

# Agricultural information gathering and use among smallholders' sugarcane farmers during the covid-19 pandemic in Tanzania: a case of Kilosa district.

## ABSTRACT

**Aims:** The agricultural sector is considered the backbone of Tanzania's economy. Information accessibility to farmers depends on the situation and the available sources. This article aims at attempting to understand the agricultural information gathering and use among smallholders' sugarcane farmers during the covid-19 pandemic in Tanzania: a case of Kilosa district.

**Research Methods:** In this study, we conducted field surveys among farmers, and of the out in Ruaha, Kidodi, and Kidogobasi villages in Kilosa district, in Morogoro region, Tanzania. A total number of 4776 key informants were engaged in the study to examine information accessibility to farmers depending on the situation and the available sources.

**Results:** The study found out that agricultural information smallholder farmers needed for sugarcane farming was information on markets 84%, sugarcane payment per ton 74%, and information on the harvest and fertilizers application 72%. We observed that the main source of agricultural information was fellow farmers and agricultural information officers and Radio. We discovered that, before the outbreak of the COVID-19 pandemic, the majority (89.7%) accessed agricultural information from their fellow farmers, (71.3%) of respondents said that agricultural extension officer was their preferred source. It was revealed that the majority (83.0%) of the smallholder sugarcane farmers revealed that a limited number of agricultural extension officers was the main challenge, (72.4%) of the respondents said that a limited number of seminar-workshop and agricultural training incomplete statement. The findings adds up on the insights on the utilization of agricultural information during pandemic.

**Conclusion:** It can be concluded that agricultural information accessibility is important to smallholder farmers' sugarcane production; furthermore, agricultural extension officers are a significant role in farmers' productivity even amid the COVID-19 pandemic.

*Keywords: Sugarcane production, smallholder Farmers, information accessibility, COVID-19 Pandemic, Tanzania.*

## 1. INTRODUCTION

The agricultural sector is considered the backbone of Tanzania's economy, it contributes about 28 % of the country's GDP and about 24% of the total exports products are agricultural products (Limbu and Mashindano 2002). It employs about 70% of the whole Tanzania population, some Tanzanians are involved directly in farm production while others work as agents for agricultural products, exportation, and industrial production (Tanzania 2015).

Contributions of the agricultural sector are not limited to economic growth, it has been the key factor in poverty reduction in rural areas, improving living standards of the people, and strengthening food supply and food security in the country. Tanzanians produce a variety of crops such as rice, banana, coffee, sugarcane, cotton, maize, beans and potatoes, sorghum, millet, sunflower, tea.

Sugarcane is the major source of sugar used in Tanzania, Due to the skyrocketing interest in agricultural commercialization by African governments from large-scale to smallholder farmers, the increasing interest in cash crop production, government supportive priorities, and rising industrial demand for sugar. Due to its application in industrial products Tanzanian government has been implementing different strategies to improve sugarcane farming at both larger scale and small-scale farming through different programs like Big Results Now (BRN). The smallholder farmers have been the great source of sugarcane to sugar-producing industries in Tanzania, the efforts have been made to increase sugarcane production as it is the main source of sugar produced in different industries such Kilombero, Kagera sugar, and Mtibwa sugar of Tanzania (Martiniello and Azambuja 2019). Its annual sugar production is 300,000 tonnes that do not

meet the requirement, which is approximately 520,000 tonnes (Sulle 2017). Kilombero Sugar Company is the largest sugar company in Tanzania which gets its raw materials from smallholder farmers cultivating around the company which is estimated to be 7500 (Sulle 2017).



**Figure 1:** Map showing the location of Kilombero sugar company the main buyer of sugarcane produced by smallholder farmers.

Productivity among smallholder farmers is determined by several factors, amount of rainfall, quality of seeds, soil factors, government support and policy, and information accessibility. One of the major needs of the smallholder farmers is agricultural information, the timely access to information, quality, authenticity, the relevance of the information helps the farmers to make an informed decision and improve the quality and quantity of their production (Odongo 2014). Argues that smallholder farmers can make a significant contribution to production if equipped with all their needs including the right information at the right time such as agricultural practices for production, pest control, seed varieties, manure, and fertilizer. Information has been a key to decision making among farmers, as farmers inquire about crops varieties, market trends, government priorities, with different information is likely to have different impacts on farmers as their agricultural information needs vary (Ortiz-Crespo et al. 2021).

