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# Access and Use of Information and Communication Technology (ICT) among Cassava Value Chain Actors in South-East Nigeria

Okwor Uchechi Mercy<sup>1\*</sup>, Agwu Ekwe Agwu<sup>2</sup>, Anugwa Ifeoma Q<sup>3</sup>

## ABSTRACT

This study examined the access and use of information and communication technology among cassava value chain actors in South East, Nigeria. Data from 120 cassava value chain actors was obtained and analysed using frequencies, percentage, mean, factor analysis and t-test. Input suppliers had access to cell phone (M=2.88), smart phone (M=1.71), radio (M=1.62) and television (M=1.92). Farmers had access to cell phone (M=2.75), radio (M=1.83) and television (M=2.04). Marketers had access to cell phone (M=2.83) and television (M=1.50). Processors had access to cell phone (M=2.50), smart phone (M=1.54), radio (M=1.67), television (M=2.25) and cd/dvd (M=1.83). Consumers had access to cell phone (M=2.88), smart phone (M=1.58), radio (M=2.21), television (M=2.25) and cd/dvd (M=1.75). Consumers (87.5%), input suppliers (58.3%), marketers (45.8%), farmers (20.8%) and processors (20.8%) used ICTs for sourcing information on cassava value chain activities. Both males (M=5.01, SD=7.548) and females (M=5.00, SD= 7.505) considered ICT use effective and there was no significant difference (t=0.352, df (118), p ≥0.725, two tailed test). Challenges to access and use of ICT by cassava value chain actors were categorized under human capacity, content and technical capacity using factor analysis. The study recommended that extension agents should make use of a variety of ICT tools in disseminating relevant and timely information to actors in the cassava value chain.

**Keywords:** ICT, cassava value chain, actors, access, use

## 1. INTRODUCTION

Cassava (*Manihot esculenta*) is the most widely consumed staple food and most widely cultivated crop in Nigeria. This makes cassava an important crop in terms of production and consumption (Adeoye, 2021). Its current production is estimated to be 66million metric tons in 2024, with a 6% difference from 62million metric tons in 2023 (Dia et al., 2024). Cassava can be processed into many other forms like garri, akpu, tapioca, abacha, starch, cassava chips, pellets, flour, adhesive and alcohol which can serve as raw materials in livestock feed mill, confectioneries, textile and brewery industries. This implies that cassava is a multi-purpose crop (Adeoye, 2021);

and value can be added to cassava in various ways while it passes from one individual to the other, culminating to a chain-like sequence of activities called value chain. A value chain is the complete range of activities required to bring a product or service from its conception to its end use, encompassing various stages such as production, processing, marketing, and distribution (Nwele, 2020).

The cassava value chain involves transforming raw cassava tubers into a diverse array of high-value products. According to Nwele (2020), the primary components in cassava value chain include input suppliers, farmers, processors, marketers, and consumers, with each segment contributing to the transformation of cassava and movement of cassava products from “farm to table”. The key actors in the cassava value chain include input suppliers who provide a range of physical inputs (such as farm equipment/tools, chemicals, fertilizers, improved cassava cuttings etc.), farmers who cultivate the crop; processors who convert raw cassava into various products like high-quality cassava flour, garri, etc, marketers who facilitate logistics/transportation of cassava and its derivatives to markets. At the same time, consumers represent the final link, driving demand for these diverse products (Ahmadi et al., 2022).

Value chain centers on flow of material resources, finance, knowledge and information among actors hence, the use of Information and Communication Technology (ICT). Information and Communication Technologies encompass a wide range of tools and resources employed for the creation, dissemination, storage, and management of information (Umukoro et al., 2020). These technologies range from traditional media, such as radio and television, to advanced digital platforms, including the internet, mobile phones, and various software applications (Zadeh, 2024). The transformative potential of these technologies has been widely recognized across various sectors, particularly in agriculture, where they facilitate access to crucial information, enhance market linkages, and improve overall productivity for agrarian communities (Saha et al., 2024). In the agricultural value chain, ICTs are instrumental in bridging information asymmetries, enabling farmers to access vital data on fertilizer sources, market rates, and pest control, thereby optimizing their operational decisions and enhancing resilience (Olaitan, 2024).

