The effect of Information Technology (IT) on household income among farmers in Ghana: How does access to financial services serve as a mediator

Anthony Siaw*, Martinson Ankrah Twumasi*, Evan Ntiamoah Brako*, Edmond Yeboah Nyamah**, Yuansheng Jiang*

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Abstract

In emerging countries, information technology (IT) and access to financial services (AFS) are critical determinants determining household income. However, little is known about how IT and AFS work together to increase home wellbeing. This research aims to look into the influence of access to financial services in mediating the impact of IT on household income in Ghana. The study investigates the role of social networks as a moderator in the IT-AFS interaction. A multi-stage sampling strategy was used to collect data from 478 farmers for this study. The study discovered that having access to technology and financial services increases household income. Due to the mediation role of access to financial services, the positive impact of access to IT on household income was also proven. The variable, social network, influenced these mechanisms. This research shows how having access to technology and financial inclusion can help people get out of poverty. This work adds to the body of knowledge. The paper includes policies for ensuring IT and AFS development to improve the welfare of rural households.

Keywords*: Information technology, Access to financial services, Household income, Ghana.*

1. Introduction

Scholars have proposed that prioritizing poverty alleviation, an enhancer of household welfare, is essential for the growth of an economy (Atkinson, 2017; Wang and He, 2020). Thus, increasing household income positively affects the growth of the economy. For example, a household with high income may increase their demand for goods and services, leading to a rise in the profit share of suppliers (companies), all other things being equal, which has a tremendous positive impact on those companies' expansion such as the creation of employment opportunities which results in economic growth. Similarly, increasing household income positively affects the welfare of most households through a rise in per capita income (van den Berg, 2010; Kikulwe *et al.*, 2014). For instance, relat-

* College of Economics, Sichuan Agricultural University - Chengdu Campus, China.
** Department of Marketing and Supply Chain Management, School of Business, University of Cape Coast, Cape Coast, Ghana.
Corresponding author: yjiang@sicau.edu.cn

ed household welfare indicators, including good health condition, educational investment, risk management, and entrepreneurial enhancement, become attainable if the household is financially sound (Churchill and Marisetty, 2019; Fawole and Ozkan, 2018; Koomson and Danquah, 2021). Churchill and Marisetty (2019) showed that people who are financially included are more likely to start a small-scale business on their own to improve household livelihood. This means that enhancing factors (e.g., financial inclusion and access to IT) that can help improve household income is essential, especially for rural dwellers, mostly farmers.

Due to their incapacity of gaining knowledge, farmers are mostly prevented from adopting advanced farming methods (e.g., improved seeds, fertilizers, and pesticides). The challenge of inadequate information again restricts farmers from improving their sales through relatively higher prices, which hampers farm households' welfare and agriculture development (Ben Hassen and El Bilali, 2021; Ma and Wang, 2020; Zheng and Ma, 2021). Access to information technologies (such as mobile terminals, the Internet, radios, and television) can provide services that can help farmers adopt advanced technologies, increase their investment in farming inputs, and make the best sales decisions, resulting in increased farm income through improved production and marketing performance (Gaiani, 2008; Hudson *et al.*, 2017; Siaw *et al.*, 2020). Information regarding job offers and other investment opportunities is also secured through IT accessibility (Leng *et al.*, 2020). This means that off-farm jobs, a household income booster, are obtained when IT services are accessible. The study claims in this remark that having access to technology has a direct impact on household income.

This study examines the mechanism underpinning the IT-household income relationship. First, access to IT is considered a channel for information acquisition, including financial skills and knowledge information, enabling individuals to overcome some barriers that prohibit them from using financial services and products. People's ability to participate in the financial market improves when they have access to knowledge about financial services (Ankrah Twumasi *et al.*, 2022). Following the above discussion, the relevant question underlying the theoretical underpinning is how can IT vis-à-vis access to financial services improve farmers' income? The foundations are based on the intuition that the IT users may be likely to increase their financial services accessibility; hence, impacting their income. This assumption is consistent with the intensive and extensive margin theories. Therefore, the study examines the mechanism in the IT-household income relationship captured by the mediating role of AFS. Second, people are mostly convinced to partake in financial services when they have friends and relatives operating in the financial market. It is believed that precautional measures are important for individuals when patronizing the financial market to prevent wrong financial decision (Ankrah Twumasi *et al.*, 2022; Bucher-Koenen *et al.*, 2017). On the other hand, people gain confidence to participate in the financial market if they know a professional or have a connection to someone in the financial market. As a result, the author investigates the moderating influence of social networks in the IT-AFS relationship (if a farmer has a connection with a financial institution official).

