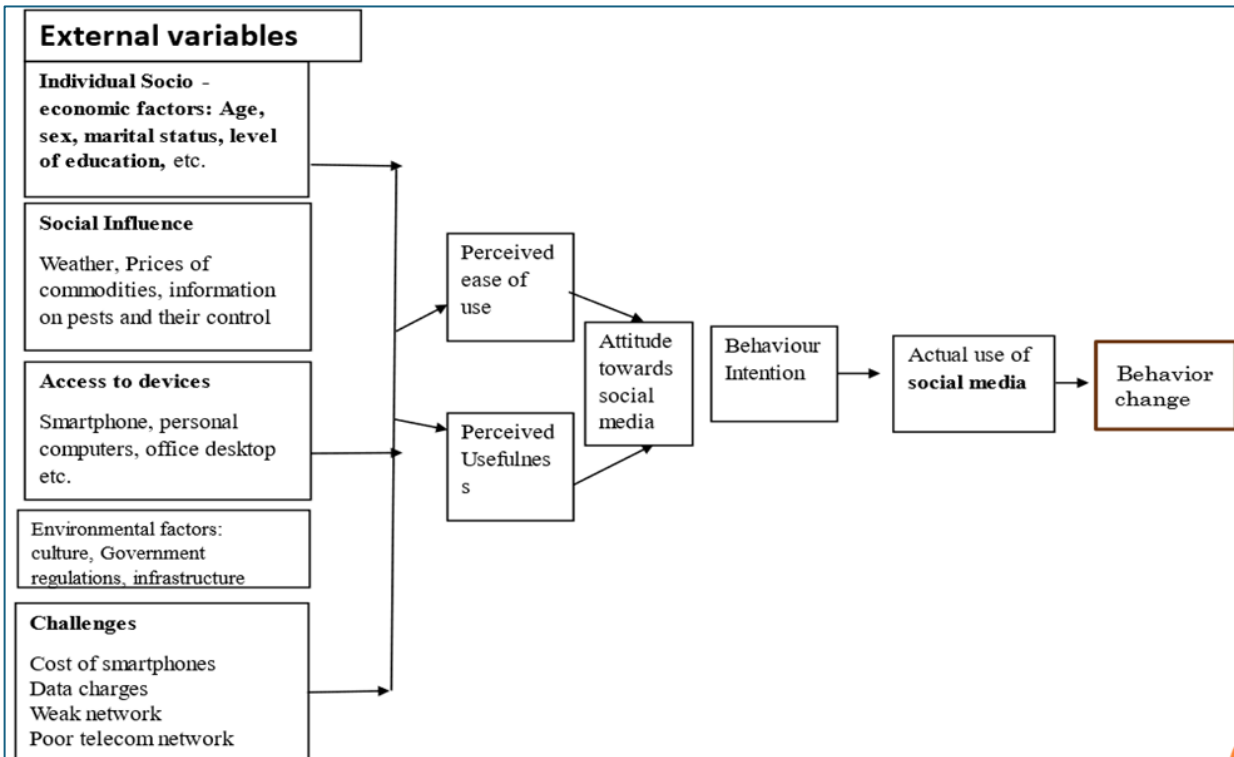


Figure 1. Conceptual framework (Source: Author's construction adapted from Davis and Venkatesh, 2003).

characteristics (e.g., age, education, marital status, work experience), information needs, access to electronic devices, group membership, and contextual challenges and opportunities. AEAs' technology choices are shaped by the type and urgency of information needed, their digital literacy, and access to tools such as smartphones and laptops. Group membership is crucial in disseminating new ideas and fostering experimentation with technology. In northern Ghana, infrastructural challenges—such as poor telecom networks, high data costs, and power shortages—affect social media adoption. However, geographic constraints can motivate AEAs to turn to digital communication. Perceived usefulness (PU) and perceived ease of use (PEOU), drawn from the Technology Acceptance Model (TAM), are critical; if AEAs believe social media improves their job performance and is easy to use, they are more likely to adopt it (Nistor, 2013). Ultimately, positive perceptions of utility and usability shape behaviour intentions toward technology use, leading to greater adoption of social media among AEAs. The visual representation of the conceptual framework for this study is presented in Figure 1.

