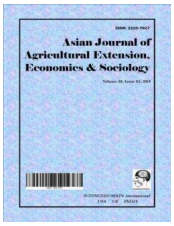

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Diagnosing the Dimensions of Benefits and Constraints of Information and Communication Technology (ICT) Utilization among Cassava Farmers in Uyo Agricultural Zone, South-South Nigeria

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Authors' contributions

This work was carried out by both Authors. Both authors designed the study. Author AAT managed the literature search and wrote the first draft. Author JTE performed the statistical analysis, analysed the results, read and approved the final manuscript.

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ABSTRACT

Major dimensions of benefits and constraints of ICTs utilization among cassava farmers in Uyo agricultural zone were assessed in this study. A multi-stage sampling method was used to select 100 respondents for the study. The study relied on primary data gathered through the use of well designed and validated questionnaire. Factor analysis technique and composite index were adopted to ascertain the major dimensions of benefits and constraints of ICTs utilization among cassava farmers as well as the level of severity of the constraints that are responsible for the sub-optimal cassava production in Uyo agricultural zone. The major dimensions of benefits of ICTs utilization perceived by the respondents in the study area include; promotion of access to cassava production, processing and marketing information; promotion of easy access and sharing of information on

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improved cassava varieties, weather forecasting and credit facilities for cassava production; Promotion of adoption of cassava production innovations and promotion of effective cassava production leading to rural development. Findings also revealed that the numerous constraints to the use of ICT tools by cassava farmers in Uyo agricultural zone unlocked separately into government policies, technological and administrative constraints as the major dimensions of constraints. How rewarding the efforts on improvement of cassava would be, even in the nearest future, would depend to a large extent on the elimination of these major constraints. Unless pragmatic approach is used to reduce the constraints responsible for the low utilization rate of ICTs, food security in Uyo agricultural zone, South-south, Nigeria, would still be elusive.

Keywords: Dimensions; constraints; benefits; ICTs; cassava farmers.

1. INTRODUCTION

Undoubtedly, application of Information and Communication Technology (ICTs) to agriculture may be a relatively new phenomenon in developing countries, but ICT's contributions to agricultural development and poverty alleviation is becoming increasingly noticeable. ICT's contribution to food security and rural livelihoods have gained increased recognition and were endorsed officially at the World Summit on the Information Society in 2005 (International Institute for Communication and Development [1]. According to [1], increase efficiency, productivity and sustainability of small-scale farms have been observed in areas where ICTs' utilization for agricultural production have been significant. ICTs can be defined as those technologies. used in collecting, processing, storing, retrieving, disseminating and implementing data and information using microelectronics, optics, telecommunication and computers [2].

They are also defined as those technologies that facilitate communication, processing and transmission of information by electronic means for the benefits of its users (Technical Centre for Agricultural and Rural Cooperation [3].

The definition above implies that the use of ICTs in cassava production and extension services would be quite essential for rural development, especially now that its use has witnessed an upsurge in almost all areas of rural life in several African countries, [3] Cassava (*Manihot* spp) is one of the most popular root crops grown in West Africa especially in Nigeria [4]. The Federal Government of Nigeria has, in recent times, placed much emphasis on cassava production in all the states of the country because of the variety of uses the crop could be put to [4].

Therefore, stakeholders in cassava production can access information and knowledge about the crop through ICTs. ICTs can also improve market access through the awareness of up-to- date market information on cassava production prices, inputs and consumers needs. This can improve cassava farmers' livelihood substantially and has a dramatic impact on their negative position.