Against this backdrop, this current study makes some contributions. First, the study enlarges studies on the effect of IT on household wealth development by considering a nation from Sub-Sahara Africa (SSA), Ghana, which will help widen the understanding of the role of IT in household development in SSA, since most countries within the region have similar economic and social setting. Most studies on IT-income relationships are found in Asia and other few developing (less focus on SSA). Finally, the research is the first of its sort. There has never been a study that looks into the influence of AFS in mediating the effect of IT on household income, particularly in a developing country in SSA.

2. Analytical framework and hypothesis development

2.1. *The impact of Information Technology (IT) on income*

Many developing countries have benefited from the introduction of information technology (Briggeman and Whitacre, 2010; Aker, 2011;

Castellacci and Viñas-Bardolet, 2019). In this study, the researcher analyzed the impact of IT on total household incomes. Firstly, the study argued that IT directly impacts income (Garrity, 2016; Zou *et al.*, 2021). With the use of technology, income limits created by financial exclusion can be alleviated. Thanks to information technology, information on household remittances, loans, financial operations, and other topics could become simple and convenient. Secondly, the study established that IT could decrease transaction costs (e.g., information acquisition, negotiation, enforcement, and cost). Small-scale businesses can be created with these unused funds through the reduction of transaction costs (Ahmed *et al.*, 2021).

Namonje-Kapembwa *et al.* (2019) and Lokanathan and de Silva (2012) showed that high transaction costs limit individuals' ability to improve their income. The third path shows that IT can enhance financial skills and knowledge. As people acquire financial information and managerial skills through financial education, they become confident to participate in the financial market to create wealth (Ankrah Twumasi *et al.*, 2021a; Riebe, 2021; Khan and Surisetti, 2021). Finally, the study showed that IT provides business/market information. The ability to acquire market information about how, where, when and what to patronize in the market or business segments can positively affect household income (Kisielnicki and Markowski, 2021).

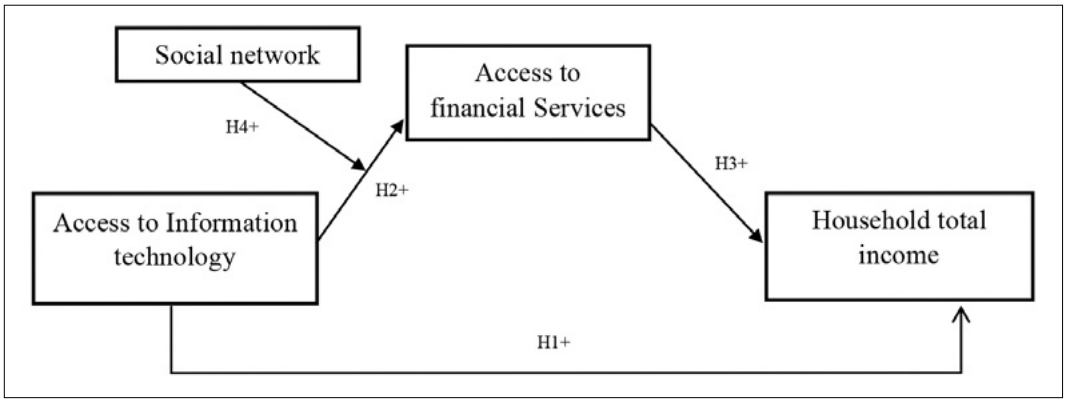
From the above, the study can presume that household income is more likely to improve positively when rural dwellers have access to IT. For example, farm income could improve through the adoption of new technology, new marketplace, new seed in the system, and purchase of other new required farming inputs. Tamayo and Pineda (2017) underlined that farm productivity is likely to arise when technological development occurs. Second, IT is anticipated to improve meaningful information about agricultural technology adoption as well as financial and agricultural markets (Waaswa *et al.*, 2022; Van Niekerk and Phaladi, 2021; Karrer and Barjolle, 2012). The Internet, TV, radio, and mobile terminals can be used to reduce the cost of obtaining market information linked with a high transaction cost (Ahmed *et al.*, 2021; Kalenzi and Kwon, 2018). Access to IT can help to improve business capabilities and job creation, which would enhance household income, all things being equal. Below is the hypothesis the author proposed for this section:

H1: IT positively impacts household income.