Despite the transformative potential of ICTs in agricultural value chain, their adoption rates vary significantly across regions and demographics, with a persistent digital divide often exacerbated by gender, socioeconomic status, and educational attainment (Choruma et al., 2024). In Nigeria, women's limited mobility, coupled with extensive household and caregiving responsibilities, further restricts their engagement with digital agricultural tools (Choruma et al., 2024). This issue is further compounded by a significant gender gap in mobile phone ownership, with women in low- and middle-income countries being 21% less likely to own a mobile phone than men, thereby limiting their primary gateway to digital agricultural services (Dionysious, 2018). This discrepancy is particularly pronounced where limited infrastructure and lower literacy rates further marginalize women from the benefits of the digital revolution (Sufian et al., 2023).

Within the cassava value chain, gender dynamics profoundly influence access to, and control over resources, including information and communication technologies, which are increasingly vital for optimizing the agricultural practices and market linkages (Masamha et al., 2024). Women often face disproportionate challenges in accessing these technologies due to prevailing socio-cultural norms, limited education, and financial constraints, which can hinder their participation and benefits in the agricultural value chain (Abdullahi, 2025; Joseph et al., 2021). Hence, this study seeks to address the following research questions: What is the extent of access and use of ICTs on cassava value chain activities? What is the respondents’ perception of the effectiveness of ICT in terms of the relevance, timeliness and level of satisfaction? What are the challenges to the respondents’ use of ICT for sourcing information on cassava?

### Objectives of the study

- a. determine the extent of access and use of ICTs on cassava value chain activities;
- b. ascertain the perception of the effectiveness of ICT in terms of the relevance, timeliness and level of satisfaction;
- c. identify the challenges to the respondents’ use of ICT for sourcing information on cassava.

### Hypothesis

There is no significant difference between male and female actors in their perceived effectiveness of ICT.

## 2. RESEARCH METHODOLOGY

### Study area

The study was carried out in Abia State which is among the five states in South-East Nigeria. The state capital is Umuahia. It lies within latitude 4°45’ and 6°07’N and longitude 7°00’ and 8°10’E (Onumadu and Onuoha, 2015). Abia State is divided into three agricultural zones: Umuahia, Ohafia and Aba and comprises 17 local government areas. The 17 LGAs of Abia state are Umuahia North, Umuahia

South, Ikwuano, IsialaNgwa North, IsialaNgwa South, Aba North, Aba South, Osisioma Ngwa, ObiomaNgwa, Ukwa East, Ukwa West, Ugwunagbo, Umunneochi, Isuikwuato, Ohafia, Bende, and Arochukwu. It is bordered on the north by Anambra, Enugu and Ebonyi States, on the west by Imo State, on the east by Cross River and Akwa Ibom States and on the south by Rivers State (Onya et al., 2016).

According to the National Population Commission (2006), Abia state has a population of about 2.8 million people and a land mass cover of 5,833.77sq.km. The climate is tropical and humid all year-round. The rainy season begins in March and ends in October with a break in August. The dry season occurs from November to February. The mean annual rainfall ranges from 2000mm to 2500mm. The relative humidity is usually high throughout the year, reaching a maximum of 90% during the rainy season. The temperature ranges between 22°C and 31°C.

The population for the study comprised male and female actors in the cassava value chain including input suppliers, producers, marketers (wholesalers and retailers), processors and consumers. Actors were identified based on their major roles in the cassava value chain. Multistage and snowball sampling procedures were used in selecting input suppliers. In the first stage, two agricultural zones (Aba and Umuahia zones) were purposively selected from the three agricultural zones in the state on the basis of the availability of input suppliers. In the second stage, two blocks were randomly selected from each of the two zones, giving a total of four blocks (Aba urban block, Uhie block, Umuahia urban block and Ibeku block). In the third stage, six input suppliers (3 males, 3 females) were selected through snowball sampling procedure from each of the four blocks giving a total of 24 input suppliers.

Farmers/producers were selected using multistage and purposive sampling procedures. In the first stage, two agricultural zones (Aba and Umuahia zones) were randomly selected from the three agricultural zones in the state. In the second stage, two blocks were selected from each of the two zones giving a total of four blocks (Agalaba block, Ohanze block, Ikwuano North block and Olokoru/Ubakala block). In the third stage, one circle was purposively selected from each block (Ovom 1 circle, Umuobiakwa circle, Umudike circle and Apumiri circle) based on the preponderance of cassava production activities. In the fourth stage, a list of cassava farmers was collected from extension agents out of which six cassava farmers (3 males, 3 females) were randomly selected from each circle giving a total of 24 cassava farmers.