METHODOLOGY

Study area

The research was conducted in the Northern Region of

Ghana, which has 16 districts located at 9.353426° N, - 0.966679° E (Figure 2). The region shares borders with the North East Region in the north, the Republic of Togo in the east, the Oti Region in the south, and the Savannah Region in the west. The 16 districts are Gushiegu, Karaga, Kpandai, Kumbungu, Mion, Nanton, Nanumba North, Nanumba South, Saboba, Sagnarigu, Savelugu, Tamale, Metro, Tatale, Tolon, Yendi Municipal, and Zabzugu.

Of the region's 2,894,300ha land surface, 2,315,440ha, or about 80 % of the land mass, is available for agricultural purposes. However, it has only some 810,404ha under cultivation in agriculture, a high investment potential in the region's agricultural sector. As indicated by the Ghana Statistical Service, the region has a total of 2,032,000 people, of whom around 1,615,264 (79.49%) are involved in the agricultural sector, from production to post-harvest handling. The area is thinly inhabited, with the best possible reason for emigration, geography, and climate. Chronic hunger, poverty, malnutrition, ill health, and high levels of female and child mortality exist and need to be corrected (Adeyeye *et al.*, 2023; Bawa, 2019; FAO, 2009).

The region's land is generally suitable for growing the major staple food crops like cereals (Maize, Rice, Sorghum), Legumes (Soybean, Groundnut, Cowpea), and Root and tubers (Yam, cassava, sweet potato), Vegetables (Tomato, Cucumber, Carrots, Pepper, etc.). The Northern Region has typically been referred to as one of the nation's food baskets because of its contribution

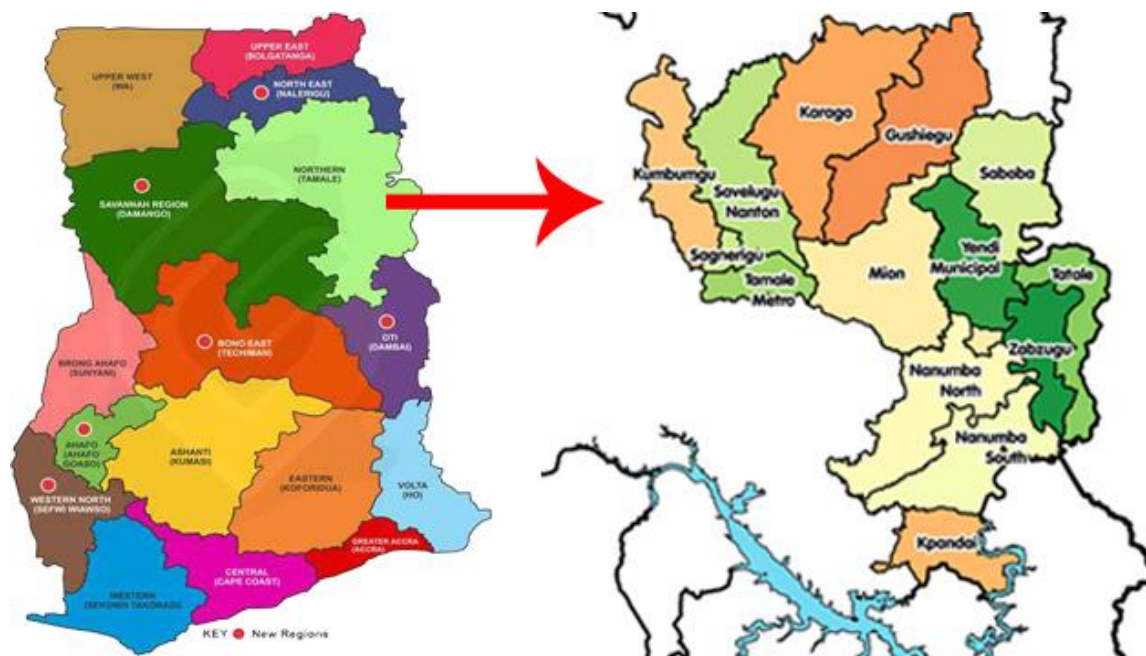


Figure 2. Map of Ghana Showing the study area (Source: Ghana Districts.com).

and Agriculture (MoFA) Statistics, Research, and Information Directorate (SRID) indicates that the region produced 126,845 Mt of rice, 157,915 Mt of maize, 110,622 Mt of groundnut, 94,188 Mt of soybean, 57,021 Mt of cowpea, 53,373 Mt of millet, 84,662 Mt of Sorghum, 1,790,083 Mt of yam, and 849,862 Mt of cassava in the year of production in 2019 (SRID-MoFA, 2020). Key Livestock in the region are cattle, small ruminants, pigs, and donkeys.