Information accessibility to farmers depends on the situation and the available sources, several studies conducted before the outbreak of COVID-19 found that the major sources of agricultural information to farmers were Interpersonal communication and social gatherings, radio, Television, (Mtega 2018). However, the outbreak of the COVID-19 pandemic has affected the ways of sharing information among farmers around the globe, with limited social gatherings and emphasis on social distancing, wearing masks, and lockdown in most countries (Okike 2020).

Accessibility and use of the right agricultural information at the right time guarantee primary success to smallholder farmers as information plays a key role in decision-making, farmers enquire for different information that helps them to increase agricultural productivity (Ndimbwa et al. 2019). Smallholder sugarcane farmers build their output on the agricultural information they gather and use for maximum sugarcane production (Martiniello and Azambuja 2019).

Considering their preferred means to obtain information, that is interpersonal communication with the extension officers and social gathering with their fellow farmers (Elly and Silayo 2013). This has drastically changed as a result of the COVID-19 pandemic. Different studies have been conducted to assess information gathering and use among farmers in COVID-19 such as Application of Agricultural Drones and to Understand Food Supply Chain During Post COVID-19 by Dutta and Mitra, Smallholder farmer perceptions about the impact of COVID-19 on agriculture and livelihoods in Senegal by (Middendorf et al., 2021), the Main issues of the Contract Farming Structure in Sugar Cane Farming. Perspectives of Smallholder Farmers in Kilombero Region in Tanzania by (Saenko and Sesabo 2019).

However little is known about Agricultural Information Gathering and Use among farmers. Therefore, this study assessed the Agricultural Information Gathering and Use among Smallholders' Sugarcane Farmers during COVID-19 Pandemic in Tanzania.

## 2. METHODOLOGY

### 2.1. Research approach.

A research approach is a plan of action that gives direction to conduct research systematically and efficiently (Kothari 2017). The study adopted a quantitative approach because of its appropriateness to the topic of the study. The quantitative approach helped the study to collect numerical data from the smallholder farmers.

### 2.2. Description of the Study Area

This study was conducted in Ruaha, Kidodi, and Kidogobasi villages in Kilosa district, which is located Morogoro region in east-central Tanzania. It's about 148 km from Morogoro town and 300 km west of Dar es Salaam. Kilosa extends between Latitude 5°55' and 7°53' South and Longitudes 36°30' and 37°30' east. According to the latest Population and Housing Census 2012, Kilosa district had thirty-five wards (35 wards) with a total population of 438,175 and comprise 218,378 Males and 219,797 Females and have two administrative constituencies, Kilosa Constituency and Mikumi constituency (Tanzania 2013). The major economic activity conducted by farmers in the Kilosa district is Sugarcane production and their main buyer is Kilombero Sugar Company Limited.

### 2.3 Study Population

The study population for this study was smallholders farmers engaging in sugarcane production. Moreover, about 7476 farmers have been registered in different associations like Kitete AMCOS 627, Harambee AMCOS 80, RCGA AMCOS 4311, Msindazi AMCOS 690, Msowelo AMCOS 309, Muungano AMCOS 356, Hope MCOS 64, Kidodi AMCOS 193, Bonye AMCOS 557 AND Miwa AMCOS 289 that made a total of 7476 of the targeted population to conduct research.

### 2.4 Sampling Technique

The study used a multistage sampling technique, which purposively select three wards from the Mikumi constituency the selected wards are the ones with the most smallholder farmers producing sugarcane for that reason the respective wards were chosen out of 15 wards. In addition, the study used simple random sampling to get three villages from selected wards, and then simple random sampling was used to select respondents from the three-selected ward.