Multistage, purposive and snowball sampling procedures were used to select marketers. In the first stage, two agricultural zones (Aba and Umuahia zones) were purposively selected from the three agricultural zones in the state on the basis of the preponderance of cassava marketing activities. In the second stage, two blocks were selected from each of the two agricultural zones, making a total of four blocks (Aba urban block, Akwette block, Owerinta block and Ibeku block). In the third stage, snowball sampling technique was used to select six marketers (3 males, 3 females) from the major markets (Ahia ohuru market, Nkwo ngwa market, Oriegba market and Ahieke market) in each of the four blocks giving a total of 24 marketers.

Multistage and cluster sampling procedures were used to select cassava processors. In the first stage, two agricultural zones (Aba and Umuahia zones) were randomly selected from the three agricultural zones in the state. In the second stage, two cassava processors cluster (Okpu-umuobo cluster, Ogorhill cluster, Umudike cluster, Ndume cluster) were selected from each of the two zones giving a total of four clusters. In the third stage, six cassava processors (3 males, 3 females) were randomly selected from each of the four cassava processors cluster giving a total of 24 cassava processors.

Consumers were selected using a multistage sampling procedure. In the first stage, two agricultural zones (Aba and Umuahia zones) were randomly selected from the three agricultural zones in the state. In the second stage, two blocks were randomly selected from each of the two zones, giving a total of four blocks (Aba urban block, Okpu-umuobo block, Olokoru/Ubakala block and Umuahia urban block). In the third stage, one circle was purposively selected from each block, making a total of four circles (Umule circle, Umuette circle, Old Umuahia circle and Ndume circle). In the fourth stage, six consumers (3 males, 3 females) were randomly selected from three households in each circle (1 male, 1 female per household), giving a total of 24 consumers. This gives a total of 120 cassava value chain actors (24 input suppliers, 24 cassava farmers, 24 cassava marketers, 24 cassava processors and 24 consumers of cassava products).

Data for the study were collected using structured interview schedules designed for each group of actors. Data in objective 1 were summarized and presented using mean score, standard deviation and frequency. Mean scores of 1.5 and above were considered as having high access to ICTs. Data in objective 2 were analyzed using mean and standard deviation. The cut-off mean was 1.0. Thus, responses under the varied categories with mean scores greater than or equal to 1.0 were regarded as effective ICTs in terms of relevance, timeliness and satisfactory. In contrast, mean scores responses of below 1.0 were regarded as ineffective. Data in objective 3 were analysed using factor analysis. Factors that loaded 0.4 and above were considered challenges under each factor (human capacity, content, technical capacity). The hypothesis sought to determine if there is a significant difference between male and female actors in

their perceived effectiveness of ICTs used in sourcing for information on cassava value chain activities. It was achieved by comparing their mean scores using t-test at 5% level of significance.

### 3. RESULTS AND DISCUSSION

#### Access to ICTs for information on cassava value chain activities

Entries in Table 1 show that input suppliers had access to cell phone (M=2.88), smart phone (M=1.71), radio (M=1.62), television (M=1.92) but had limited access to computer (M=0.92) and cd/dvd (M=1.13). This implies that input suppliers own most of the ICTs, hence, are always on the lookout for information using a variety of ICT tools. Moreso, the majority of the input suppliers are learned and consider access to ICTs as an integral aspect of their business.

Table 1 indicates that farmers had access to cell phone (M=2.75), radio (M=1.83), television (M=2.04) and had limited access to smart phone (M=0.88), computer (M=0.63) and cd/dvd (M=0.96). The findings revealed that cassava farmers had low access to some ICT tools. The limited access to ICTs could be attributed to the high cost of ICT tools/service as well as limited income generated from cassava production. Increasing penetration of phones in even in rural/remote areas explains the high access to cell phones by cassava farmers.

Results in Table 1 also reveal that marketers had access to cell phone (M=2.83) and television (M=1.50) and had limited access to smart phone (M=0.88), computer (M=0.67), radio (M=1.25), cd/dvd (M=0.79). This implies that marketers had high access to cell phone, and television more than smart phone, computer, radio and cd/dvd. Respondents ascertained that cell phone can be handled with ease at the market place whereas television can be accessed at home after the day's sales unlike smart phone or computer that requires more effort to access.