Furthermore, ICTs according to [5] enable cassava farmers in the rural communities to interact with other stakeholders, thus reducing social isolation. ICTs widen the perspective of rural communities in terms of national and global development, open up new business opportunities and allow easier contact with friends and relatives as well as help eliminate the gap between agricultural knowledge and rural communities. As observed by [6], many countries of the world now regard understanding ICT and mastering its necessary skills and concepts as part of the core of education, alongside reading, writing and numeracy. ICTs used by cassava farmers according to [7] and [8] include radio, television, fixed and mobile phones, Short Message Services (SMS), World Wide Web (www), search engines, packet digital assistants, cameras, video, e-mail, computer, contact databases and systems, CD-Rom, DVD, rural radio and web publishing, among others. These ICT tools were also rated as highly relevant to cassava production activities in the areas of cassava stem selection, land preparation, marketing of produce, land selection for cassava, sowing/planting of cassava, fertilizer application and transportation [9]. In another dimension of benefits, [10] observed that ICTs could provide cassava farmers with information on improved cassava varieties, weather forecasting, pest control and other agricultural related services. More so, ICTs can deliver timely information to farmers which can help boost and income [10]. [5] reported that cassava farming had been upgraded from being just a staple food to a source of income as well. Cassava farmers, therefore, and use ICTs to

optimize production to meet the increasing demand both locally and internationally.

Affirmatively, ICTs holds a lot of benefits for cassava farmers but the effectiveness and efficacy of cassava farmers in Uyo agricultural zone, South-South Nigeria to key in and enjoy these benefits as well as achieve sustainable production depends upon the extent to which they are free from constraints towards the utilization of these ICTs. Despite the fact that there are a number of factors encouraging farmers to utilize ICTs, literature have identified a wide range of barriers and constraints to ICTs utilization, some of which are true for farming in general and some of which are particular to cassava farming. Arokoyo T [11] reported that rural farmers in Nigeria, including cassava farmers, have not been able to substantially adopt ICTs to increase productivity substantially. Reasons advanced for this scenario include low level of ICT readiness, poor ICT infrastructure, erratic and unstable power supply, limited and high cost of telephone services, limited access to computers and internet, lack of communication policy by government, high level of rural poverty, high level of illiteracy, policy inconsistency and commercialization of radio stations, among others. Ekerete Beulah I et al. [12] while assessing ICTs utilization by Agro-Processors in Ikono Local Government Area of Akwa Ibom State, South-South, Nigeria identified the high cost of ICT facilities as the primary constraint. [13] in his study on information and communication technologies used by female cassava farmers in Umuahia agricultural zone, Abia State, observed that cassava farmers could not use most of the computer-based ICT components due to their high computer illiteracy coupled with other barriers and stressed on the need to build the capacity of the women farmers in computer skills and literacy and to encourage them to own personal computers, to benefit fully from the advantages offered by the ICT technologies in modern agriculture. A more recent study carried out by [5] reported that constraints to access and use of ICTs by cassava farmers in Obudu, Cross River State were a low income earning, inadequate access to ICT training, inadequate access to ICT infrastructure and lack of time among others.

Unarguably, some studies have been done on ICTs utilization by cassava farmers, but studies that have examined the severity of constraints faced by cassava farmers in utilizing ICTs were scarce in Uyo agricultural zone, South-South Nigeria. There is need to further expand the frontier of knowledge and learning, by making available empirical information on the dimensions and severity faced by cassava farmers in utilizing ICTs as well as the dimensions of perceived benefits of ICTs' utilization among the farmers. Therefore, this study was set to fill this gap by focusing on dimensions of perceived benefits of ICTs' utilization as well as the dimensions and severity of constraints faced by cassava farmers in utilizing ICTs in Uyo agricultural zone of Akwa Ibom State with the following objectives, to: diagnose the significant dimensions of perceived benefits of ICTs utilization among the cassava farmers in the study area, examine the levels of benefits of ICTs among the cassava farmers, diagnose the significant dimensions of constraints to ICTs utilization among the cassava farmers in the study area and examine the level of severity of the constraints to ICTs utilization among the cassava farmers in the study area.