### 2.5 Data collection Instrument

The study adopted a questionnaire survey to collect the data for this study, according to (Kothari 2017) describes questionnaires in research as instruments for gathering data beyond the physical reach of the observer. Also, the questionnaire was used because most of the farmers were able to read and write, Kothari argues that the questionnaire gives room for the respondent to think and give the best response according to their understanding.

### 2.6 Data Analysis

The study used a statistical package for social science (SPSS) to generate frequency tables, percentage tables, and figures, charts.

## 3. RESULTS

### 3.1 Demographic information

The study involved 81 respondents, the majorities 69.00% were male, and the least 31.00% were female, respondents. Moreover, most of the respondents 25.30% were between 20-25 years of age, followed by 19.50% aging between 41-45 years. The results show the majority of respondents 71.30% were married followed by 27.60% of the respondents who were still single. Most of the respondents 36.80% had attained secondary school education, followed by 34.50% who went to primary school. Furthermore, the findings indicate that 75.50% of smallholder farmers' cultivated area ranged from 1-to 10 acres. (Table 1)

**Table 1: demographic Characteristics**

Variables	Frequency	Percentage (%)
<b>Gender</b>		
Male	60	69.00
Female	27	31.00
<b>Age</b>		
20-25	22	25.30
26-30	14	16.10
31-35	9	10.30
36-40	15	17.20
41-45	17	19.50
46-50	5	5.70
51 and above	5	5.70
<b>Marital status</b>		
Married	62	71.30

Not married	24	27.60
Widow	1	1.10
Divorce	0	0.00
<b>Education level</b>		
Not go to school	5	5.70
Primary	30	34.50
Secondary	32	36.80
College	6	6.90
Degree	14	16.10
<b>Farm Size</b>		
1-10	63	75.50
11-20	20	20.40
21-30	2	5.70
31-40	2	2.20

### 3.2 Agricultural information is needed for the production of sugarcane.

The respondents were asked about the agricultural information they need from sugarcane farming, the majority of the respondents 84% need information on markets, 74.00% sugarcane payment per ton, 72.40% information on the harvest. In addition, 72.00% inquired about fertilizers application. (Table 2)

**Table 2: Agriculture information needed in the production of sugarcane**

<b>Agriculture information needed</b>	<b>Frequency (f)</b>	<b>Percentage (%)</b>
Farm preparation	34	39.10
Sugarcane payment per tones	65	74.00
Improved varieties	42	48.30
Harvesting information	63	72.40
Herbicides.	19	21.80
Pesticides.	40	46.00
Application of fertilizers	63	72.00
Marketing information	72	82.80
Transport information	46	52.90
Expansion of the markets	3	3.40
The weather station at KSCL	1	1.10
Management of farm	1	1.10
Planting and using hybrid sugar cane seed	4	4.60
Distance from the farm to KSCL industry	2	2.30
Transparency of information about sucrose extracted from out-growers farmers	1	1.10

Source: field 2021

### 3.3 Accessibility of agriculture information by smallholders sugarcane farmers

The respondents were asked about the access they had to the agricultural information, the majority of the respondents (66.70%) stated that were able to access the information they needed at the right time (Table 3).

**Table 3: Accessibility of agriculture information by smallholder's sugarcane farmers**

<b>Categories</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Getting agriculture information at the right time	29	33.30
Accessing agriculture information at a late time	58	66.70

Source: field 2021

### 3.4 The farmers' response to limited access to agricultural information

The respondents revealed that the majority (42.70%) of them went to seek advice from extension officers, (41.30%) of respondents got information by seeking advice from farmers experienced in sugar cane production (Table 4)

**Table 4: the farmers' response to limited access to agricultural information**

<b>Categories</b>	<b>Frequency (F)</b>	<b>Percentage (%)</b>
Seek advice for extension officers	32	42.70

Reduce production of sugar cane	3	4.00
Involves in production of other crops	2	2.70
Seek advice to farmers experienced in sugar cane production	31	41.30
Attending in sugarcane production exhibition	1	1.30
Seek advice from agriculture inputs suppliers	10	13.30
Cultivating sugarcane farms affected with diseases	1	1.30
Reading agriculture books to solve challenges of producing sugarcane	2	2.70
Getting advice from researchers	3	4.00
Getting advice from association leaders	6	8.00
Using my own experience	3	4.00
Using herbicide application	3	4.00
Reading newspapers	1	1.30