Processors had access to cell phone (M=2.50), smart phone (M=1.54), radio (M=1.67), television (M=2.25), cd/dvd (M=1.83) and had limited access to computer (M=1.00). Similarly, consumers had access to cell phone (M=2.88), smart phone (M=1.58), radio (M=2.21), television (M=2.25), cd/dvd (M=1.75) and had limited access to computer (M=1.21). High access to cell phone, smart phone, radio, television and cd/dvd by processors and consumers could be attributed to their monthly income. Moreso, the fairly large household size of processors and consumers enhances the likelihood of accessing these ICTs. Summarily, processors and consumers had the highest access to ICT followed by input suppliers, farmers and marketers.

**Table 1.** Access to ICTs for information on cassava value chain activities

| Access to ICT   | Cell phone  |      | Smart phone |      | Computer |      | Radio       |      | Television  |      | CD/DVD      |      |
|-----------------|-------------|------|-------------|------|----------|------|-------------|------|-------------|------|-------------|------|
|                 | M           | SD   | M           | SD   | M        | SD   | M           | SD   | M           | SD   | M           | SD   |
| Input suppliers | <b>2.88</b> | 0.33 | <b>1.71</b> | 1.36 | 0.92     | 1.01 | <b>1.62</b> | 0.97 | <b>1.92</b> | 0.92 | 1.13        | 0.85 |
| Farmers         | <b>2.75</b> | 0.53 | 0.88        | 1.19 | 0.63     | 0.82 | <b>1.83</b> | 0.86 | <b>2.04</b> | 0.69 | 0.96        | 0.95 |
| Marketers       | <b>2.83</b> | 0.38 | 0.88        | 0.99 | 0.67     | 0.81 | 1.25        | 0.79 | <b>1.50</b> | 0.77 | 0.79        | 0.83 |
| Processors      | <b>2.50</b> | 0.65 | <b>1.54</b> | 1.10 | 1.00     | 1.02 | <b>1.67</b> | 0.91 | <b>2.25</b> | 0.67 | <b>1.83</b> | 0.76 |
| Consumers       | <b>2.88</b> | 0.44 | <b>1.58</b> | 1.31 | 1.21     | 1.02 | <b>2.21</b> | 0.93 | <b>2.25</b> | 0.94 | <b>1.75</b> | 1.03 |

**Table 2.** Use of ICTs by actors in cassava value chain

| Use of ICT | Input suppliers |      | Farmers |      | Marketers |      | Processors |      | Consumers |      |
|------------|-----------------|------|---------|------|-----------|------|------------|------|-----------|------|
|            | Freq.           | %    | Freq.   | %    | Freq.     | %    | Freq.      | %    | Freq.     | %    |
| Yes        | 14              | 58.3 | 5       | 20.8 | 11        | 45.8 | 5          | 20.8 | 21        | 87.5 |
| No         | 10              | 41.7 | 19      | 79.2 | 13        | 54.2 | 19         | 79.2 | 3         | 12.5 |

#### Use of ICTs for information on cassava value chain activities

Results in table 2 reveal that consumers (87.5%), input suppliers (58.3%), marketers (45.8%), farmers (20.8%) and processors (20.8%) used ICTs for sourcing information on cassava value chain activities. This implies that input suppliers and consumers used ICTs more than other actors in the cassava value chain. Considering the educational level of consumers and input suppliers, it is expected that they will have a favorable attitude towards using ICT to source information. Input suppliers and consumers also had access to more ICTs than other actors thus, making it easier to use it. The role of input suppliers as consultants on agricultural inputs may also increase the possibility of using ICT to source information. It was also observed that farmers and processors were the least actors to use ICT in

the cassava value chain. This could be as a result of the preference of the farmers and processors in sourcing information from their colleagues.