According to Hazell *et al.* (2019), Agricultural development in northern Ghana faces significant constraints due to a combination of socio-economic and environmental challenges. These include poor education and healthcare, limited economic opportunities, weak infrastructure, and governance-related corruption. Additionally, harsh climatic conditions, degraded soils, and pest pressures hinder productivity. Farmers also face limited access to advanced technologies and a lack of knowledge of improved agronomic practices. Furthermore, inadequate coordination between the Ministry of Food and Agriculture (MOFA) and the Ministry of Education (MOE) has led to a disconnect between research, education, and extension services, impeding support for smallholder farmers.

The Northern Region of Ghana has private and public extension officers, who render valuable services to peasant farmers, commercial farmers, and Non-Governmental Organisations to boost agricultural production and productivity.

Research design

The study employed a descriptive survey design to capture the current state and characteristics of the research population. This approach enabled the researchers to provide an accurate depiction of existing conditions. A mixed-methods strategy was also adopted, combining qualitative and quantitative techniques to enhance the study's depth and validity. By integrating both methods, the researchers addressed the limitations of using either approach alone (Oranga *et al.*, 2025).

Study population

This study's target population comprised all the Agricultural Extension Workers, who are also referred to as extension agents, in the Northern Region of Ghana. According to MoFA (2020), the total number of AEAs in the region was 202. Krejcie and Morgan's (1970) table was used to select 135 respondents for the survey.

Sampling technique and sample size

A multi-stage sampling technique was used for this study. First, the northern region of Ghana was purposively selected out of 16 regions, because that was where the research gap was identified. The region is described as one of the lowest in mobile phone ownership (41%), Ghana Statistical Service (GSS, 2020), and poor telecommunications infrastructure. Stratified sampling techniques were used in the second phase. The northern region was divided into two zones – East and West- based

on geographical location, farming activities, and proximity to key internet infrastructure. The East included the regional capital and peri-urban communities where ICT infrastructure was pronounced, and the West, near the

In the multinomial case, response probabilities were represented in Equations (ii) and (iii) as

$$P(Y = j/x) = \frac{\exp(X\beta_j)}{1 + \sum_{i=1}^J \exp(X\beta_i)} = p_j(X, \beta); j = 1, \dots, j \dots \dots (ii)$$

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Ghana-Togo border, had more rural communities and relatively poor ICT infrastructure. Thirdly, random sampling of five (5) districts from each zone - east and west zones was selected to obtain ten (10) districts in the region. Lastly, all the extension agents in the selected districts were purposively included in the sample, yielding a sample size of 135 out of 202 extension workers. However, due to an industrial action organised by the Civil and Local Government Staff Association of Ghana (CLOSAG) of which the workers were part, 120 AEAs were reached during the survey.

Data sources

Data was gathered from primary and secondary sources. The primary data was gathered with a semi-structured questionnaire, observations, key informant interviews, and focus group discussions. The purpose of the semi-structured questionnaire was to get detailed information about the concepts and issues being studied. The questionnaire for the study was designed focusing on the objectives. That enabled the researchers to get the required information needed for the study. Key Informant Interviews (KIIs) and Focused Group Discussion (FGDs) were used to validate the data collected from the respondents. The secondary data was obtained from journals, newspaper articles, statistics from the MoFA, the National Communications Authority (NCA), the Statistical Service of Ghana, IT companies, and web pages. The questionnaire was validated in a pilot study at Savelugu, which helped to reduce the number of social media tools used in the study from fifteen (15) to nine (9).

Data analysis

Data was analysed using descriptive statistics and reported in frequency, percentages, and means. The Multinomial logistic regression (MNL) statistical method was used to model relationships between a categorical dependent variable with three or more unordered outcomes and multiple independent variables, which may be categorical or continuous (Liang *et al.*, 2020). Unlike binary logistic regression, MNL is suited for predicting outcomes where categories have no natural order, such as political preference, brand choice, or technology use. The results are presented in Table 4, indicating the significant variables. The Multinomial logistic regression model used was given as;

$$P(Y = j/x_1, x_2 \dots \dots x_n) = P\left(Y = \frac{j}{K}\right); j = 0, 1 \dots, J \dots \dots (i)$$

$$P(Y = 0/X) = \frac{1}{1 + \sum_{i=1}^J \exp(X\beta_i)} = p_0(X, \beta) \dots \dots (iii)$$