Source: field 2021

### 3.5 Benefits of timely accessing agriculture information

The respondents were asked about the benefits they got from accessing and using agricultural information, the majority (90.8%) of the respondents said that it help to increase production, (75.9%) of the respondents were able to get improved varieties during the sewing season, hence good yield during the harvesting season. (Table 5)

**Table 5: Benefits of timely accessing agriculture information**

Categories	Frequency (F)	Percentage (%)
Increase in sugarcane production	79	90.80
The rate of using improved varieties increases	66	75.90
Help in pest control management	47	54.00
Increase income.	53	60.90
Help in weeds control practices	25	28.70
Planting sugar cane at a light time	1	1.10
Sugarcane disease protection	2	2.30
To be competent in sugarcane production	1	1.10
Fire break preparation	1	1.10

Source: field 2021

### 3.6 Perceived impact of inadequate agriculture information on sugarcane production

The respondents were asked if the inadequacy of agricultural information had affected the production, the table below is showing 88.50% of the respondents agreed that limited accessibility of agricultural information impacted their productivity

**Table 6: Perceived impact of inadequate agriculture information on sugarcane production**

Categories		Frequency(F)	Percentage (%)
After your sugarcane production	Yes	77	88.50
No effect your sugarcane production	No	10	11.50
Total		87	100.00

Source: field 2021

### 3.7 The sources of agriculture information used by small-scale sugarcane producers before and in the COVID-19 pandemics.

**Sources used by smallholder farmers in accessing agriculture information before COVID-19 pandemics.**

Before the outbreak of the COVID-19 pandemic, the majority (89.70%) accessed agricultural information from their fellow farmers, (71.30%) of respondents said that agricultural extension officer was their preferred source.

**Table 7: Sources used by smallholder farmers in accessing agriculture information before the COVID-19 pandemics**

CATEGORIES	FREQUENCY(F)	PERCENTAGE (%)
Radio.	41	47.10
Television.	40	46.00



Researchers	33	37.90
Mobile phone	28	32.20
Agricultural input suppliers	55	63.20
Agricultural extension	62	71.30
Fellow farmers	78	89.70
Magazines.	10	11.50
Posters.	16	18.40
Personal email	5	5.70
Neighbors.	48	55.20
Local government officials.	11	12.60
Reading different agriculture books	1	1.10
My husband	2	2.30
Website	1	1.10

Source: field 2021

### 3.8 Perceived impact of COVID-19 pandemic on agriculture information accessibility

The respondents were asked if the outbreak of the covid-19 pandemic affected their agricultural information accessibility, 85.50% of the respondents agreed that limited accessibility of agricultural information affected their productivity

**Table 8: Perceived impact of COVID-19 pandemic on agriculture information accessibility**

Categories		Frequency	Percentage (%)
The outbreak of COVID-19 affected agricultural information accessibility	Yes	77	88.50
	No	10	11.50
Total		87	100.00

Source: field 2021

### 3.9 The extent of using the source of agriculture information

Respondents showed that after the outbreak of the COVID-19 pandemic, the majority 79.00% in Table 9 below accessed agricultural information from their fellow farmers, (71.30%) of respondents said that agricultural extension officer was their preferred source.

**Table9. The extent of using the source of agriculture information**

CATEGORIES	FREQUENCY(F)	PERCENTAGE (%)
Radio.	65	74.00
Television.	40	46.00
Researchers	30	34.00
Mobile phone	62	71.30
Agricultural input suppliers	48	55.10
Agricultural extension	62	71.30
Fellow farmers	69	79.00
Magazines.	10	11.50
Posters.	16	18.40
Personal email	7	8.00
Neighbors.	48	55.20
Local government officials.	9	10.30

Source: field 2021

### 3.10 Methods used in disseminating agriculture information to small-scale sugarcane producers.

#### Methods used by Farmers in the gathering of agriculture information

The respondents were asked about the methods they used to gather agricultural information, the majority (81.60%) of the respondents attended agricultural exhibitions, (75.50%) of the farmers went to agricultural group meetings to get the information they needed.

