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The Effect of ICT Use on the Profitability of Young Agripreneurs in Malawi

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Abstract: The agricultural sector's significant position in an economy and high potential benefits of agricultural transformation give developing countries major opportunities, especially for youth, to commercially start an agricultural enterprise. Increasing youth engagement in agriculture is fundamental for sustainably transforming agriculture and reducing youth unemployment. In achieving this, information and communication technologies hold great potential. Harnessing youth agribusiness opportunities through the use of ICT and its innovations are key to increasing profitability and providing employment. The study assesses the effect of the intensity of ICT use on profit using data collected from 317 young agripreneurs and an ordered logit model. The results show that profitability increases with the number of ICT tools used to receive and disseminate information relevant to agribusinesses. Therefore, relevant stakeholders should strive towards the implementation of programs that increase the number of ICT tools that can be used in agribusinesses.

Keywords: agribusiness; ICT; profit; Malawi; youth

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1. Introduction

The increase in digital transformation across the world has changed the way information is shared and the speed of communication. Despite being traditional sources of information, "the radio, TV, print, and video" are still relevant communication channels, while the modern sources such as emails, websites, computers, tablets, mobile phones, SMS, and social media are also becoming commonly applicable and used in African Agriculture [1].

The arrival of modern information and communication technologies (ICTs), especially mobile phone technology and the internet, has had a tremendous impact on communication in terms of speed and how it is conducted [1]. In Africa, ICTs have conventionally been "based on indigenous forms of storytelling, song, and theatre, print media, and radio". This is particularly also true in Malawi where theatre on radios and TV play a huge role in relaying different information to the public including agriculture. Indeed ICT has also reduced the cost of accessing information and new knowledge and has been creating many new opportunities in different sectors of African economies, including agriculture [2]. Apart from the traditional media, such as radio, TV, print, and video, modern ICT devices and applications used in agriculture include computers, tablets, mobile phones, satellites, office software, short messaging services (SMS), social media, geographical information systems (GIS), and drones the use of which is being explored in some African countries, such as Ghana [3]. Not all forms of ICTs are yet fully applicable to agriculture in the African context. Some are more relevant than others based on factors like cost, accessibility, applicability, and user profile [3].

ICTs provide record-keeping tools, enable the promotion of agriculture among the youth and help create virtual markets for agricultural products. Adegbidi, Mensah, Vidogbena, and Agossou [4] reveal that 41% of rice farmers in Benin use mobile phones for

sharing and accessing information. Sangingi [5] also demonstrates that in Kenya, the use of the mobile phone application called Icow increased milk production by 56%, incomes by 40%, and influenced the increase in subscription rates to the agricultural market information application mFarm by over 7000 farmers. Wossen et al. [6] establish that the Nigerian e-voucher based input subsidy program improved productivity and welfare outcomes of smallholders.

In Malawi, the agricultural sector employs 80% of the total labor force and contributes one-third of the total GDP [7]. However, it can be argued that the youth are not utilizing this employment opportunity in agriculture as youth unemployment is at 23% which is higher than the national unemployment rate of 21% [8].

World Bank estimates show that 87% of the world youth population (age 15–24 years), numbering over 1.2 billion live in developing countries. In Sub-Sahara Africa, youth comprises 20% of the total population. In Malawi, youth (age 15–34; as per National Youth Policy of Malawi [9]) comprises 34.4% of the total population. The lack of engagement in agriculture by the youth is further evident at the continent level. Maiga, Christiaensen, and Palacios-Lopez [10] estimated youth participation rates in agricultural labor using data from six countries; Ethiopia, Malawi, Niger, Nigeria, Tanzania, and Uganda, and found participation rates of 27.1% (in Nigeria) to 63.4% (in Niger). The average probability of youth working in agriculture across the six countries was at 50.6%.