2.2. *Access to financial services plays a mediating influence*

In many countries, access to financial services has been seen as a critical component of poverty reduction efforts. Financial services usage in Ghana is hampered by a lack of access to financial services as well as a lack of financial knowledge and skills. Access to IT is a determinant for AFS; thus, it is considered a channel to promote household access to financial services (AFS). Studies (e.g., Andoh *et al.*, 2015; Ankrah Twumasi *et al.*, 2022; Thomas and Spataro, 2018) have shown that many individuals are reframing from formal financial services because of poor financial knowledge and skills. However, the information needed to enhance financial education is now available on the radio, television programs, and the Internet. Many consumers use mobile short messaging services (SMS), hotline services, brief video messages, and mobile banking services to get financial information. With these scenarios, the author argues that access to IT can help people access and use financial services. Using and accessing financial services may also positively impact household income growth. Access to financial services has been considered a vital tool to alleviate poverty to ensure smooth consumption, implying that it is an income enhancer. For instance, Ankrah Twumasi *et al.* (2020b) and Ouattara *et al*. (2020) acknowledged that with access to credit and savings mobilization, individuals could boost their income by having access to financial services. According to Lin *et al.* (2019) and Sekyi *et al.* (2020), the inputs required for agricultural production growth can be purchased if farmers can utilize financial services such as credit. Mobilized savings, bond, and fixed deposit investments promote wealth growth and can also provide people with a source of income in the

Figure 1 - Conceptual model.



form of dividends and profits. AFS directly affects household income, according to the mechanism by which it affects household income. This study concluded that while IT accessibility directly impacts household income, access to and proper usage of financial services, which is influenced by IT, also helps boost household income. Therefore, the author proposed a hypothesis for this section:

H2: Access to financial services will mediate the positive impact of IT accessibility and household income.

2.3. *The social network's moderating role*

This study contends that IT accessibility directly impacts AFS; nonetheless, it is vital to highlight that most people will become interested in patronizing AFS after being persuaded by relatives or friends who have experience in the financial sector. We used the term social network to refer to knowing someone who works at a financial institution (a relative or a friend) (FI). Ankrah Twumasi *et al.* (2020a) used social network as a determinant of access to credit and found that social network has a favorable and significant impact on households' access to credit in the financial sector. When a person develops a relationship with a financial institution official, he or she gains more trust and confidence in using financial services and products, meaning that farmers who know FI officials are more likely to participate in the financial market. In practice, these officials may provide their partners with precise information that will help them understand financial services users considerably better. Furthermore, there are several fraud cases in Ghana's financial market, which discourages people from engaging in the market; the social network might be a helpful method for bolstering users' confidence and trust in financial services. As a result, social networks can have a significant impact on the IT-AFS interaction. A theory is proposed on this note:

H3: Social networks will moderate the positive impact of IT accessibility on AFS such that the relationship is more substantial when social networks are high.

However, the study offered the following hypothesis to portray the mediation effects' connection to the moderating effects of social networks:

H4: The favorable impact of IT accessibility on household income is moderated by social networks through AFS, with the connection being stronger when social networks are high.

3. Methodology and data source

3.1. *Method of data collection and sampling techniques*

A multi-stage sampling strategy was used to collect data from 478 farmers for this study. The two (2) regions chosen in the first stage were the Eastern region in southeastern Ghana and the Brong Ahafo region in central Ghana. In the second stage, one district from each designated region was picked. Kintampo north district in

the Brong Ahafo region and Brim central district in the Eastern region were among them. Kintampo, Babatokuma, and Benkrom in the Kintampo North District and Manso, Asuboa, and Nkwanta in the Brim Central District were the three (3) settlements chosen conveniently from each designated district in the third stage. Finally, the respondents were conveniently recruited to serve as the research sample. A total of 20-30 rural households were chosen.

Interviews and questionnaires were used to collect data from these rural farm households in Ghana. Due to the questionnaire's complexity, an in-depth interview was undertaken. A pre-test of the questionnaire was conducted to eliminate any doubts. The survey data questionnaires included questions about socioeconomic characteristics, Internet use, and other variables relevant to the study's goal. SPSS 26 was used for the descriptive and regression analysis. The PROCESS macro model 3.4.1 was used to test the study's hypotheses (Hayes, 2018a). This allows for simultaneous examination of the direct mediation and moderation hypotheses in a single model.

