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## RESEARCH ARTICLE



# Potential of Mobile-Based Apps Online Platforms in Fast-Tracking Access of Agriculture Information

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## Abstract

**Objectives:** This paper report the potential of online mobile phone-based platforms in fast-tracking access of agricultural information to farmers, with a case study of Arusha, Tanzania. **Method:** We used the questionnaire-based and focus group discussion methods and a total of 156 respondents were randomly selected for data collection. **Findings:** The results showed that 77.6% of respondents possess smartphones and 32.7% of them use internet-based platforms to search for agriculture information which usually is not applicable or specific in their local Arusha context. Such finding raised a need for developing internet-based platform for accessing agricultural information by farmers for use in their local context. Thus, the same respondents were assessed for their readiness to use a mobile-based agricultural app if developed. The results indicated that 80% of the respondents were willing and would use the app. **Novelty:** The paper demonstrated how mobile phone-based apps can be used to quicken accessibility of agricultural information in a local-based, context-specific location.

**Keywords:** Mobile Apps; Agriculture Information; Online Platform; Smartphones; Information Access

## 1 Introduction

Agriculture is a dominant activity globally as without which, food would not be produced, consequently depriving human development<sup>(1)</sup>. It is a major source of income and industrial raw materials in many countries worldwide<sup>(2)</sup>. In Tanzania, agriculture employs over 80% of the total population and accounts for 56% of the Gross Domestic Product (GDP) and approximately 60% of earnings through exports<sup>(3)</sup>. Due to its role in food and incomes, need for correct information such as the best methods of cultivating crops, ways of keeping livestock, weather predictions, soil characteristics, high-quality seeds, what to cultivate, when to cultivate, where to cultivate, and the best markets for selling agricultural products is very significant in the development of agriculture<sup>(4,5)</sup>. Such kind of agricultural information helps the farmers on making appropriate decisions and select proper procedures for farming hence contributing

to agriculture development<sup>(6)</sup>.

Agricultural information in developing countries is commonly shared with farmers through extension services, local social networks, and cooperative organizations<sup>(7,8)</sup>. However, there exists a significant gap as when such information goes through those agents, it reaches users as secondary or passive and that can affect the quality of the intended message by the developer. For instance, in Tanzania, there exist a challenge in getting specific agricultural information by farmers especially about the time it takes from the source to farmers and correctness in terms of the source's intention. Some of the common methods used by agriculturalists to access agriculture information include radio, television, newspaper, extension officers and farmers exchange information to themselves<sup>(8,9)</sup>. These methods are effective but comparatively user-unfriendly as farmers do not own them. Using these methods involves several steps to deliver the information from the source to users, example there must be time to receive, process, interpret and report the information to the media as a result they are not time-efficient, the period for broadcasting information concerning agriculture may not be appropriate for users who might be going through family problems and not demand-driven<sup>(10)</sup>. The linkages between farmers, extension officers, and researchers need to be strengthened through the application of mobile-based apps to improve the current means of accessing agriculture information<sup>(11)</sup>.

The mobile revolution has the potential of improving people's livelihood through agriculture<sup>(5,12)</sup>. However, there are insufficient mobile applications tailored to improve access to agriculture information<sup>(13,14)</sup>. Currently, there are over 43 million mobile subscribers in Tanzania<sup>(15)</sup>, in which about 53% of these subscribers have access to the internet<sup>(16)</sup>. With this massive usage of mobile communication and internet penetration, this study has the potential of positively impacting the way of accessing agricultural information.

This study depicts the assessment of whether using an online platform through agriculture apps could be a proper way of improving access to agriculture information. Furthermore, this paper emphasized the importance of mobile-based apps in increasing the efficiency of farmers because mobile phones are easily accessible to individuals residing in rural areas, especially farmers with low incomes. It has become obvious that farmers are eager and receptive to use mobile application platforms for information access regarding agriculture<sup>(13,17)</sup>. Nationwide, according to the Tanzania Communications Regulatory Authority (TCRA) annual report, the percentage of small-scale farmers with mobile phones in Tanzania is 66%<sup>(16)</sup>. Thus, this work was conducted to identify the proportion of the study population with mobile phones which are specifically smartphones, and also assess willingness whether or not a development of a mobile-based online platform will be a strong tool they can use for accessing agricultural information.

## 2 Methodology

The questionnaire-based and focus group discussion methods were used for this research survey. These approaches were used because it allows farmers to provide their views and experience all these to their language<sup>(18)</sup>. Also, it offers the opportunity to study participants involved in interaction that is focused on understandings and attitudes. Both techniques were conducted among different groups of farmers and agriculture experts, involving extension officers, and farmers working in the fields. The responses from all individuals who participated were open and anonymous<sup>(19)</sup>. The data obtained from the respondents of the questionnaire were used to measure the necessity of whether using an online platform through agriculture apps could be a proper way of improving access to agricultural information. The questions used in all sections were independent. Dependent variables were used to evaluate if respondents needed a mobile application platform to access agricultural information. A total of 16 focus groups was created each consisting at most 10 participants. Each group took an average of 37 minutes session for discussion of the topics.