We employed maximum likelihood to make estimates for multinomial logit models in which the logarithm of the normal probability function under usual circumstances provided consistent and asymptotically regular estimators. That was expressed by Equation (iv) as;

$$l(\beta) = \sum_{i=1}^n \sum_{j=0}^J 1[Y_i = j] \log [p_j(X_i, \beta)] \dots \dots (iv)$$

Social media user categories used

Apart from the listed socio-economic variables – Age, sex, marital status, level of education, experience, number of farmers assigned, membership of an organisation, and average monthly income- the other variables for comparison were versatile, expert, novel, and introvert user categories. These refer to behavioural categorisations of social media users. These types are often used in communication research, marketing, and digital behaviour studies to appreciate how individuals engage with social platforms based on their motivation, confidence, and activity levels (Alarcón-del-Amo *et al.*, 2011). The following are their definitions:

Versatile users: are highly adaptable individuals who engage in various social media activities, including content creation, consumption, sharing, and interaction across multiple platforms and formats.

Expert users: are proficient and confident social media users with advanced knowledge of platform functions, often create high-quality or influential content, and may act as opinion leaders or moderators in online communities.

Novel users: are newcomers or inexperienced participants who are still becoming familiar with social media platforms. Their usage is often cautious, minimal, and focused on basic consumption rather than active interaction.

Introvert users: prefer passive or private engagement on social media. They primarily consume content without frequently posting, commenting, or interacting publicly. The socio-economic variables estimated were described with their expected signs of influence, as shown in Table 1. The qualitative data on the themes was first transcribed and analysed using NVivo.

The socio-economic characteristics of the AEs are as

Table 1. Definition of the variables in the equation.

Variable	Definition	Expected signs
Age	The age of respondents was measured in years, and the specific ages were 1=32, 2=35, and 3=36. 4=37, 5=40, 6=45, 7=46, 8=52, 9=57 years	+/-
Sex	Sex of respondent – Dummy: Male = 1, Female = 0	+/-
Educational level	Measured in years of access to formal education. Coded as 1=secondary, 2=Diploma, 3=First degree, 4=Masters, 5=PhD.	+/-
Average monthly income	Measured in Ghana Cedis. 1=1000, 2=1300, 3=1500, 4=1900, 5=2000, 6=2500, 7=3000, 8=3500, 9=4500+.	+/-
Marital status	Marital status, Married = 1 Single = 0	+/-
Experience	Experience gained as extension worker: 1= less than 1 year, 2=2-4 years, 3=5-8 years, 4=>10 years, 5=20+ years	+/-
Membership in an organization	Whether an agent belongs to a group =1 Yes, 0 = No	+
Number of farmers assigned	Number of farmers assigned 1=less than 300, 2=301-800, 3=801-999, 4=1000, 5=2000, 6=3500	+/-
SM training received	Whether the respondent has received SM training: No = 0, Yes = 1	+

Source: Author's construction (2022).

Table 2. Demographic characteristics of AEs.

Variable	Characteristic	Frequency	%
Age	<25	6	5
	26-35	58	48
	36-45	46	38
	46-60	10	9
Sex	Male	95	79
	Female	25	21
Education	Secondary	1	1
	Diploma	70	58
	1st Degree	34	28
	Masters	15	13
Experience	< 1 year	3	2
	2-4 years	74	62
	5-8 years	19	16
	>8years	24	20
Marital status	Married	105	87
	Single	15	13
Average monthly income	1000-2000	92	77
	2001-3000	23	19
	3001-4000	5	4
Membership of a group or association	Yes	62	51
	No	59	49
Training received	Yes	47	39
	No	73	61

Source: Field survey Data, 2022.

shown in Table 2. The ages of the respondents range from 25 to 60 years. The education levels of the AEs ranged

from secondary (1%), Diploma (58%), first degree (28%), and master's certificate holders (13%). Eighty-seven per