3.2. *Key variables selection and definition*

Here AFS means the number of financial services (savings, credit, and insurance) accessed by the farmer. As a result, it varies from 0 (lowest) to 3 (highest). Because of the model (PROCESS-macro) employed in assessing the study's results, the author used the number of AFS accessible by the respondents. PROCESS-macro does not respond when the mediating variable is a dummy. Here, insurance in the AFS variable includes crop/weather index insurance and insurance of household physical assets such as cars, gold, and farm equipment. Also, access to IT was measured as the number of IT products used by the farmer. Since our study captured only mobile, Internet, radio, and television use, the measurement ranged from 0 to 4. Thus, a farmer who uses all the four IT products listed is given the highest score of 4. A combination of off-farm and farm income is used to calculate household income. Wages/salaries, rent, remittances, pensions, and dividends are all examples of off-farm income. Other variables (e.g., age, gender, education, farming experience, distance from farmers' residence to the nearest financial institution, financial literacy, and household size) were added as control variables after following other literature (e.g., Ankrah Twumasi *et al.*, 2021a; Ma *et al.*, 2020; Siaw *et al.*, 2020) and our available data (see Table 8.1 for the definition of the other control variables). Also, see Table A1 in the Appendix to see how financial literacy was measured.

4. Results and discussions

4.1. *Descriptive analysis*

The respondents' descriptive data are presented in Table 1 below. According to the findings, the average number of IT products utilized by respondents is 1.52, while the average number of financial services accessed by respondents is 1.48. Ghc4490 was the average yearly farm income and household income per capita. The responders' average age was around 42 years old. The majority of the households had an average of five individuals. While 70% of the respondents were men, just 42% had completed high school or had completed some form of higher education. Furthermore, 71% of the participants are married, and 44% of the respondents are members of a professional association. In addition, the average distance between respondents' dwellings and the nearest financial institution is 1.34 kilometres. On average, 13.65 percent of farmers have prior farming experience. Meanwhile, the respondents' average agricultural experience was 14 years, and their average farm size was 3.34 acres. 54% and 46% of the respondents are from Brong Ahafo and the Eastern region, respectively.

4.2. *Empirical analysis*

4.2.1. *The mediation path model test*

Observed variables were chosen above latent variables when evaluating the study's hypotheses, leading to the usage of the PROCESS-macro model. Tables 2 and 3 illustrate the results of regressing the mediator and outcome variables

Table 1 - The variables in the model's definitions and data descriptions.

Variables	*Description*	*Mean*	*S.D*
Focal variables			
Access to IT	Number of IT products accessed	1.52	0.95
Access to financial services	Number of financial services accessed	1.48	0.97
Household income	Amount of total household income (GH₵1000/capita)	4.49	2.76
Control variables			
Gender	1 if respondent is a male; 0 otherwise	0.70	0.46
Marital status	1 if respondent is a married; 0 otherwise	0.71	0.53
Age	Respondent age (numbers)	41.72	12.20
Education	1 if the respondent had a high school education or above; 0 otherwise	0.42	0.49
Household size	Number of members in a household(number)	5.36	1.30
Farm size	Respondent farm size (in acres)	3.34	1.87
Farm experience	Years of farming experience (years)	13.65	7.84
Farm Member Association	1 if respondent is a member of farm association; 0 otherwise	0.44	0.50
Financial literacy	1 if the respondent if financial literate; 0 otherwise	0.74	0.44
Distance	The distance from the respondent house to the nearest financial institution	1.34	0.47
Eastern	1 if respondent resides in Eastern region; 0 otherwise	0.46	0.51
Brong Ahafo (BA)	1 if respondent resides in BA region; 0 otherwise	0.54	0.49

on the control factors. Table 2 depicts the basic mediation model, whereas Table 3 depicts a moderated mediation model that incorporates the role of the social network as a moderator. The AFS-based mediation model illustrates the direct and indirect effects of IT accessibility on household income. The data in Table 2 support the study's initial hypothesis (H1). As a result, the data imply that having access to information technology has a good impact on household income; hence, the two variables have a significant and positive relationship. Similarly, AFS mediates the positive relationship between FL and household income, implying that the study's second hypothesis (H2) is correct. The indirect impact of the mediator is positive (0.140) and has a respectable range, as shown in Table 4, with 95 percent Bias-corrected confidence intervals ((BC CI) = [lower = 0.117, higher = 0.221]). A total of 5000 bootstrap samples were used to calculate the BC CI.