### Effectiveness of ICTs in terms of relevance, timeliness and respondents' level of satisfaction

#### a) Relevance

Table 3 shows that cell phone (M=1.05) and smart phone (1.00) were relevant to input suppliers. Radio (M=1.00) was the only ICT tool relevant to farmers. Marketers indicated that cell phone (1.00) was relevant in sourcing information on cassava marketing. Cell phone (M=0.29), smart phone (M=0.29), computer (M=0.21), radio (M=0.08), television (M=0.17), and cd/dvd (M=0.00) were not relevant to processors in sourcing information on processing cassava. Consumers indicated that cell phone (M=1.03) and television (M=1.17) were relevant in sourcing information on cassava products for consumption. Relevance of ICTs means that the information provided by the ICT is suitable for the current information need for either input suppliers, farmers, marketers, processors or consumers. However, processors did not consider any of the ICTs as relevant. Overall, actors considered the use of mobile phone (cell phone and smartphone), radio and television as relevant in sourcing information on cassava value chain activities. This finding is consistent with Levi (2015) who observed that mobile phone (52.6%), radio (62%) and television (76.8%) are relevant in providing agricultural information. This assertion is based on the notion that information provided through these ICTs is usually up-to-date and thus regarded as important in cassava value chain activities. Usually, frequency of use of ICT implies that information gotten from it will be considered relevant. This could explain the ICTs regarded as relevant for input suppliers, farmers, and marketers. None of the ICTs was frequently used by processors which also reflects in relevance of ICT used for information on cassava. However, consumers considered cell phone and television important but not radio. This could be due to visual characteristic of television and proliferation of mobile phone.

**Table 3.** Relevance of ICTs used for information on cassava

| ICT used   | Input suppliers |      | Farmers |      | Marketers |      | Processors |      | Consumers |      |
|------------|-----------------|------|---------|------|-----------|------|------------|------|-----------|------|
|            | M               | SD   | M       | SD   | M         | SD   | M          | SD   | M         | SD   |
| Cell phone | 1.05            | 0.95 | 0.29    | 0.62 | 1.00      | 0.96 | 0.29       | 0.62 | 1.03      | 0.89 |
| Smartphone | 1.00            | 0.83 | 0.25    | 0.53 | 0.42      | 0.65 | 0.29       | 0.62 | 0.08      | 0.28 |
| Computer   | 0.42            | 0.65 | 0.13    | 0.33 | 0.17      | 0.38 | 0.21       | 0.50 | 0.08      | 0.28 |
| Radio      | 0.29            | 0.46 | 1.00    | 0.90 | 0.37      | 0.57 | 0.08       | 0.28 | 0.13      | 0.33 |
| Television | 0.42            | 0.50 | 0.17    | 0.38 | 0.42      | 0.65 | 0.17       | 0.38 | 1.17      | 1.92 |
| CD/DVD     | 0.00            | 0.00 | 0.04    | 0.20 | 0.08      | 0.28 | 0.00       | 0.00 | 0.13      | 0.44 |

#### b) Timeliness

Entries in Table 4 show that cell phone (M=1.06) and smartphone (M= 1.05) were timely in sourcing information by input suppliers. None of the ICT tools (cell phone (0.29), smartphone (M=0.25), computer (M=0.17), radio (M=0.13), television (M=0.17), and cd/dvd (M=0.04) was timely in sourcing information by farmers. Table 4 also shows that only cell phone (M=1.04) was timely in sourcing information by marketers whereas smartphone (M=0.42), computer (M=0.17), radio (M=0.29), television (M=0.29) and cd/dvd (M=0.13), were not timely for marketers in sourcing information. On the other hand, processors indicated that none of the ICTs, cell phone (M=0.29), smartphone (M=0.29), computer (M=0.21), radio (M=0.13), television (M=0.13), cd/dvd (M=0.04) was timely in sourcing information on cassava processing. Consumers also indicated that none of the ICTs, cell phone (M=0.25), smartphone (M=0.08), computer (M=0.08), radio (M=0.13), television (M=0.13), cd/dvd (M=0.08) was timely in sourcing information on cassava products for consumption. Timeliness means that information can be obtained when it is needed.

Input suppliers considered cell phone and smartphone timely, while marketers considered cell phone timely in sourcing information on cassava value chain activities. Farmers, processors and consumers did not consider any of the ICTs timely in sourcing information on cassava. The findings imply that cell phone and smartphone are perceived to be timely in providing information on cassava value chain activities by input suppliers and marketers. Immediate response via call or text message is provided through phone, unlike other ICTs that may take a while to provide responses or may not have provision for feedback (for instance, radio). Phones can be used to access information conveniently at any time and location.