2. METHODOLOGY

The study was carried out in Uyo Agricultural Zone in the South-south region of Nigeria. Uyo Agricultural zone is made up of Ibesikpo, Uyo, Uruan, Itu and Ibiono Local Government Areas. The area falls under the rainforest zone with mean annual rainfall of about 2484 mm, annual temperature is about 27ºC, and relative humidity ranges from 70–80 percent [14]. Two distinct seasons are discernible; the dry season (November – March) and rainy season (April – October). The study area is centrally located in Akwa Ibom state, and as the commercial nerve centre assumes extra importance in the state. Economic activities of the inhabitants are farming, trading, crafts, transportation, civil service, artisans etc. the area has a large concentration of cassava farms and numerous cassava processing mills [11].

The selection of respondents was based on the Akwa Ibom State Agricultural Development Programme (AKADEP) framework. A multi-stage sampling method was used to select the respondents. First, the Uyo zone was purposively selected for the study. The second stage involved a simple random sampling (by ballot) of 5 out of 8 blocks from the zone while the third and fourth stages

deployed the use of simple random sampling for the selection of 5 cells from the selected block and 20 cassava farmers from each cell. A total of 100 cassava farmers were selected for the study.

This study relied on primary data gathered through the use of well designed and validated questionnaire. The questionnaire was administered on the selected respondents in the study area. Descriptive and inferential statistical tools were used for data analysis. Descriptive statistical tools included frequency counts, percentages, mean as well as composite index while inferential statistical tool used included Factor analytical procedures.

3. RESULTS AND DISCUSSION

3.1 Naming of the Major Dimensions of Perceived Benefits of ICT Utilization among the Cassava Farmers in the Study Area

Twenty-four items were initially generated and validated during the instrument construction phase to reflect this objective. Factor analytic procedure primarily analyzed the interrelationship among variables (scale items) in terms of their underlying dimensions (factors). Factor analysis using principal component approach was used to produce linear combinations of these items or variables, and a small number of these combinations account for the majority of the variability within the set of intercorrelations among the original variables. Its goal is to extract the maximum variance from a data set, resulting in a few orthogonal (uncorrelated) components.

The first principal component is the combination that accounts for the most significant amount of variance in the sample. The second component accounts for the next most enormous amount of variation in the sample and is uncorrelated with the first. The researcher used the Kaiser's rule criterion to decide the number of components to retain and interpret. The rule states that only those components of an instrument that account for variances greater than 1(i.e. eigenvalue more significant than 1) should be retained [15]. The researcher, however, examined the communality values when determining the selection of eigenvalue for extraction of factors. Communalities extraction expresses the amount of variance accounted for by the number of factors extracted in a variable matrix, taken together. Thus, the size of communality extraction value, therefore, assesses how much variance in a particular variable is accounted for by the others in the factor solution. The index of communality extraction tells the degree which a variable or item relates with other variable included in the analysis, and vice-versa.

The 4 components with their corresponding items (statements) shown in Table 1 were merged whenever they were judged to be conceptually related. This is consistent with recommendations by [16,17,18], who stated that the deletion or merger of a particular statement/item can only be justified when the item (s) to be eliminated or merged are conceptually related with another group items. This resulted in the generation of 4 major dimensions of perceived benefits of ICT utilization among the cassava farmers in the study area, which is in consonance with the 4 underlying components of the 24 earlier generated. Component one accounted for 48.705% of the variance in the data, this was followed by component two with 12.269% variance, followed by component three with 9.550%, and then component four which accounted for 4.693% of the variance. The components are named as:

Component 1: This component containing nine (9) items which loaded positively in excess of 0.5 is appropriately tagged promotion of access to cassava production, processing and marketing information. This is because most of the items are concerned with the respondents feeling satisfied with ICTs for allowing them access to cassava production, processing and marketing information. This finding indicates that ICT is very relevant to cassava production activities especially for both pre-planting and post-planting operations. The fact that, ICT is relevant to marketing of cassava produce is in line with the findings of [19] that, marketing information is one of the most relevant ICTs services which could be offered to farmers in Nigeria.