**Table10: Methods used in disseminating agriculture information to small-scale sugarcane producers**

Categories	Frequency (F)	Percentage (%)
------------	---------------	----------------

Contacting agricultural Information personnel	18	20.70
Farm and home visits	30	34.50
Result demonstration	66	75.90
Field trips	39	44.80
Radio program	16	18.40
Agriculture exhibition	71	81.60
Guest speakers.	5	5.70
Group meeting.	17	19.50
Group meeting.	66	75.50
Audio- visual materials	5	5.70
Through agriculture meeting	1	1.10
Conducting different seminars	2	2.30

Source: field 2021

### 3.11 Challenges facing small-scale sugarcane producers in accessing agricultural information

#### Challenges facing during accessing agricultural information

The respondents were asked about the challenges they faced in gathering and using agricultural information, the majority (83.00%) of the respondents revealed that a limited number of agricultural extension officers was the main challenge, (72.40%) of the respondents said that a limited number of seminar-workshop and agricultural training was challenging indeed.

**Table 11: Challenges facing during accessing agricultural information**

Categories	Frequency (F)	Percentage (%)
Farmers' Associations lack Good Leadership	55	63.20
Unknown sources of information.	22	25.30
Lack of Library and Information Centre	54	62.10
Lack of Agricultural Demonstrations	22	25.30
Lack of Agricultural Extension Officers	70	83.00
Language barrier in accessing information	34	39.10
A limited number of Seminars, Workshops and Training Programmers	63	72.40
Poor network infrastructure	1	1.10

Source: field 2021

### 3.12 Preferred sources of agricultural information by smallholder sugarcane farmers

The respondents were asked about their preferred sources of agricultural information for easy and timely accessibility, the majority (89.70%) of the respondents sought agricultural information from their fellow experienced farmers, (55.20%) of respondents indicated that agricultural extension officers used as measures to improve sugarcane production

**Table 12: Proposed measure for accessing agriculture information to improve sugarcane production**

Categories	Frequency (F)	Percentage (%)
Using agriculture officers	48	55.20
Knowledgeable farmers.	78	89.70
Search (www).	25	28.70
Commercial and agriculture agencies	14	16.10
Mass media.	44	50.60
Local government.	17	19.50
Telecentres.	2	2.30
Research institutions.	28	32.20
Self-experiences	1	1.10

Source: field 2021

### 3.13 Suggestions to the agricultural information providers for the improvement of agriculture information accessibility to the smallholder sugarcane farmers in the COVID-19 pandemic

The respondents were asked about their suggestions, which could bring easy accessibility of agricultural information in the COVID-19 pandemic. The majority (75.00%) of the respondents said that Increasing more Radio programs on agriculture is due to COVID-19. 63.20% of the respondents argue that the dissemination of agricultural information

through mobile phones due to social distancing will be of good help. 57.70% said that recruiting more agricultural extension officers could improve information accessibility.

The study found that recruitment of extension officers, ant corruption association leaders, and Provision of Seminars, Workshops, and Training Programs was the main suggestion provided by smallholder farmers in sugarcane production to the government to ensure they provide these services to them to shift up the production of sugarcane to small scale farmers.

**Table 13:** Suggestion to the government on the improvement of agriculture information to smallholder sugarcane producers

Categories	Frequency (F)	Percentage (%)
Recruitment of extension officers	50	57.50
Increasing more Radio programs on agriculture due to COVID-19	66	75.00
Dissemination of agricultural information through mobile phone due to social distancing.	55	63.20
Association leaders should be ant corruption	19	22.10
Transparence of market information concerning sucrose and tons of sugar cane	9	10.50
Introducing of Library and Information Centre.	4	4.70
Provision of Seminars, Workshops and Training Programmers	40	45.90
Government conduct sugar cane exhibition for small farmers	4	4.70
Group's formation to ensure easily information dissemination	2	2.30