**Table 4.** Timeliness of ICTs used for information on cassava

| ICT used   | Input suppliers |      | Farmers |      | Marketers   |      | Processors |      | Consumers |      |
|------------|-----------------|------|---------|------|-------------|------|------------|------|-----------|------|
|            | M               | SD   | M       | SD   | M           | SD   | M          | SD   | M         | SD   |
| Cell phone | <b>1.06</b>     | 0.90 | 0.29    | 0.62 | <b>1.04</b> | 0.96 | 0.29       | 0.62 | 0.25      | 0.67 |
| Smartphone | <b>1.05</b>     | 0.79 | 0.25    | 0.53 | 0.42        | 0.65 | 0.29       | 0.62 | 0.08      | 0.28 |
| Computer   | 0.46            | 0.65 | 0.17    | 0.38 | 0.17        | 0.38 | 0.21       | 0.50 | 0.08      | 0.28 |
| Radio      | 0.21            | 0.41 | 0.13    | 0.33 | 0.29        | 0.46 | 0.13       | 0.33 | 0.13      | 0.33 |
| Television | 0.33            | 0.48 | 0.17    | 0.38 | 0.29        | 0.46 | 0.13       | 0.33 | 0.13      | 0.33 |
| CD/DVD     | 0.00            | 0.00 | 0.04    | 0.20 | 0.13        | 0.33 | 0.04       | 0.20 | 0.08      | 0.28 |

**c) Satisfaction**

Data in Table 5 show that cell phone (M=1.00) and smartphone (M=1.03) were considered satisfactory by input suppliers in sourcing information on cassava input supply unlike computer (M=0.33), radio (M=0.29), television (M=0.29) and cd/dvd (M=0.00). Table 5 also shows that radio (M=1.02) was considered satisfactory by farmers in sourcing information on cassava production while cell phone (M=0.30), smartphone (M= 0.25), computer (M=0.17), television (M=0.21) and cd/dvd (M=0.08) were not considered satisfactory. Marketers perceived cell phone (M=1.08) to be satisfactory in sourcing information on cassava marketing activities, unlike smart phone (M=0.42), computer (M=0.17), radio (M=0.29), television (M=0.33), cd/dvd (M=0.08). Processors perceived none of the ICTs, cell phone (M=0.29), smart phone (M=0.30), computer (M=0.25), radio (M=0.13), television (M=0.17), cd/dvd (M=0.00), to be satisfactory in sourcing information on cassava processing. Consumers considered cell phone (M=1.50), smart phone (M=1.10) and television (M=1.46) to be satisfactory in sourcing information on cassava products whereas computer (M=0.08), radio (M=0.17), and cd/dvd (M=0.08) were not considered satisfactory.

Level of satisfaction is ascertained if the user is satisfied with the kind and quality (in terms of content) of information derived from ICT. Generally, cassava value chain actors are satisfied with information obtained from cell phone, smart phone, radio and television. Input suppliers considered cell phone, and smartphone satisfactory, while farmers considered radio satisfactory. Marketers considered cell phone satisfactory whereas consumers considered cell phone, smart phone and television satisfactory. Processors did not consider any of the ICTs satisfactory following the trend of frequency of use, relevance and timeliness. Of all the actors in the cassava value chain in the study area, processors do not seem to have interest in using ICT in their activities.

**Table 5.** Level of satisfaction of ICTs used for information on cassava

| ICT used    | Input suppliers |      | Farmers     |      | Marketers   |      | Processors |      | Consumers   |      |
|-------------|-----------------|------|-------------|------|-------------|------|------------|------|-------------|------|
|             | M               | SD   | M           | SD   | M           | SD   | M          | SD   | M           | SD   |
| Cell phone  | <b>1.00</b>     | 0.93 | 0.30        | 0.62 | <b>1.08</b> | 0.96 | 0.29       | 0.62 | <b>1.50</b> | 1.18 |
| Smart phone | <b>1.03</b>     | 0.80 | 0.25        | 0.53 | 0.42        | 0.65 | 0.30       | 0.64 | <b>1.10</b> | 1.03 |
| Computer    | 0.03            | 0.56 | 0.17        | 0.38 | 0.17        | 0.38 | 0.25       | 0.60 | 0.08        | 0.28 |
| Radio       | 0.29            | 0.46 | <b>1.02</b> | 0.64 | 0.29        | 0.46 | 0.13       | 0.33 | 0.17        | 0.48 |
| Television  | 0.29            | 0.46 | 0.21        | 0.41 | 0.33        | 0.56 | 0.17       | 0.38 | <b>1.46</b> | 1.12 |
| CD/DVD      | 0.00            | 0.00 | 0.08        | 0.28 | 0.08        | 0.28 | 0.00       | 0.00 | 0.90        | 0.28 |