Component 2: This factor containing six (6) items which loaded positively in excess of 0.5 is appropriately tagged promotion of easy access and sharing of information on improved cassava varieties, weather forecasting and credit facilities for cassava production. This is because most of the items are concerned with the respondents feeling satisfied with ICTs for

giving them access to sharing of information on improved cassava varieties, weather forecasting and credit facilities for cassava production among themselves. This finding agree with [10] who posited that ICTs can provide cassava farmers with information on improved cassava varieties, weather forecasting, pest control and other agricultural related services. More so, ICTs can deliver timely information to farmers which can help boost their productivity and income [10].

Component 3: This factor containing five items which loaded positively in excess of 0.5 is appropriately tagged Promotion of adoption of cassava production innovations. This is because the items gave insight into the usage of ICTs that led the respondents to search for and decided to adopt cassava production innovations.

Component 4: This factor containing four items which loaded positively in excess of 0.5 is appropriately tagged Promotion of effective cassava production leading to rural development. This is because the respondents believed that the use of ICTs has enabled them to produce effectively with resultant improvement on yield and income. These improvements, of course, will contribute positively to economic growth and development of the study area. ICTs according to [0] enabled cassava farmers in the rural communities to interact with other stakeholders, thus reducing social isolation. ICTs widen the perspective of rural communities regarding national and global development, open up new business opportunities and allow easier contact with friends and relatives as well as help eliminate the gap between agricultural knowledge and rural communities.

3.2 Level of Perceived Benefits of ICTs among the Cassava Farmers (LBICTCF)

The level of perceived benefit of ICTs among the cassava farmers was estimated using composite index approach. The index range lies within 0.00 and 1.00, as the respondents estimated index tends towards 1.00, it implies that their level of benefit was extremely high and vice versa as it tends towards 0.00. However, for ease of analysis, the index of each item was distributed along a categorized level of perceived benefit based on equal interval, such that 0.00 – 0.500 indicates low level of benefit, 0.501 – 0.750 indicates average level of benefit while 0.751 – 1.00 indicates high level of benefit of ICTs. Result of the analysis as shown on Table 2 revealed that majority (76.0%) of the respondents perceived high level of benefit from utilization of ICTs; 20.0% perceived average level of benefit while only 4.0% perceived low level of benefit from the use of ICTs. This depicts that a good number of the cassava farmers perceived that the use of ICTs could be highly beneficial.

3.3 The Naming of the Major Dimensions of Constraints to ICTs Utilization among the Cassava Farmers in the Study Area

Factor analysis was used to establish the underlying interrelations existing among the very many variables identified as constraints to the use of ICT tools by the cassava farmers. This makes it possible to reduce the variables to a more meaningful framework. In the preliminary analysis, the Kaiser-Meyer-Olkin (KMO) test of sampling adequacy achieved a score of 0.821. All the 19 factors had communalities of 1.00 or higher, indicating their appropriateness for the factor analysis. The 19 significant factors were further reduced to common factor patterns. This was done to empirically explain the constraints to the use of ICT tools by the cassava farmers. In doing this, principal component analysis with Varimax rotation and Kaizer Normalisation was used to determine which factors have significance. Factor retention was based on eigenvalue of 1.0. Only factors that account for variances greater than 1.0 were included in the factor extraction. Three (3) underlying themes or components were obtained using a cut-off point of 0.50.

For component 1; Lack of government policies to enhance the development of ICT in rural areas was highest with a factor loading of 0.853, followed by High cost of Telecommunication service (0.802), Low ICT literacy level (0.802), High cost of maintenance of ICT (0.792), Inadequate access to ICT (0.749) and Complexity in using ICTs (0.725) in that order.