4.2.2. *Test of the moderated mediation path model*

Table 3 shows the estimation result of the moderated mediation path model. In this estimation, the social network variable has been added as a moderator. The AFS variable was predicted using an interaction term between access to IT and social networks. The interacting variables of access to IT and social networks are focused on before being interacted. The rest of the model's specification is identical to that of the mediation model. According to the findings, the study's third hypothesis (H3) is supported in this section. That is, how the AFS variable is affected by the interaction between social networks and access to IT is statistically significant (coefficient = 0.113). The simple slope tests are positive and significant for farmers who have their social network higher (simple slope = 0.408, $p < 0.01$) and those who have their social network lower (simple slope = 0.134, $p < 0.01$). Farmers with a

Table 2 - The mediation path model estimates (Model 1).

Variables	*AFS*	*Household income*
Control variables		
Gender	-0.091 (0.136)	-0.081 (0.128)
Age	-0.003 (0.015)	0.011 (0.048)
Education	0.127 (0.058)*	0.177 (0.027)***
Marital status	0.068 (0.147)	0.033 (0.026)
Household size	-0.074 (0.052)	0.051 (0.041)
Farm size	0.075 (0.019)***	0.331 (0.023)***
Farm experience	-0.011 (0.011)	0.180 (0.072)*
Farm Member Association	0.145 (0.149)	0.231 (0.079)***
Financial literacy	0.406 (0.185)*	0.082 (0.174)
Distance	0.241 (0.038)***	0.239 (0.112)*
Eastern	0.043 (0.013)**	0.067 (0.029)*
Independent variable		
Access to IT	0.427 (0.149)**	0.481 (0.162)**
Mediator		
AFS		1.369 (0.175) ***
R^2	0.147	0.318
Regional dummies	Yes	Yes

*Source: Survey results, 2020. Asterisks *. ** and *** represent significant levels at 10%, 5% and 1% respectively. Standard errors are in parentheses. The reference region = Brong Ahafo.*

Table 3 - Estimates from the moderated mediation path model (standard error).

Variables	*AFS*	*Household income*
Control variables		
Gender	-0.094 (0.136)	-0.079 (0.128)
Age	-0.003 (0.015)	0.013 (0.048)
Education	0.130 (0.058)*	0.175 (0.026)***
Marital status	0.067 (0.147)	0.033 (0.026)
Household size	-0.076 (0.052)	0.055 (0.040)
Farm size	0.075 (0.019)***	0.328 (0.023)***
Farm experience	-0.011 (0.011)	0.180 (0.072)*
Farm Member Association	0.142 (0.149)	0.231 (0.079)***
Financial literacy	0.406 (0.185)*	0.082 (0.174)
Distance	0.243 (0.038)***	0.237 (0.112)*
Eastern	0.040 (0.013)**	0.064 (0.029)*
Independent variable		
Access to IT	0.429 (0.148)**	0.481 (0.162)**
Mediator		
AFS		1.369 (0.175) ***
Moderating effects		
Social network	0.106 (0.051)*	
Access to IT × Social network	0.113 (0.046)**	
R^2	0.178	0.525
Regional dummies	Yes	Yes

Source: 2020 survey findings. Asterisks, **, and *** indicate significant levels of 10%, 5%, and 1% are indicated by asterisks *, **, and ***, respectively. In parenthesis, you'll see standard mistakes. The reference region = Brong Ahafo.*