Statistics from International Telecommunications Unit show that the youth are at the forefront in the adoption of ICTs. The International Telecommunications Unit (2017) reports that worldwide, in 104 countries, more than 80% of the youth population are online, while in developed countries, 94% of young people aged 15–24 use the internet compared with 67% in developing countries and only 30% in the least developed countries. Out of the online young people, 39% are in China and India while nearly 9 out of 10 young individuals not using the internet live in Africa or Asia and the Pacific [11]. Whilst in Africa, 39.3% of the total population uses the internet compared to 58.8% worldwide. However, internet use differs a lot across Africa and is more intriguing (Figure 1); and Malawi stands at the lowest level as compared to the neighboring countries with only 14% of the population using the internet, compared to 85% in Kenya, 52% in Zambia, 38% in Tanzania and 20% in Mozambique (Internet World Stats; Usage and Population Statistics [12]). This presents room for Malawi to expand internet use, especially for agriculture to drive the youth into agricultural employment.

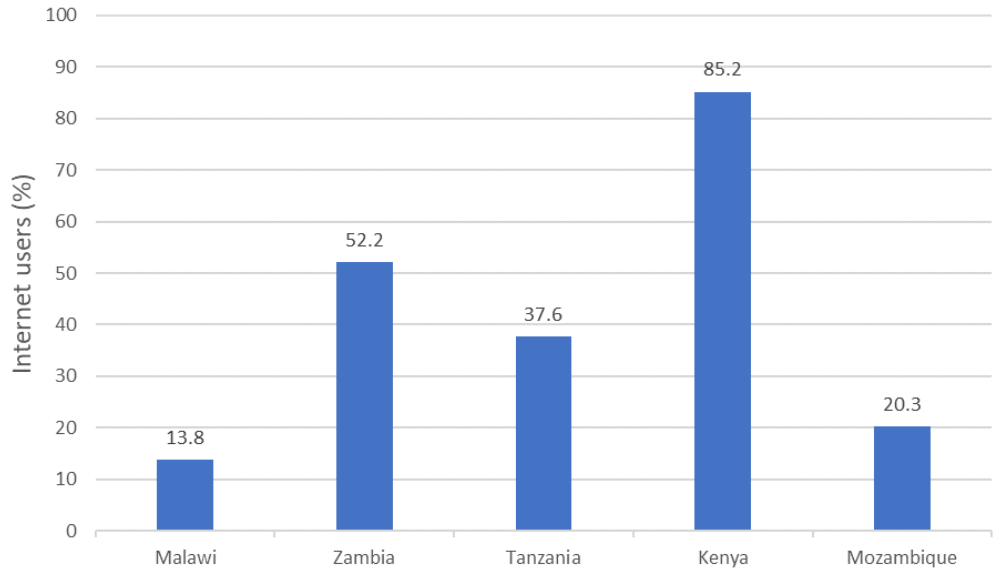

Figure 1. Internet usage in Malawi and neighboring counties.

However, the cost of internet poses the biggest barrier to the integration of ICT in agriculture and the realization of the numerous and significant benefits it may bring to the growth and development of youth agribusiness in Malawi. According to the Alliance for Affordable Internet (2018 statistics), Africa and particularly Sub-Sahara Africa have one of the highest costs of internet in the world. When calculated as a percentage of GNI per capita, the average prices of broadband data (1GB Mobile Prepaid) are 8.76% for Africa, 17.85 for Malawi, 1.54% for Asia (lowest), and 3.58% for the Caribbean and Latin America. It is worth noting that 17.85% is way above the United Nations recommended 2% cost of the internet when calculated as a percentage of GNI per capita. Nonetheless, ICT has great implications on agriculture and agricultural value chains relating to productivity, post-production processing and storage, marketing and trade as well as access to finance. Hence, its challenges in the adoption, use, and application should not be understated.

Increasing youth engagement levels in agriculture is fundamental not only for sustainably transforming agriculture, but also reducing youth unemployment. In achieving this, ICT holds great potential. Harnessing youth agribusiness opportunities through the use of ICT and its innovations holds the key to increasing profitability as well as providing employment opportunities.