Table 1. Principal components analysis for major dimensions of perceived benefits of ICT utilization among the cassava farmers in the study area

s/n	Perceived benefits	Com1	Com 2	Com 3	Com 4	CEI
1	ICT helps me to access information on cassava production activities	.537				.789
2	ICT can be used to access information on fertilizer availability/application	.763				.782
3	ICT helps me to access information on Agro-chemicals	.676				.647
4	ICT can be used to access information on disease and pest management	.871				.817
5	ICT can be used to access information on best cassava processing methods	.823				.773
6	ICT helps me to access information on marketing channels	.822				.782
7	ICT can be used to access information on various value addition of cassava	.850				.804
8	ICT can be used to access information on storage facilities	.737				.782
9	ICT helps me to access information on market prices	.567				.708
10	ICT can be used to access information on weather forecasting		.618			.721
11	ICT helps me to access information on Harvesting		.677			.740
12	ICT can be used to access information on available credit facilities		.662			.753
13	ICT can be used to access information on improved varieties of cassava		.748			.726
14	ICT can be used to access information on best planting techniques		.822			.828
15	ICT facilitates information exchange among fellow farmers		.783			.820
16	ICT facilitates interaction between Researchers, Extension workers and Farmers			.777		.714
17	ICT helps farmers learn about innovation faster			.828		.777
18	ICT helps in immediate feedback			.803		.751
19	ICT facilitates decision making			.677		.729
20	ICT facilitates problem solving			.681		.806
21	ICT makes information easily accessible				.718	.657
22	ICT improves efficiency and effectiveness of farming activities				.809	.719
23	ICT facilitates Mass communication				.642	.706
24	ICT facilitates rural development				.798	.718
	Eigen Value	11.689	2.945	2.292	1.126	
	Percentage(%) of Variation	48.705	12.269	9.550	4.693	
	Cumulative Percentage (%)	48.705	60.974	70.524	75.217	
	Extraction Method					
	Rotation Method					
	Rotation converged in 8 iterations					

Note: CEI = Communality Extraction Index
Com= Components

Table 2. Distribution of the respondents based on level of perceived benefits of ICTs among The Cassava Farmers (LBICTCF)

LBICTCF index interval	LBICTCF index interpretation	Respondents	Percentage (%)
0.0 – 0.500	Low	4	4.0
0.501 – 0.750	Average	20	20.0
0.751 – 1.00	High	76	76.0
Total		100	100.0

Source: Field Survey, 2016

Table 3. Principal components analysis for major dimensions of constraints to ICTs utilization among the cassava farmers in the study area

	Constraints				
		Components			
S/n		CEI	Com1	Com 2	Com3
1	Poor Telecommunication network	.644	.612		
2	Complexity in using ICTs	.610	.725		
3	Lack of government policies to enhance the development of ICT in rural areas	.799	.853		
4	High cost of Telecommunication service	.653	.802		
5	Low ICT literacy level	.773	.802		
6	High cost of maintenance of ICT	.749	.792		
7	Inadequate access to ICT	.644	.749		
8	Lack of Interest	.668	.706		
9	Poor electricity Service	.682		.812	
10	Lack of adequate awareness of ICT	.768		.821	
11	High cost of ICT tools	.795		.837	
12	Low Technical knowhow	.797		.852	
13	Lack of competence in handling ICT tools	.732		.751	
14	Lack of Finance to acquire ICT tools	.602			.678
15	High cost of repairing ICTs	.615			.718
16	Negative attitude of people towards change	.623			.694
17	Household commitment and hindrances	.673			.602
18	Lack of internet services in rural areas	.684			.797
19	Lack of Extension services	.648			.763
	Diagnostics Statistics				
	Eigenvalues		8.569	2.690	1.901
	% of Variance		45.099	14.160	10.005
	Cumulative %		45.099	59.259	69.263
	Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 6 iterations.				