Cell phone and smartphone were perceived to be effective in all the parameters of effectiveness (relevance, timeliness and level of satisfaction) by input suppliers excluding farmers and processors. Marketers considered only cell phone as effective in terms of relevance, timeliness and level of satisfaction. This finding is consistent with that of Abdulsalam, et al., (2016) who observed that mobile phone (cell phone and smart phone) has become the most effective and efficient medium of communication in the value chain. Phones enable interactive information flow unhindered by space, volume, medium or time. Mobile phone can be acquired and used by any individual ensuring ease in communication. In cases where the actor needs clarification, they can put a call across to a fellow input supplier, farmer, marketer, processor, or consumer and get answers. However, most value chain actors rely on experience in carrying out activities because most times, information provided on ICTs is not location-specific or homogenous.

**Difference between male and female actors and effectiveness of ICTs used in sourcing information on cassava value chain activities**

Entries in Table 6 reveal no significant difference in the effectiveness of ICTs used in sourcing information on cassava value chain activities between male and female actors. The means of the scores for effectiveness of ICT used between male and female was compared using an independent sample t-test. There was no significant difference ( $t=0.352$ ,  $df(118)$ ,  $p = 0.725$ , two tailed test) in the means for male ( $M=5.01$ ,  $SD=7.548$ ) and female ( $M=5.00$ ,  $SD= 7.505$ ). The size of the difference in mean was infinitesimal ( $\eta^2=0.001$ ; mean difference= 0.483). Looking at the two means, one can confidently say that both male and female consider ICT use effective. Effectiveness of ICT use is closely associated with perception. It is not dependent on gender. It was expected that men would perceive ICT use as effective due to the general opinion that men are likely to use ICTs to access agriculture-related information more than women. However, it was observed that there was no significant difference between men and women. It could be associated with the changing roles in the society, realization of the need for ICT by both men and women and the fact that women are more involved in cassava production activities.

From the results in Table 6, it can be inferred that effectiveness of ICT use is closely associated with perception not gender since there was no significant difference between men and women. Hence, the null hypothesis that there is no significant difference between male and female actors in the effectiveness of ICTs used is accepted.

**Table 6.** Difference between male and female actors in the perceived effectiveness of ICTs used

| Gender | N  | Mean | SD    | Std.error mean | T     | df    | Decision |
|--------|----|------|-------|----------------|-------|-------|----------|
| male   | 60 | 5.01 | 7.548 | 0.974          | 0.352 | 118   | Accept   |
| female | 60 | 5.00 | 7.505 | 0.965          | 0.352 | 117.9 |          |

$p \geq 0.05$

**Challenges to access and use of ICT by actors in cassava value chain**

Entries in Table 7 shows that challenges to access and use of ICT by cassava value chain actors were categorized under human capacity, content and technical capacity using factor analysis. Human capacity refers to competencies embodied in individuals' example age, education, experience, social skills, personality, attitude, intelligence, creativity. Content refers to substantive information, collection of techniques, processes or methods used in a product or service while technical capacity refers to systems put in place that is required to operationalize a product or service.

**Table 7.** Factor analysis of challenges to access and use of ICT by actors in cassava value chain

| Variables                                                                         | Factor 1<br>Human<br>capacity | Factor 2<br>Content | Factor 3<br>Technical<br>capacity |
|-----------------------------------------------------------------------------------|-------------------------------|---------------------|-----------------------------------|
| Complex nature of ICT                                                             | 0.166                         | 0.520               | <b>0.603</b>                      |
| Irrelevant information provided through ICT                                       | 0.239                         | <b>0.726</b>        | 0.206                             |
| Social influence                                                                  | <b>0.411</b>                  | -0.187              | -0.128                            |
| Lack of awareness of ICT use                                                      | <b>0.733</b>                  | 0.108               | 0.215                             |
| Lack of interest in ICT use                                                       | <b>0.703</b>                  | 0.224               | 0.168                             |
| Lack/inadequate education                                                         | <b>0.586</b>                  | 0.582               | 0.180                             |
| High cost of using ICT tools                                                      | <b>0.860</b>                  | 0.247               | 0.040                             |
| Differences in information on cassava value chain activities received through ICT | 0.283                         | <b>0.511</b>        | -0.047                            |
| High cost of ICT tools                                                            | <b>0.879</b>                  | 0.090               | 0.092                             |
| Lack of money to buy ICT tools                                                    | <b>0.709</b>                  | 0.272               | 0.404                             |
| Unsolicited service provision                                                     | 0.252                         | <b>0.670</b>        | 0.055                             |
| High cost of ICT service                                                          | 0.149                         | 0.149               | <b>0.913</b>                      |
| Poor ICT training                                                                 | <b>0.679</b>                  | 0.491               | 0.084                             |
| Poor access to ICT infrastructure                                                 | <b>0.828</b>                  | 0.029               | 0.359                             |