The emphasis of ICT in agriculture has been on leveraging ICT adoption in agricultural value chains. Studies that have been done reveal the opportunities of adopting ICT in agribusiness. For instance, in western Kenya, 90% of young farmers are using ICTs for agricultural activities [13]. However, agribusiness is not that advanced as envisioned by the ICT adoption advocates showing adopting ICT alone in various levels of agribusiness is not enough. Therefore, there is a dearth of knowledge on the extent to which ICT is adopted and used among young farmers. This study, therefore, seeks to assess the effect of the intensity of ICT use on the profit of young agripreneurs in Malawi. The isolation and focus afforded to ICT as the main area of investigation in this study provides vital evidence that holds great potential in not only increasing productivity for the agricultural sector of the Malawian economy, but also most importantly serving as a route for increasing youth participation in agricultural-related activities through the motivation factor, and thus solving the unemployment problem in one way.

2. Materials and Methods

2.1. Data

The study was carried out in Lilongwe and Dedza districts of Malawi. Lilongwe has both the highest rural and urban population in Malawi constituting 9.3% and 5.6% of the total population, respectively [8]. Whilst Dedza has a population of 830,512 representing 4.7% of the total population in Malawi. Lilongwe also has the highest number of people above 18 years old while Dedza has the 4th highest number of people above 18 years [8]. The data was collected in December 2019 from 317 young (age 18–35 years) farmers randomly selected from three Extension Planning Areas (EPAs) in Lilongwe namely; Chitedze, Chitipi, and Mpingu; and six EPAs in Dedza namely; Golomoti, Kaphuka, Linthipe, Ntakataka, Songwe, and Ukwe. The sample farmers were involved in producing and selling crops.

The sample was designed by a two-stage probability design with EPAs as primary sampling units and individuals (the youth) as secondary sampling units. A sampling frame with a list of EPAs in the two districts was obtained from the Malawi Housing and Population Census of 2018. A simple random sampling technique was used to select the EPAs and 317 young individuals from the list of youth who are in the farming business was obtained from district youth offices and youth organizations for the selected EPAs. The sample size was limited because of a shortage of funding.

2.2. Conceptual and Analytical Framework

The study aims at investigating the effect of ICT use on the profitability of young agripreneurs in Malawi. The respondents were asked questions on the following ICTs, mobile phones (short text messages and phone calls), social media platforms (Facebook and WhatsApp), search engines (Google), radio, and computers. As the interest of the study is on the combination of these ICT tools, the main independent variable was constructed as a categorical variable taking values of 1 for a single ICT tool, and a maximum of 5 for a combination of 5 ICT tools (see Table 1).

Table 1. Description of variables.

Variable	Description	Code	Mean	St.dv.
Profit (MWK [1]/year)				
	0–100,000	Profit category 1	0.44	
	100,001–150,000	Profit category 2	0.23	
	150,001–200,000	Profit category 3	0.10	
	200,001–250,000	Profit category 4	0.07	
	250,001–300,000	Profit category 5	0.08	
	>300,000	Profit category 6	0.08	
Number of combinations of ICT tools				
	Only one ICT tool	ICT category 1	0.65	
	Two ICT tools	ICT category 2	0.19	
	Three ICT tools	ICT category 3	0.10	
	>=Four ICT tools	ICT category 4	0.07	
Age	Continuous (from 18 to 35)		26	5.2
Gender				
	Female	0	0.41	
	Male	1	0.59	
Education				
	None/illiterate	0	0.11	
	Adult education	1	0.02	
	Primary (1–8 years of formal education)	2	0.50	
	Secondary	3	0.34	
	Tertiary	4	0.03	
Marital status				
	Never married	0	0.47	
	Married	1	0.45	
	Divorced/separated	2	0.03	
	Widow/widower	3	0.04	
Primary occupation				
	Farming (crop + livestock)	0	0.56	
	Employed	1	0.10	
	Labourer	2	0.06	
	School/College young farmer	3	0.19	
	Non-school young farmer	4	0.10	
Years of experience in agricultural related business	Continuous		3.9	2.6
Distance to the main market in minutes of walking time	Continuous		11.3	11.4

[1]—MWK denotes Malawi Kwacha, a local currency in Malawi. As of 24 December 2021, it is valued at 816.4 Malawi Kwacha to 1 USD.