Note: CEI = Communality Extraction Index
Com= Components

For component 2; Low Technical knowhow emerged highest with a loading of 0.852, followed by High cost of ICT tools (0.835), Lack of adequate awareness of ICT (0.821) and Poor electricity Service (0.812).

For component 3; Lack of internet services in rural areas emerged highest (0.797), followed by High cost of repairing ICTs (0.718), Negative attitude of people towards change (0.694), Lack of Finance to acquire ICT tools (0.678), and Household commitment and hindrances (0.602).

Given that most of the variables in component 1 are directly or indirectly linked to issues relating to government policies, the component was therefore labeled as

Table 4. Distribution of the respondents based on level of severity of constraints to ICTs utilization among the cassava farmers (LBICTCF)

LBICTCF Index Interval	LBICTCF Index Interpretation	Respondents	Percentage (%)
0.0 – 0.500	Low	10	10.0
0.501 – 0.750	Average	61	61.0
0.751 – 1.00	High	29	29.0
Total		100	100.0

government policies and related constraints. Similarly, given that most of the variables in component 2 are linked to technology know how issues, this has been labeled as technological and related constraints. Then component 3, was named administrative constraints. To this effect, the numerous constraints to the use of ICT tools by cassava farmers in Uyo agricultural zone unlock separately unto issues relating to government policies and related constraints, technological and related constraints, and administrative constraints.

3.4 Level of Severity of the Constraints to ICTs Utilization among the Cassava Farmers in the Study Area

The level of severity of constraints to the utilization of ICTs among the cassava farmers was estimated using composite index approach. The index range lies within 0.00 and 1.00, as the respondents estimated index tends towards 1.00, it implies that severity of constraints was extremely high and vice versa as it tends towards 0.00. However, for ease of analysis, the index of each item was distributed along a categorized level of perceived constraints based on the equal interval, such that 0.00 – 0.500 indicates the low severity of restrictions, 0.501 – 0.750 indicates average level of constraints while 0.751 – 1.00 indicates high level of constraints to ICTs utilization. A result of the analysis as shown in Table 4 revealed that 29.0% of the respondents perceived the constraints to be highly severe, the majority (61.0%) of the respondents perceived that the constraints were averagely severe while only 10.0% perceived the constraints to the use of ICTs were lowly severe. This finding agrees with [11] who reported that rural farmers in Nigeria, including cassava farmers, have not been able to substantially adopt ICTs to increase productivity substantially. Reasons advanced for this scenario include; low level of ICT readiness, poor ICT infrastructure, erratic and unstable power supply, limited and high cost of telephone services, limited access to computers and internet, lack of communication policy by government, high level of rural poverty, high level of illiteracy, policy inconsistency and commercialization of radio stations, among others.

4. CONCLUSION AND RECOMMENDATIONS

The study has revealed that the significant dimensions of benefits perceived by the respondents in the study area include; promotion of access to cassava production, processing and marketing information, development of easy access and sharing of information on improved cassava varieties, weather forecasting and credit facilities for cassava production, Promotion of adoption of cassava production innovations and Promotion of active cassava production leading to rural development. The result revealed that a good number of the cassava farmers perceived a high level of benefit from the use of ICTs. On the other hand, the result showed that the numerous constraints to the use of ICT tools by cassava farmers in Uyo agricultural zone unlock separately into issues relating to government policies and related restrictions, technological and associated limitations, and administrative constraints as the major dimensions of constraints. However, the study revealed majority (61.0%) of the respondents as perceiving that the constraints were averagely severe.

Given the fact that the Akwa Ibom State Government is currently promoting and empowering cassava farmers which involves women and youth through skill acquisition and production inputs, the study therefore recommends that ICT literacy training be incorporated into the programme and also the number of skill acquisition centers be increased in order to enable more farmers mostly in the study area to benefit. Akwa Ibom State Government should ensure that adequate ICT

infrastructure are put in place in the state as to give everyone opportunity to benefit from the use of ICT, since it is the in-thing in this 21st century.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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