Source: field 2021

## 4. DISCUSSION

### 4.1. The farmers' agricultural information needed for sugarcane production

The study found out that agricultural information smallholder farmers needed for sugarcane farming was information on markets 84.00%, sugarcane payment per ton 74.00%, and information on the harvest and fertilizers application 72.00%. The study was conducted by (Msomba et al. 2021) who found out farmers were much interested in pests and diseases management, fertilizers management, crops varieties, and marketing information. Adio et al. 2016 observed that farmers mostly prefer to get agricultural information on improved varieties, use of fertilizer, crop management, and use of pest management, the study conducted by (Diemer et al. 2020) uncovered that most of the smallholder farmers searched for information on pest management and crops varieties (Mohanakumara et al. 2017). Analyzed Farmers' Information Needs and found out that most farmers need information for crops production.

### 4.2. The sources of agricultural information used by smallholder farmers for sugarcane production

The study found out that the main source of agricultural information was fellow farmers and agricultural information officers and Radio. This study agrees with the study conducted by (Mtega 2018) in Tanzania found out that radio and extension officers were major sources of agricultural information among smallholder farmers. The study conducted on the influence of agricultural information sources on production by (Anaglo et al. 2020) identified the following, fellow farmers, radio, and extension officers' main sources of agricultural information to farmers. The study conducted by (Parmar et al. 2019) identified the mobile phone as the major source of agricultural information accessibility to smallholder farmers. (Mubofu and Malekani 2020). Argue that most farmers use extension officers as their trustworthy source of agricultural information.

### 4.3. The ways used to disseminate agriculture information to smallholder farmers for sugarcane production before and after the COVID-19 pandemic

The study found out that, before the outbreak of the COVID-19 pandemic, the majority (89.70%) accessed agricultural information from their fellow farmers, (71.30%) of respondents said that agricultural extension officer was their preferred source. This study agrees with (Mdee et al. 2021) and (Saleh 2020) who uncovered those smallholder farmers mainly depended on informal channels such as their fellow farmers to obtain information, (Nyasimi et al. 2017) found that mobile phone was the major way of disseminating agricultural information to farmers. The study found out that after the outbreak of COVID-19 the radio (70.00%) became the major source of information and agricultural extension officer (67.00%) (Erjavec and Manfreda 2021) found out that COVID-19 changed and communication tradition and most farmers obtained the agricultural information through Phone calls, Television, and Radio, (Nchanji et al. 2021) found out that most of the information providers supply their information through the digital means as the impact of COVID-19 outbreak.

### 4.4. The challenges facing smallholder sugarcane farmers in gathering and using agricultural Information

The study found out that the majority (83.00%) of the smallholder sugarcane farmers revealed that a limited number of agricultural extension officers was the main challenge, (72.40%) of the respondents said that a limited number of seminar-



workshop and agricultural training. (Adetimehin et al. 2018) in Nigeria revealed that most farmers could not access the agricultural information because of Limited agricultural extension services; Agricultural information on media is aired at odd hours, limited agricultural training, limited information services. (Anaglo et al. 2020) found out poor ICT facilities are the main challenge to access to agricultural information. (Aldosari et al. 2019) found out that most agricultural information is electronic media and farmers have limited knowledge on using ICT facilities. (Khanna and Kaur 2019) found out that lack of awareness was the major challenge to their information persuasion.

## 5. CONCLUSION AND RECOMMENDATIONS

Based on the results, agricultural information accessibility is essential to smallholder farmers' sugarcane production; also agricultural extension officers still play an important role in farmers' productivity even amid the COVID-19 pandemic. In addition, smallholder farmers still use experienced farmers to access agricultural information; moreover, the COVID-19 pandemic has caused the shift of agricultural information inquiring from the agricultural extension officers as the main source to Radio where more farmers listen to Radio to obtain agricultural information. The study recommends that the information providers should use Radio for dissemination of agricultural information to smallholder farmers, as the results of COVID-19 pandemic with limited interpersonal communication as the results of COVID-19 prevention protocols and also the government need to recruit more agricultural extension officer since they are the reliable source of agricultural information to smallholder farmer. This recommendation contradicts the preceding recommendation on maintenance of social distance through radio communication since extension officers will have face-to-face communication as they offer advisory services.

### COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly used products in our area of research and country. There is no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by the personal efforts of the authors.

## REFERENCES

1. Adetimehin, OD, Okunlola, JO, & Owolabi, KE. Utilization of agricultural information and knowledge for improved production by rice farmers in Ondo State, Nigeria. *Journal of Rural Social Sciences*. 2018. 33(1). 76-100.
2. Adio, Emmanuel Olorunnishola, Abu, Yusufu, Yusuf, Sheriff K, & Nansoh, Shehu. Use of agricultural information sources and services by farmers for improving productivity in Kwara State. *Library Philosophy and Practice (e-journal)*. 2016. 1456(1-16).
3. Aldosari, Fahad, Al Shunaifi, Mohamed Saleh, Ullah, Muhammad Amjad, Muddassir, Muhammad, & Noor, Mehmood Ali. Farmers' perceptions regarding the use of information and communication technology (ICT) in Khyber Pakhtunkhwa, Northern Pakistan. *Journal of the Saudi Society of Agricultural Sciences*. 2019. 18(2), 211-217.
4. Anaglo, JN, Antwi, G, Manteaw, SA, & Kwapong, NA. Influence of Agricultural Information Sources on The Practices and Livelihood Outcomes of Cassava Farmers in Eastern Region of Ghana. 2020.
5. Braun, Virginia, & Clarke, Victoria. To saturate or not to saturate? Questioning data saturation as a useful concept for thematic analysis and sample-size rationales. *Qualitative research in sport, exercise and health*. 2021. 13(2), 201-216.
6. Diemer, Nikola, Staudacher, Philipp, Atuhaire, Aggrey, Fuhrmann, Samuel, & Inauen, Jennifer. Smallholder farmers' information behavior differs for organic versus conventional pest management strategies: A qualitative study in Uganda. *Journal of cleaner production*. 2020. 257, 120465.
7. Elly, Tumsifu, & Silayo, Ephraem Epafra. Agricultural information needs and sources of the rural farmers in Tanzania: A case of Iringa rural district. *Library review*. 2013.
8. Erjavec, Jure, & Manfreda, Anton. Online shopping adoption during COVID-19 and social isolation: Extending the UTAUT model with herd behavior. *Journal of Retailing and Consumer Services*, 102867. 2021.
9. Heale, Roberta, & Twycross, Alison. Validity and reliability in quantitative studies. *Evidence-based nursing*. 2015. 18(3), 66-67.
10. Khanna, Abhishek, & Kaur, Sanmeet. Evolution of Internet of Things (IoT) and its significant impact in the field of Precision Agriculture. *Computers and electronics in agriculture*. 2019. 157, 218-231.
11. Kilkenney, Monique F, Kim, Joosup, Andrew, Nadine E, Sundararajan, Vijaya, Thrift, Amanda G, Katzenellenbogen, Judith M, Anderson, Phil. Maximizing data value and avoiding data waste: a validation study in stroke research. *Medical Journal of Australia*. 2019. 210(1), 27-31.