It is hypothesized that intensively using ICT tools in agriculture improves farmers' access to information on inputs, prices, finance, and market identification through Agricultural Information Systems (AIS), networking, and virtual markets. This eventually leads

to improved usage of inputs and output sales (Figure 2). This framework is backed by Saidu, Clarkson, Suleiman, Muhammed, and Joibo [14], who argue that entrepreneurs can increase production and sell more products to potential buyers and enhance effective management of sales as well as minimize direct and indirect costs, particularly advertisement cost and at the same time improve business process. Additionally, Kale, Rohilla, Meena, and Wadkar [15] believe that ICT provides timely information on what, when, where, why, and how to produce and sell agricultural products. Informed by this body of literature, this study investigates the relationship between the intensity of ICT use and increased profit.

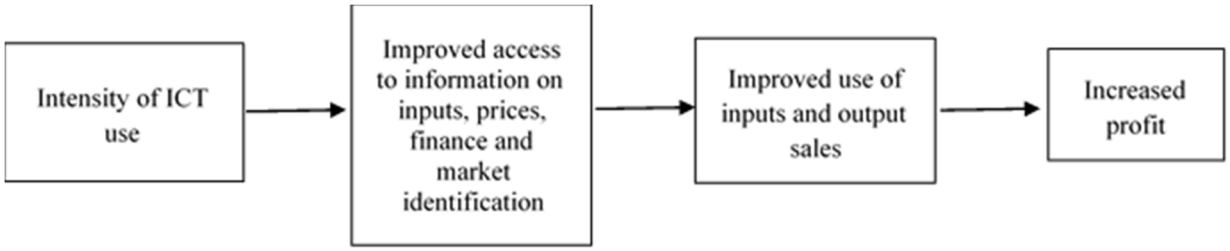

Figure 2. Conceptual framework of ICT use.

In the construction of the dependent variable, respondents were asked to provide a range rather than provide a specific value of profit from their agribusinesses. This was done to reduce measurement errors in the variable which are common from survey data [10]. The categories are ranked from lower profit to higher profit. For a categorical dependent variable, the use of ordinary least squares (OLS) estimation would be inappropriate due to inefficient and inconsistent estimates. Using multinomial logit or probit would not be efficient as well because no account would be taken of the extra information implicit in the ordinal nature of the dependent variable. Thus, this study uses an ordered logit model, which uses an ordered multinomial response variable as a dependent variable to estimate the parameters in conjunction with the unknown values defining the ranges of the latent variable [16].

The ordered logit model follows a logistic cumulative distribution function and can be expressed as

$$y^* = \alpha + X\beta + \mu \tag{1}$$

where y^* is an unobserved value of profit and y is an observed value of profit and can be expressed as

$$\begin{gathered} y_i = 1\ if\ y^* \le\ \gamma_1 \\ y_i = 2\ if\ \gamma_1 \le y^* \le \gamma_2 \\ y_i = 3\ if\ \gamma_2 \le y^* \le \gamma_3 \\ y_i = J\ if\ \gamma_J \le\ y^* \end{gathered} \tag{2}$$

Such that the probability that y falls in the category j is given by:

$$\begin{gathered} \text{prob}(\gamma_{j-1} \le y^* \le \gamma_j) = \text{prob}(y^* \le \gamma_j + y^* > \gamma_{j-1}) = \text{prob}(\alpha + X\beta + \mu \le \\ \gamma_j + \alpha + X\beta + \mu > \gamma_{j-1} = \Lambda(\gamma_j - X\beta) - \Lambda(\gamma_{j-1} - X\beta) \end{gathered} \tag{3}$$

where γ is a threshold value defining the ranges of the dependent variable and X is a vector of independent variables.