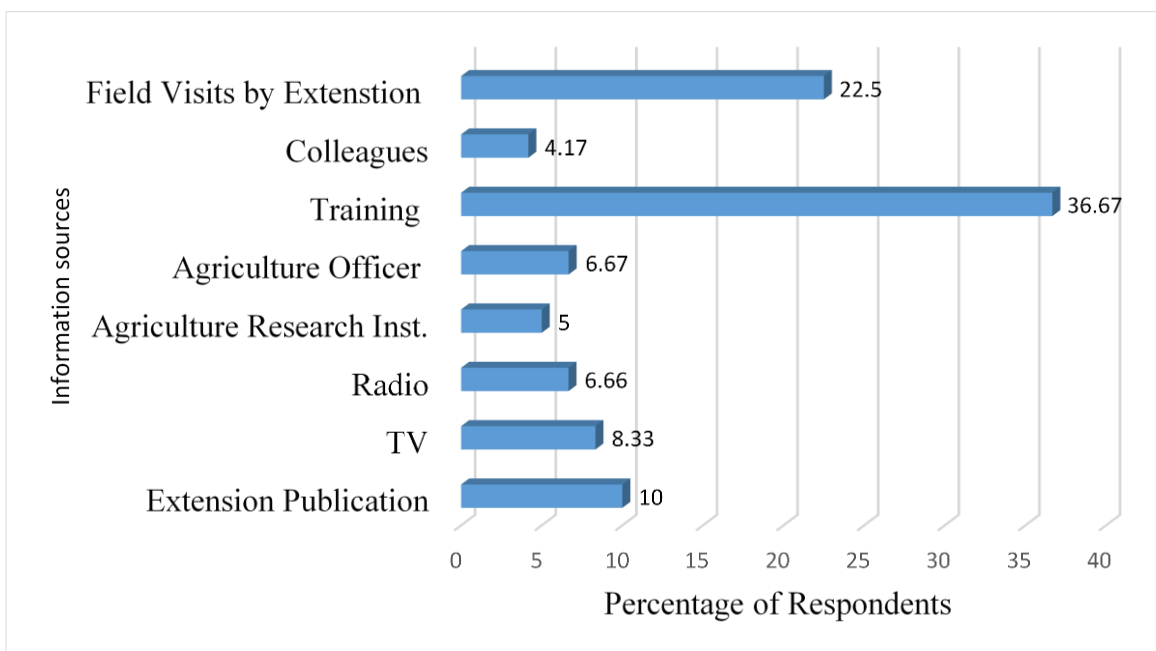


Figure 3. Traditional information sources of AEs Source: Field survey Data, 2022.

of the AEs with farmers ranged from 1 to 8 years. Again, the respondents were categorised according to the number of farmers assigned, with the least being those assigned fewer than 300 farmers and the most being those assigned more than 3500 farmers.

Traditional sources of extension information for AEs

The primary sources of information for Extension workers were training workshops, Extension Publications, Television (TV), Radio, Agricultural Research Institutes, Agricultural Officers, Colleague extension staff, Conferences on extension service delivery, and expert field visits. Besides, all respondents indicated using social media as a significant source of information for extension services.

From Figure 3, the favourite source of information for extension workers in northern Ghana was Training (37%). That was because it provided an opportunity to learn firsthand from experts (Preeti and Somdutt Tripath, 2024). The training was usually experiential. Training was followed by Field visits (22.5%), Extension Publications (10%), and Television (8%). What was surprising from this study was the fact that only 5% of the respondents indicated their source of information was from the Agricultural Research Institutes. As the key research institutions and the fact that Research–Extension linkages have been trumpeted for a while, it was expected to become a key source of information. However, as Leeuwis (2004) contends, published documents and research reports, which ought to

have been a reliable source of information, are typically organised along the lines of specialised fields of study and not on the issues AEs face in the field. Sam *et al.* (2016) also observed the poor linkages among researchers, AEs, and farmers as the main problems that hindered the free flow of information to farmers. Field visits as a source of information were deemed important in this study because of the hands-on approach involved, which was always rich and impactful. This is supported by Cook *et al.* (2021), who said that field visits (Trips) can enhance understanding of a subject. It helps learners use all senses and physically interact with field materials, which is very experiential. This is corroborated by the FGD - *‘The lessons from Farm visits are very important to farmers since they allow them to learn firsthand from us and the subject matter specialist.* Male participant FGD 9

Contemporary sources of extension information for AEs

Figure 4 highlights the growing reliance on Agricultural Extension Agents (AEAs) in the Northern Region of Ghana for contemporary sources of information beyond traditional means. According to Figure 4, 50% of AEs used social media and messaging platforms such as WhatsApp, Facebook, and YouTube to access agricultural information. These were followed by the use of search engines (16%), digital platforms (15%), agricultural websites (10%), and ICT-based services (9%).