12. Kothari, C. Research methodology methods and techniques by CR Kothari. Published by New Age International (P) Ltd., Publishers. 2017. 91.
13. Limbu, FL, & Mashindano, OJN. The agricultural sector and poverty in Tanzania: The impact and future of the reform process. *The Nyerere Legacy and Economic Policy Making in Tanzania*. 2002. 41-71.
14. Martiniello, Giuliano, & Azambuja, Ricardo. Contracting sugarcane farming in global agricultural value chains in eastern Africa: Debates, dynamics, and struggles. *Agrarian South: Journal of Political Economy*. 2019. 8(1-2), 208-231.
15. Mdee, Anna, Ofori, Alesia, Chasukwa, Michael, & Manda, Simon. Neither sustainable nor inclusive: A political economy of agricultural policy and livelihoods in Malawi, Tanzania, and Zambia. *The Journal of Peasant Studies*. 2021. 48(6), 1260-1283.
16. Mihas, Paul. (2019). Qualitative data analysis Oxford research encyclopedia of education.
17. Mohanakumara, V, Biradar, Nagaratna, Mulla, Javid, & Potdar, Milind. Analysis of Farmers' Information Needs on Fodder Production. *Journal of Human Ecology*. 2017. 58(3), 162-168.
18. Somba, Bahati H, Ndaki, Patrick M, & Nassary, Eliakira K. Assessing Adaptation measures to climate change applied by out-growers for the sustainable production of sugarcane in Tanzania. *Journal of Global Agriculture and Ecology*. 2021. 12(1), 18-29.
19. Mtega, Wulystan Pius. (2018). The usage of radio and television as agricultural knowledge sources: The case of farmers in Morogoro region of Tanzania. 2018.
20. Mubofu, Christian, & Malekani, AW. Agricultural information sources, channels, and strategies for sharing agricultural research findings among farmers in Iringa district in Tanzania. *Library Philosophy and Practice*. 2020. 1-14.
21. Nchanji, Eileen Bogweh, Lutomia, Cosmas Kweyu, Chirwa, Rowland, Templer, Noel, Rubyogo, Jean Claude, & Onyango, Patricia. Immediate impacts of COVID-19 pandemic on bean value chain in selected countries in sub-Saharan Africa. *Agricultural systems*. 2021. 188, 103034.
22. Ndimbwa, Tumpe, Ndumbaro, Faraja, & Mwantimwa, Kelefa. Delivery mechanisms of agricultural information and knowledge to smallholder farmers in Tanzania: A meta-analysis study. *University of Dar es Salaam Library Journal*. 2019. 14(2), 87-98.
23. Nyasimi, Mary, Kimeli, Philip, Sayula, George, Radeny, Maren, Kinyangi, James, & Mungai, Catherine. Adoption and dissemination pathways for climate-smart agriculture technologies and practices for climate-resilient livelihoods in Lushoto, Northeast Tanzania. *Climate*. 2017. 5(3), 63.
24. Odongo, Dorine. (2014). Agricultural information access among smallholder farmers: Comparative assessment of peri-urban and rural settings in Kenya. *Agricultural Information Worldwide*. 2014. 6, 133-137.
25. Okike, Benedict Ifeanyichukwu. Information dissemination in an era of a pandemic (COVID-19): librarians' role. *Library Hi Tech News*. 2020.
26. Ortiz-Crespo, Berta, Steinke, Jonathan, Quirós, Carlos F, van de Gevel, Jeske, Daudi, Happy, Gaspar Mgimiloko, Majuto, & van Etten, Jacob. User-centered design of a digital advisory service: enhancing public agricultural extension for sustainable intensification in Tanzania. *International journal of agricultural sustainability*. 2021. 19(5-6), 566-582.
27. Parmar, Ishwar S, Soni, Peeyush, Kuwornu, John KM, & Salin, Krishna R. Evaluating farmers' access to agricultural information: Evidence from the semi-arid region of Rajasthan state, India. *Agriculture*. 2019. 9(3), 60.
28. Saenko, Valerii, & Sesabo, Jennifer Kasanda. Main Issues of the Contract Farming Structure in Sugar Cane Farming. Perspectives of Smallholder Farmers in Kilombero Region in Tanzania. *Sharing Society*. 2019. 79.
29. Saleh, Musa. Impact of COVID-19 on Tanzania's political economy. *Int. J. Adv. Stud. Soc. Sci. Innov*, 1. 2020.
30. Saunders, Mark, Lewis, PHILIP, & Thornhill, ADRIAN. Research methods. Business Students 4th edition Pearson Education Limited, England. 2007.
31. Sulle, Emmanuel. Social differentiation and the politics of land: Sugar cane outgrowing in Kilombero, Tanzania. *Journal of Southern African Studies*. 2017. 43(3), 517-533.
32. Tanzania, NBS. 2012 population and housing census. Population Distribution by Administrative Areas. 2013.
33. Tanzania, NBS. Integrated Labour Force Survey 2014, Analytical Report. Dar es Salaam: National Bureau of Statistics, Ministry of Finance. 2015. Have only citations in the revised main text in the reference list