Estimation of the parameters β and γ is done using maximum likelihood. Thus, a likelihood function from Equation (3) is given by:

$$\ell_i(\gamma,\ \beta) = 1[y_i = 0]\log[\Lambda(\gamma_1 - x_i\beta)] + 1[y_i = 1]\log[\Lambda(\gamma_2 - x_i\beta) - \Lambda(\gamma_1 - x_i\beta)] + \cdots + 1[y_i = J]\log[1 - \Lambda(\gamma_J - x_i\beta)] \tag{4}$$

However, the interest is not in the estimated β and γ, but the response probability $\text{prob}(y = j|x)$ known as marginal effects given by:

$$\partial p_i(x)/\partial_{xk} = \beta_k\left[\eta\lambda(\gamma_{j-1} - x\beta) - \lambda(\gamma_j - x\beta)\right],\ 0 < j < J \tag{5}$$

In this study, y^* is specified as:

$$y^* = \alpha + \beta_1 Number\_of\_ICT\_tools + Z_i'\beta_i + \mu$$

where Z_i' is a vector of the following independent variables: education, age, marital status, gender, occupation, distance to nearest district market, and experience in agriculture.

3. Results and Discussion

The observed dependent variable y_i captures the ordered categories of profit of a young agripreneur. Table 1 describes all the variables that were used in the analysis and their descriptive statistics. The results show that the majority of the sample young farmers (65%) used only one single ICT tool, while less than 2% used five ICT tools. The number of younger farmers using ICT tools decreases with the increasing combination of ICT tools, and phone call is the most often used ICT tool among those who used only one ICT tool. The results also show that 44% of the young farmers are in the lower profit category, i.e., MKW 100,000 or less per year, 84% attained primary and secondary, mostly male, and primarily undertaking farming.

Figure 3 reports the percentage of respondents using each type of ICT tool. Somewhat surprisingly, mobile phone, which is relatively expensive to most of the ICT tools, is the most used ICT tool (45%), while the least used ICT tool is a computer-written adverts and notices (1%). Even though it is expensive to acquire a mobile phone, receiving and disseminating information through mobile is easy and flexible.

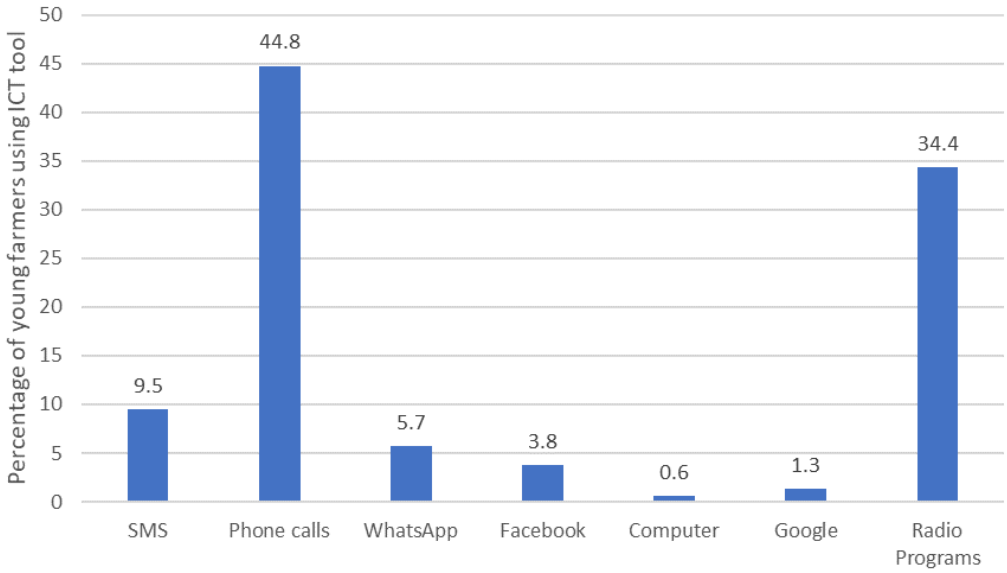

Figure 3. Proportion of use of ICT tool (% young farmers).