|                                    |              |              |              |
|------------------------------------|--------------|--------------|--------------|
| Non-availability of ICT facilities | 0.171        | 0.092        | <b>0.848</b> |
| Lack of internet access            | 0.154        | 0.241        | <b>0.833</b> |
| Frequent power failure             | 0.418        | -0.167       | <b>0.535</b> |
| Language barriers                  | 0.176        | <b>0.421</b> | 0.474        |
| Age                                | <b>0.541</b> | 0.075        | 0.515        |
| Lack of government support         | 0.176        | 0.322        | <b>0.671</b> |
| Poor access to loans               | 0.238        | 0.072        | <b>0.654</b> |
| Poor/fluctuating network           | 0.065        | 0.166        | <b>0.720</b> |

*Extraction Method: Principal Component Analysis*

*Rotation Method: Varimax with Kaiser Normalization*

Factors that loaded high under human capacity were high cost of ICT tools (0.879), high cost of using ICT (0.860), poor access to ICT infrastructure (0.828), lack of awareness of ICT use (0.733), lack of money to buy ICT tools (0.709), lack of interest in ICT use (0.703), poor ICT training (0.679), lack of/inadequate education (0.586) and age (0.541). Factors that loaded high under content were irrelevant information provided through ICT (0.726), unsolicited service provision (0.670) and differences in information on input supply, production, marketing, processing and consumption through ICT (0.511). Factors that loaded high under technical capacity were high cost of ICT service (0.913), non-availability of ICT facilities (0.848), lack of internet access (0.833), poor/fluctuating network (0.720), lack of government support (0.671), poor access to loan (0.654), frequent power failure (0.535) and complex nature of ICT (0.603). The high loadings of variables under the three factors imply that they are serious challenges to access and use of ICT by cassava value chain actors. Factors like social influence (0.411) had low loading indicating that it is a minor challenge to access and use of ICT by input suppliers, farmers, marketers and processors while language (0.421) was a minor challenge to access and use of ICT by input suppliers, processors and consumers. This finding closely collaborates the study of Anyan and Frempong (2018) who classified barriers that hinder the effective use of ICT in Ghana into attitudinal factors, accessibility factors and technical barriers. Attitudinal factors can be likened to human capacity factors which include negative attitude of people, poor benefits of using ICT, lack of training in the use of ICT and lack of knowledge of opportunities that ICT provide. Accessibility factors can be likened to content factors which include low number of agricultural television and radio programmes, unable to access information using ICT due to its complexity and unfavourable radio broadcasting time. Technical factors include service not available and poor ICT infrastructure. An enhanced human capacity, in terms of knowledge and skills, is an important requirement for ICT usage.

#### 4. CONCLUSION

The use of ICT also requires an understanding of the information it contains. Human and technical capacity factors appear to be more challenging in access and use of ICT across the cassava value chain activities than the content factor. This implies that personality and technicality are factors that mostly impede access and use of ICT. One has to have the skills necessary to operate ICT (human capacity) in an enabling environment (created by technical capacity) before ascertaining whether or not the information contained in it is useful.

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#### Author Contributions

Authors contributed equally in the study.

#### Informed consent

Written and oral informed consent was obtained from all individual participants included in the study.

#### Conflicts of interests

The authors declare that they have no conflicts of interest, competing financial interests or personal relationships that could have influenced the work reported in this paper.

### Ethical approval & declaration

The study was done in conformity with ethical guidelines. Participation was entirely voluntary and all respondents provided informed consent. The participants' anonymity and confidentiality were ensured and the data obtained were utilized purely for the study. The ethical guidelines for Human Subjects are followed in the study.

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### Data and materials availability

All data associated with this study will be available based on the reasonable request to corresponding author.

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