The widespread adoption of social media aligns with findings by Paudel and Baral (2018), who emphasised its effectiveness in rural extension service, due to mobile

phone proliferation, enabling real-time information sharing and forming informal networks among stakeholders.

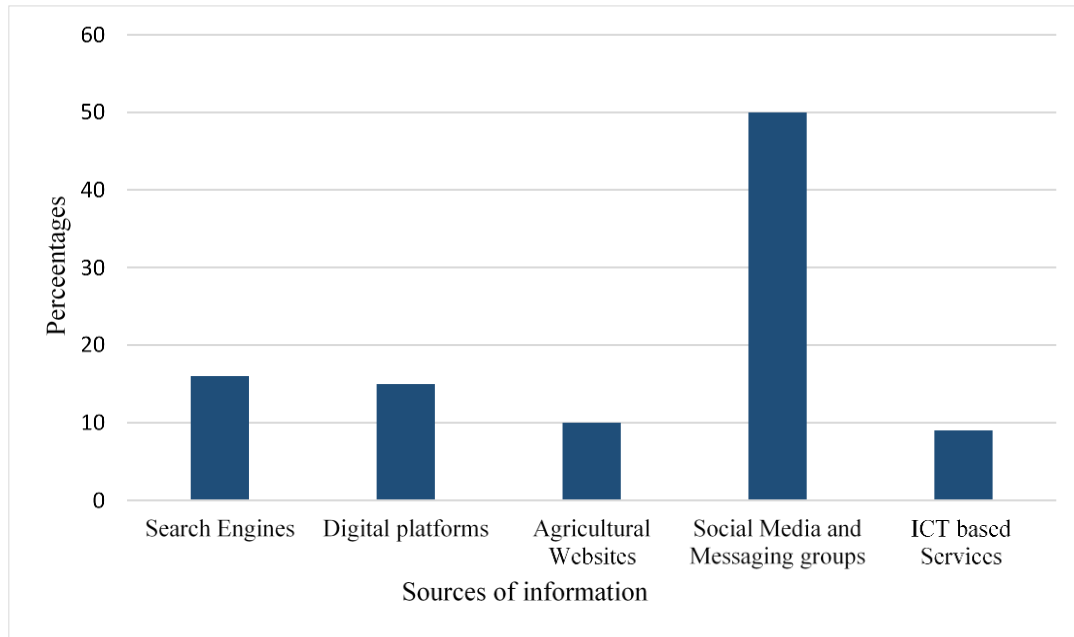


Figure 4. Contemporary Information Sources Source: Field Data, 2022.

Mugwisi *et al.* (2014) underscored social media's value in supporting both formal and informal learning. However, issues related to misinformation remained a concern. As Figueiredo *et al.* (2021) noted, the lack of quality control necessitates institutional mechanisms for verifying information. This is supported by Allcott *et al.* (2023) and Kim *et al.* (2018). Allcott *et al.* (2023) further advocated for ICT-based extension systems to reconcile the speed of digital communication with expert validation.

Search engines, notably Google, were valued for promoting self-directed learning among AEAs (Asenso-Okyere and Mekonnen, 2012), providing access to diverse agricultural content. This is also supported by the FGD-“Sourcing information from Google is okay for me since it helps me quickly find information to share with farmers”. Female participant FGD 6. Baumüller (2018) noted that digital platforms offered more targeted and interactive tools, including expert consultations and e-learning modules. Despite their potential, usage remained limited, primarily due to infrastructural and digital literacy challenges (Aker, 2011). Agricultural websites were recognised for delivering credible, expert-curated content from government and research institutions (Hilary *et al.*, 2017). However, low engagement levels were attributed to usability issues such as farmers' difficulty in adapting to and using the “obscure content, lack of local-language support, and low literacy and infrequent updates (Abdulai *et al.*, 2023; Ayim *et al.*, 2022), such as with Ghana's MoFA E-Agriculture platform. Dubois *et al.* (2024) cited internet access constraints, while Ayim *et al.* (2022) argued for

more user-friendly, mobile-optimised interfaces with content in local languages.

ICT-based services like SMS and IVR, though used by only 9% of AEAs, provided critical time-sensitive and localised information in low-internet areas (Aker and Ksoll, 2016; Mittal & Mehar, 2016). Initiatives by ESOKO, Farm Radio, and Amplio Ghana illustrated their practical applications. However, barriers such as cost, limited awareness, and preference for interactive platforms hindered broader adoption. Abdulai *et al.* (2023) recommended training programs to raise awareness and improve the adoption of ICT tools for effective decision-making.