The correctly specified ordered logit model was checked by link test (Table 2). The results show that the model was correctly specified since variable _hatsq is insignificant.

Table 2. Specification test for correctly specified ordered logit model.

Profit Category (a7)	Coef.	Std. Error	*p*-Value
_hat	0.93 *	0.25	0.000
_hatsq	0.02	0.05	0.764

***, **, * shows significance at 1%, 5% and 10%, respectively.

Table 3 presents odds ratio estimates of the ordered logit model. The odds ratio is the chance of the dependent variable changing from 0 to 1 as a result of a one-unit positive change in the explanatory variable. A statistically insignificant odds ratio is one, i.e., one-to-one or even chance. An odds ratio of less than one indicates an inverse relationship between the independent and dependent variables, while those greater than one suggest a direct relationship. Holding other factors constant, log odds of reporting a higher profit category increase by 3.18 points, 12.10 points, and 130.67 points for those using a combination of two ICT tools, three ICT tools, and four ICT tools, respectively, as compared to the base category of those using single ICT tool.

Table 3. Odds ratios of ordered logit model.

Variables	Odds Ratio	Std. Error
ICT tools (single ICT tool = base category)		
Two ICT tools	3.18 ***	0.90
Three ICT tools	12.10 ***	4.84
≥Four ICT tools	130.67 ***	75.61
Education (Illiterate/no education = base category		
Adult education	1.60	1.67
Primary	1.66	0.72
Secondary	1.45	0.66
Tertiary	1.67	1.24
Marital status (Never married = base category)		
Married	0.65	0.18
Divorced/separated	0.75	0.51
Widow/widower	1.19	0.77
Primary occupation (Farming/herding = base category)		
Employed	0.91	0.43
Labourer	1.54	0.81
School/College young farmer	0.82	0.30
Non-school young farmer	0.78	0.36
Gender		
Male	1.13	0.27
Age	1.06 **	0.02
Experience in agriculture	0.98	0.05
Distance to the main market	0.99	0.004
Estimated cutpoints [2]		
Cut1	1.67	0.74
Cut2	3.03	0.76
Cut3	3.99	0.77
Cut4	4.61	0.79
Cut5	5.89	0.83

***, **, * shows significance at 1%, 5% and 10%, respectively. [2]—These are estimated cut points on the latent dependent variable used to differentiate low values from middle and high values when values of the independent variables are evaluated at zero.

Table 4 presents marginal effects of the use of a combination of ICT tools compared to the use of only one ICT tool. The results indicate that using a combination of two ICT tools decreases the probability of being in the lowest category of profit by 26%, but increases the probability of being in the profit category 2, profit category 3, profit category 4, profit category 5, profit category 6 by 4, 9, 6, 6, and 3%, respectively. While for those using a combination of three ICT tools, their probability of being in the lowest and second from lowest categories decreases by 45% and 8%, respectively, and their probability of being in the profit category 3, profit category 4, profit category 5, and profit category 6 increases by 10, 12, 18, and 12%, respectively.

Table 4. Marginal effects.

Categories (Single ICT Tool = Base Category)	dy/dx	Std. Error
Two ICT tools		
Profit category 1	−0.26 ***	0.06
Profit category 2	0.04 **	0.02
Profit category 3	0.09 **	0.02
Profit category 4	0.06 **	0.02
Profit category 5	0.06 **	0.02
Profit category 6	0.03 **	0.01
Three ICT tools		
Profit category 1	−0.45 ***	0.05
Profit category 2	−0.08 *	0.05
Profit category 3	0.10 ***	0.03
Profit category 4	0.12 ***	0.03
Profit category 5	0.18 ***	0.05
Profit category 6	0.12 **	0.05
≥4 ICT tools		
Profit category 1	−0.54 ***	0.04
Profit category 2	−0.24 ***	0.03
Profit category 3	−0.05 *	0.02
Profit category 4	0.03	0.03
Profit category 5	0.20 **	0.06
Profit category 6	0.60 ***	0.11