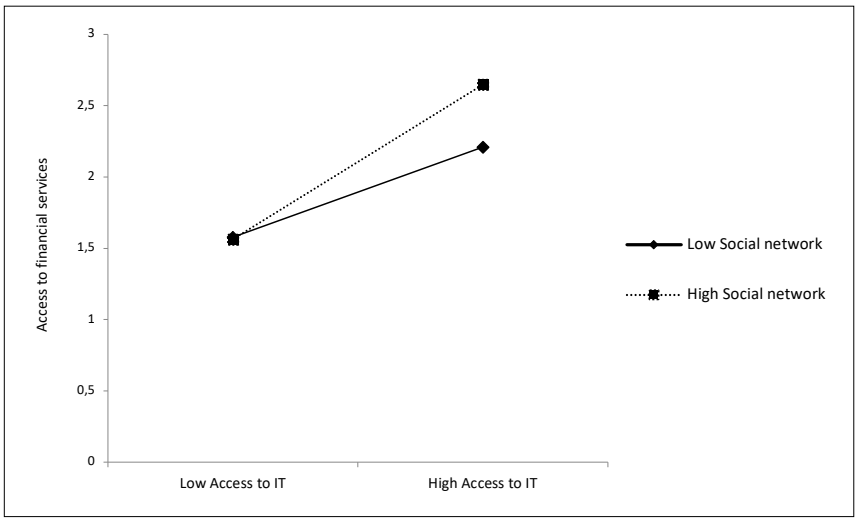


Figure 2 - Access to financial services is influenced by the combination of IT and social networks.

high social network slope have a larger magnitude than their peers with a low social network.

To shed further light on the interaction patterns, Figure 2 revealed the access to IT and AFS association at high and low social network values, which are defined as one standard deviation above and below the mean value, respectively (Greenberg and Shelah, 2014). The plotted graph (Figure 2) confirms the study's fourth hypothesis (H4). According to Table 4, AFS impact of the product term of the interaction effect between the access to IT and social network and the direct effect between access to IT and AFS is statistically significant (the moderated mediation index (index = 0.071, $p < 0.05$)). The moderated mediation index result again confirms the study's fourth hypothesis (H4) (Hayes, 2018b). In addition, both farmers who secured higher and lower social networking recorded a significant conditional indirect impact; thus. (coefficient = 0.109 and the 95 percent BC CI = [lower = 0.060, higher = 0.164]) for high social network and for low social network network (coefficient = 0.046, and the 95 percent BC CI is [lower = 0.032, higher = 0.119])

5. Discussions

The major goal of this study was to investigate the impact of access to information technology on household income in two Ghanaian regions, using the mediating function of access to financial services and the moderating role of social networks. After establishing a theoretical model depicting the mechanism; thus, information technology → financial services accessibility → household income, the study recorded the following outcomes, 1) IT accessibility improved

Table 4 - The outcomes of the mediation and moderated mediation effects (standard error).

Variables	*Indirect effects (SE)*	*95% BC CI*	
Mediation effect		Lower Boundary	Upper Boundary
Access to IT ➔ AFS ➔ Household income	0.140 (0.056)	0.117	0.221
Moderated Mediation effect Access to IT ➔ AFS ➔ Household income			
Index of the moderated mediation	0.071 (0.035)	0.036	0.173
Social network (Low)	0.046 (0.018)	0.032	0.119
Social network (High)	0.109 (0.043)	0.060	0.164

Source: Survey results, 2020. Robust standard errors are in parentheses.

household income; 2) access to financial services plays a significant mediating role in how access to IT impacts household income; 3) the direct positive link between IT accessibility and access to financial services, as well as the positive indirect effect of IT access on household income, is moderated by social networks. As a result, the association between access to information technology and household income is confirmed to be positive. The findings of this study contribute to a better understanding of the function of financial services in mediating the influence of IT on household income, as well as how social networks could regulate this link to increase IT users' financial services patronage.

Based on the fact that access to IT has a major impact on household income, it is logical to assume that as farmers get more familiar with IT products and services, their household income will improve. Some possible reasons could be attributed to this finding. First, IT can enhance financial skills and knowledge through financial information gained online; hence, enhancing their confidence to patronize profitable but risky investment to create wealth (Ankrah Twumasi *et al.*, 2021b). Second, information technology can provide information on household remittances, loans acquisition, financial operations, and many others, which serve as income booster; therefore, improving household income (Ahmed *et al.*, 2021).

The findings also revealed that access to financial services, on the other hand, positively mediates the positive effect of access to IT and household income. This emphasizes the prospect that households with access to IT will be able to take advantage of positive incentives gained from online financial information to enjoy digital and traditional financial services. Gaining skills and knowledge to access financial services online (digital finance) is a motivation tool to patronize the financial market. When this happened, income is positively affected if the householder is efficient in the financial market. The findings of this study are consistent with prior research findings that show that a greater comprehension of financial information increases an individual's propensity to utilize the financial market, which has a favorable impact on household wellbeing (Andoh *et al.*, 2015; Churchill and Marisetty, 2019; Kim *et al.*, 2018; Kumari and Ferdous Azam, 2019; Thomas and Spataro, 2018; Xu *et al.*, 2019). This study also observed that the positive link between the study variables is moderated by social networks. In a developing country like Ghana, rising unemployment and the failure of many financial institutions as a result of the central bank's decision to strengthen the banking sector (Owusu-Antwi, 2011) have influenced people's lack of trust and confidence in financial products. Furthermore, research has indicated that social networks can lower the likelihood of rural residents having access to financial services limits, such as credit application denial and rationing (Ankrah Twumasi, 2020; Chandio and Jiang, 2018). According to this study, social networks can be used to improve individual financial service patronage. Given the findings from this study, a substantive number of policy recommendations are put in place to benefit policymakers who are geared at enhancing rural farmers' households' income through IT and financial inclusion development.