Overall, while informal platforms such as social media are central to agricultural information dissemination, Nakasone *et al.* (2014) highlighted the importance of balancing them with structured, expert-driven content to mitigate misinformation risks. As David and Asamoah (2011) stressed, improving digital literacy is essential. Enhanced internet access and the usability of digital resources are necessary to realise the full potential of contemporary information platforms. Donovan (2017) and Timu *et al.* (2024) concluded that integrating flexible, accessible tools with high-quality content was key to advancing agricultural extension services. A sample of the popular social media sites is presented in Table 3.

Socio-economic factors affecting the use of social media among AEAs

Multinomial logistic regression (MNL) was used to determine the factors affecting the use of social media among AEAs in the Northern Region of Ghana. MNL is a

statistical method used to model relationships between a categorical dependent variable with three or more unordered outcomes and multiple independent variables, Anim-Dankwa et al. 65

Table 3. Some popular agricultural information platforms

Media page	Location/Country
Livestock Information and Marketing Centre (https://www.facebook.com/groups/Livestock.TN)	India
Mkulima Young (Young Farmer) (https://www.facebook.com/mkulima.young)	Kenya
Tumeric Farmers Association of India (https://facebook.com/tumeric.farmers)	India
Ghana Federation of Forestry and Farm Producers (GHAFaP) (https://ghaffap.org/)	Ghana
Global Forum for Rural Advisory Services (https://www.facebook.com/groups/gfras/)	Global
AgChat (https://twitter.com/agchat)	USA, UK & others
Agriculture Proud (https://twitter.com/AgProud)	USA
Young Farmers (https://twitter.com/F4YFkenya)	Kenya
USDA (https://twitter.com/USDA)	USA
e-Agriculture (https://twitter.com/e_agriculture)	Global
Ghana Association of farmers (https://web.facebook.com/groups/807558276293245/?_rdc=1&_rdr#)	Ghana
Complete Agriculture (https://www.youtube.com/channel/UC3OmAtvd-9AsBDEPlv9JeQQ)	Global
National e-agricultural web portal, Nigeria (http://www.eagriculture.gov.ng/eAgricPortal/)	Nigeria
General Agriculture (https://e-Agriculturte.gov.gh)	Ghana
General Agriculture (https://www.facebook.com/groups/161384865795754)	Ghana

Source: Adapted from Aliyu and Safiu (2017).

Table 4. Showing the results of the multinomial regression analysis (Base outcome category: versatile users).

Variables	Expert users	Novel users	Introvert users
Assigned farmers to AEAs	0.236 (0.135)*	0.513 (0.192)***	0.044 (0.192)
Training	0.245 (0.437)	-0.064 (0.719)	-0.828 (0.608)
Age(years)	0.051 (0.142)	-0.062 (0.256)	-0.140 (0.228)
Gender	-0.542 (0.557)	-1.206 (0.929)	1.093 (0.732)
Education	-0.633 (0.358)*	-0.845 (0.707)	-1.153 (0.583)**
Marital status	0.869 (0.648)	-0.751 (0.868)	2.027 (1.005)**
Experience	0.070 (0.377)	0.610 (0.639)	-0.414 (0.634)
Actual income	-0.058 (0.177)	-0.582 (0.280)**	-0.083 (0.241)
Member of the group	-0.654 (0.479)	1.040 (0.842)	-0.531 (0.770)
Wald chi2(27)			47.50
Prob > chi2			0.0087

Source: Field data, 2022. ***p<0.01, **p<0.05, * p<0.1.

which may be categorical or continuous (Liang *et al.*, 2020). Unlike binary logistic regression, MNL is suited for predicting outcomes where categories have no natural order, such as political preference, brand choice, or technology use. The model estimates the log odds of each outcome relative to a chosen baseline category, producing separate regression coefficients for each non-reference category. Its primary purpose is to assess how various factors influence the likelihood of different categorical choices, making it valuable in fields like social science, economics, marketing, and health research.

Table 4 presents an MNL analysis of socio-economic factors affecting social media use among agricultural extension agents (AEAs). For a reference point, we used

social media users' versatile, expert, novel, and introvert behavioural categorisations. The versatile users were the reference category and compared to expert, novice, and introvert users. The model shows a Wald chi-square value of 47.5 with a p-value of 0.0087, indicating a statistically significant fit at the 1% level.