***, **, * shows significance at 1%, 5% and 10%, respectively.

The results also show that a combination of four ICT tools decreases the probability of being in the lowest, second, and third profit categories by 54, 24, and 5%, respectively, but increases the probability of being in profit category 5 and profit category 6 increases by 20%, and 60%, respectively. In general, a higher profit category for the young farmers was associated with a higher number of use of ICT tools while controlling for other factors. Further, it was found that using more ICT tools is associated with the probability of falling in a higher profit category while using fewer ICT tools is associated with the probability of falling in a lower profit category. Consequently, as higher profits are associated with a higher number of ICT tools used by the young farmers in agribusiness, it is highly imperative and fundamental that programs aimed at enhancing the intensity of ICT use (using more ICT tools) among young farmers are designed to leverage this opportunity.

4. Conclusions and Policy Implications

This study investigates the effect of the intensity of ICT use on the profit of young agripreneurs in Malawi. Results are drawn from a sample of 317 young farmers randomly selected from Lilongwe and Dedza districts. Data was analyzed using an ordered logit model. It has been found that using more ICT tools increases the chances of realizing higher profits from an agricultural enterprise. Somewhat surprising, mobile phone, which is relatively expensive compared to most of the ICT tools, was found to be the most used ICT owing to the opinion that receiving and disseminating information through mobile is easy and flexible.

Taking advantage of the attractiveness of ICT among the youth, research findings from this study suggest that youth agribusiness could be boosted if the youth are encouraged to use more ICT tools to receive and disseminate information related and relevant to their various agribusinesses. Given that profitability is highly influenced by the use of more ICT tools, the youth, as the largest proportion of many populations using ICT, are likely to be motivated to engage and remain in agribusiness. Whether or not these young farmers can act on the opportunities brought by the use of ICT tools depends largely on the extent to which ICTs are available to them, whether they can afford their use, and whether they have the prerequisite skills to use the tools and services. Additionally, young people do

not automatically venture into farming, hence, ICT adoption and use in the agribusiness industry by the youth is not as straightforward as it might be in other industries. The youth have to see agriculture as a profitable and exciting career path. This requires education and technical training to change perspectives and improve skills, and access to resources such as land and finance.

Nonetheless, it is imperative to influence adoption and use of ICT in agriculture through the youth as young entrepreneurs are faster than their older counterparts in adopting and using ICT tools due to their enthusiasm for it. Through transacting with the young entrepreneurs and seeing how profitable they are, the senior entrepreneurs will eventually follow suit in adopting and using ICT tools.

Relevant stakeholders, therefore, should strive towards the implementation of programs that would make it easy for the youth to increase the number of ICT tools they use in their agribusinesses. Increasing access to ICT tools through enhanced affordability by reducing the cost would be one such program. Increasing awareness on the opportunities that ICT tools hold in youth agribusiness, training the youth on how to incorporate ICT tools in their agribusinesses as well as supporting the sharing of success stories on ICT and youth agriculture would provide a great avenue through which the number of ICT tools that the youth can use in their agribusiness can be increased.

5. Limitations of the Study

One of the limitations of this study is the possibility of reverse causality between ICT use and profit (higher profits leading to more use of ICT tools or more use of ICT tools leading to higher profits). It is a problem that has been noted in the literature and can be tested. However, as argued by Chavula [17], the opportunities that come with investments in telecommunications may not be fully grasped by people in developing countries like Malawi, as some of them like the internet are more expensive and might require a higher level of education and skill to operate, and thus high profits may not be the direct cause of their use. The author, therefore, suggested that results from the causality test might end up rejecting the causality. Hence, this study did not also carry out such a test. Nonetheless, the problem is not entirely ruled out.

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Conflicts of Interest: The authors declare that they have no competing interests in this section.

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