6. Conclusion and policy implications

Using household survey data from two separate locations, this study looked at how access to financial services functions as a mediator between access to IT and household income. There is a wealth of information available to help rural families thrive and enhance their wellbeing, but this study adds to it by emphasizing the relevance of IT access as a critical factor in the development of the financial market and household welfare. The research leads to the following three primary conclusions based on the aforesaid analysis.

The study discovered that having access to technology and financial services increases household income. Due to the mediation role of access to financial services, the positive impact of access to IT on household income was also proven. The variable, social network, influenced these mechanisms. This research shows how having access to technology, and financial inclusion can help people get out of poverty.

This research has a number of policy implications that can help design better methods for

improving the living conditions of rural people in Ghana and other developing nations. First, it was discovered that policies boosting IT access and financial inclusion should be prioritized. As a result, policymakers should design policies aimed at improving ICT infrastructure to serve as a channel where individual households can acquire information, including production, marketing, and financial information, to enhance their welfare. For example, interested parties such as the government, non-profit groups, and legislators should establish information technology centers for rural communities.

Second, the results showing that access to financial services plays a significant mediating role in how access to IT impacts household income, suggest that microfinance initiatives in rural regions should be considered since access to information technology, and financial services can help enhance household incomes. Example; national government can easy the entrance assessment of commencing financial institutions in rural areas to encourage investors to open financial companies to help rural dwellers.

Third, it's critical to claim that having a wide social network (moderating variable) plays a role in the relationship between IT access and financial services, as well as between IT access and household income. These findings suggest that rural citizens should develop strong ties with financial institution executives and boards in order to learn more about financial services and become more active participants in the economy's financial market.

The impact of access to IT on household income was assessed using a mediation effect model with access to financial services as the mediator and social networks as the moderators. The mediation effect model describes the process through which many factors interact, allowing all hypotheses to be tested in one model.

Readers and other researchers should be informed, however, that this work has some limitations. Due to funding constraints, the research was limited to rural areas in two (2) of Ghana's ten (10) regions. Future research could focus their efforts on more than two locations, or even the entire country. Second, the mediating variable, access to financial services, was quantified using three financial services categories: transaction service (savings), credit service (access to credit), and insurance. Financial services, on the other hand, cut over all three groups. More research can be done to develop more sophisticated scales or indices to measure financial service usage. Finally, the size of the household's income was given as an outcome variable. However, access to financial services has a stronger mediation role in the effect of access to IT on household well-being when household welfare (which includes household expenditure, income, and other family goods) is considered rather than just household income. As a result, future research should focus on diverse methods of measuring household welfare. Finally, the study acknowledges that information technology access and financial services access are inversely associated, which has significant implications for the findings. While the study found that having access to IT has a direct impact on having access to financial services, having access to financial services can also have an impact on having access to IT. As a result, care should be taken when interpreting the study's findings. Despite these limitations, the study's review is not expected to be biased in any way.

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Appendix

Table A1 - Financial literacy questions.

Questions	*Answers*
Supposed you had GHc 100 in your account with a 2% annual interest. After five years, how much will you have in this account if you leave your money to gain interest? (Interest rate)	a) More than GHc 102 b) Exactly GHc102 c) Less than GHc102
Your savings account has a 1% annual interest and the annual inflation is 2%. After a year will you be able to buy more than today using the money saved in this account? (Inflation)	a) Yes b) No
A second-hand farm machinery is more expensive to insure than a brand new one? (Insurance)	a) True b) False

Source: Lusardi and Mitchell, 2008; Xu et al., 2019.
Note: the score of the financial literacy ranges from 0-3. Using the median score as a breakeven point, we divided the respondents into financially literate (above the median) and illiterate (below the median).