In this study, Farmers assigned to an AEA significantly increased the likelihood of being a novel user ($\beta = 0.513$, $p < 0.01$). They marginally increased the likelihood of being an expert user ($\beta = 0.236$, $p < 0.1$), compared to versatile users. The influence of actual farmers on the adoption of social media in agricultural extension services is well-documented. According to Ugwoezuonu and Obodoechi (2024), Kumar Ghosh *et al.* (2021), and Shanmuka *et al.*

(2022), farmers play a pivotal role in shaping the engagement behaviours of both expert and novice users. Their studies indicate that an increase in farmer participation on social media platforms positively correlates with the likelihood of extension officers utilising these tools. This influence is particularly significant among
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expert and novice users, while its effect on versatile users is comparatively less pronounced. Education was also found to be a significant negative predictor for both expert users ($\beta = -1.153$, $p < 0.1$) and introvert users ($\beta = 0.633$, $p < 0.05$), indicating that those with higher education levels are less likely to fall into these categories relative to versatile users. Alhassan *et al.* (2022) and Olatunji *et al.* (2023) found that higher education levels among extension officers enhance the likelihood of social media use across user categories—including experts, novices, and introverts—though the degree of impact varies, warranting further investigation. This is because it is quite against the norm.

Marital status significantly increases the probability of being an introvert user ($\beta = 2.027$, $p < 0.05$). This agrees with Olaitan *et al.* (2017) and Yakubu *et al.* (2023), who found that marital status significantly affects social media use among agricultural professionals, with married individuals more likely to engage as expert or introvert users, but less likely as novice users. However, Chen *et al.* (2022) found that marital status had no significant impact on the relationship between Internet use and measures of social capital. In addition, actual monthly income significantly decreased the likelihood of being a novel user ($\beta = -0.582$, $p < 0.05$), suggesting lower-income AEAs were more likely to be novel users. This is supported by a statement from the FGD- “*When you don't have enough money, it is always difficult to buy data credit to browse the internet on your phone. Also, the effective smartphones are always costly*”. Male participant FGD 4.

Contrary to the present finding, Olaitan *et al.* (2017) reported a significant positive relationship between monthly income and social media use among agricultural extension workers in Kwara State, Nigeria. Similarly, Kim *et al.* (2022) found that increased income enhances the adoption of digital tools, suggesting that higher-income extension officers are more likely to use social media due to greater access to resources. These contrasting results highlight the complex nature of the income–technology adoption relationship.

Other variables, such as training, age, gender, experience, and group membership, did not show a significant effect, contrary to our a-priori expectations. That implied that though these factors influence the adoption of agricultural technologies among farmers, they did not influence social media usage among AEAs in the Northern Region of Ghana (Lamptey, 2022).

Conclusions and Recommendations

Social media are electronic communication tools that allow users to interact, create, share, retrieve, and exchange information and ideas in any form that can be discussed, archived, and used by virtual communities and networks. Use of social media by extension workers in agriculture is not a new concept. However, the extent of use and the socio-economic factors affecting usage were the subject of

the study. The understanding, perceiving, and using social media as a valuable tool rather than a time-wasting application are important to maximise its potential for more extension workers to improve agricultural productivity. The study indicated that the popular traditional sources for agricultural information for AEAs were training, farm visits, and extension publications. In contrast, the contemporary sources included social media and networking applications, search engines, and digital platforms. The outcome of this study shows that the number of farmers assigned to an AEA, education, marital status, and annual income significantly influenced the use of social media positively or negatively among the AEAs in the study area.

To ensure effective use of social media among agricultural extension workers in the northern region of Ghana, the study recommends that the Ministry of Food and Agriculture (MoFA) consider including SM use in its ICT policies to benefit agricultural extension workers. Also, MoFA, Non-governmental organisations, and private commercial entities should institute measures that ensure that AEAs are officially supported to use SM for their work, since it is useful. Additionally, the study recommends that the Department of Agriculture institute capacity building for AEAs through regular in-service training focusing on social media to improve their understanding and adoption of the tools effectively to maximise the benefits of SM. There is therefore a need to link social media to agricultural extension service delivery in the region. Finally, the study recommends policy measures including digital capacity-building, improved internet infrastructure, and integrating digital and conventional communication tools. These interventions are essential for enhancing agricultural extension effectiveness and boosting regional productivity.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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