In this survey study, the sample size applied was found out by Yamane's formula<sup>(20)</sup> as shown below. The result was obtained after calculation based on a total population of 49,000 farmers, a precision level of 0.08, and a 95% confidence level. The sample size was found to be 156 individuals. Random sampling was applied for both gender males and females, who were respondents to the questionnaire<sup>(21)</sup>. Finally, the data collected from respondents were analyzed by tableau software<sup>(22)</sup>.

Yamane's Formula:

$$n = \frac{N}{1 + N(e)^2}$$

Where: n = The sample size

N = The population size

e = Level of precision

This survey study took place in Arusha, Tanzania, and was preferred because it's found in the zone counted as one of the best agriculture production zones<sup>(23)</sup>. Furthermore, Arusha is one of the most developed regions in Information and

Communication Technology (ICT) infrastructures and has a vast number of mobile users as well as internet subscribers<sup>(24)</sup>. In addition, there are several agriculture institutions such as Tanzania Agricultural Research Institute (TARI), Selian agricultural research institute, and Tengeru agricultural college that provide advice on agricultural activities to the farmers, education on different agriculture methods to apply.

### 3 Results and Discussion

#### 3.1 Demographic Attributes of All Participating Individuals

Out of 156 of all respondents who participated, 50.6% were males and 49.4% were females. The majority of participants were between the age group of 30 to 39 years this was approximately 28.9% of all respondents. Table 1. Illustrates the demographic properties of all respondents who participated in this research study.

**Table 1.** Demographic Properties of All Respondents

Requirement	Types of Replies	Respondents (n)	Percentage (%)
Gender	Male	79	50.6
	Female	77	49.4
	Total = 156		100%
Age (in Years)	Below 20	3	1.9
	20 - 29	40	25.6
	30 - 39	45	28.9
	40 - 49	43	27.6
	50 - 59	23	14.7
	60 and above	2	1.3
	Total = 156		100%
Education	Non-formal education	5	3.2
	Primary education	29	18.6
	Secondary education	64	41
	Tertiary education	58	37.2
	Total = 156		100%

#### 3.2 Mobile Possession Distribution

More than three-quarters (77.6%) of all respondents own smart-phone as can be seen in Figure 1. Such a finding implies that farmers possess the necessary mobile infrastructure needed for the internet-based information delivery process. In other countries where such a higher proportion of smartphone users exist, experts have designed mobile-based online platforms for solving agriculturally based problems. For instance, the Criyagen company in Bengaluru developed Agri-app as a tool to provide information on crop production and protection, also, offering assistance from the experts via calls and chat. Furthermore, The app allows farmers to access information related to agriculture from sowing to harvesting<sup>(25,26)</sup>. Therefore, empowering users to attain high-efficiency technology-enabled crop production and marketing of the agriculture produce. In Canada, experts developed a mobile-based platform that collects information of crops and monitoring crops specifically wheat, peas and canola<sup>(27)</sup>. The developed platform can measure the temperature of the crops, height and can collect images of the crops for investigation.

In India, experts developed an E-Agro mobile app that provides expert support to farmers on issues related to the cultivation of crops, diseases, manures, crop recommendations based on soil type and weather<sup>(28)</sup>. The app focuses on bringing modern agricultural practices to farmers located in rural areas. Furthermore, the Agriculture News Network (ANN) developed the Kisan Yojana app that suggests crops, fertilizers and provides agriculture information concerning the schemes and profit provided by the Indian government to the farmers<sup>(26,29)</sup>. Figure 1 below portrayed the distribution of mobile ownership.

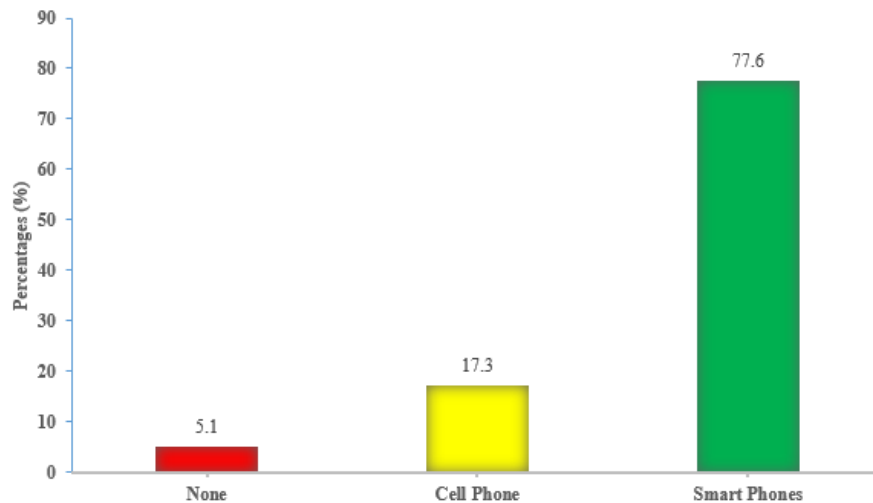


Fig 1. Mobile Possession Distribution

### 3.3 Sources of Agricultural Information

In this part, the farmers were accepted to select several sources of agriculture information they always use to seek agricultural information. Nearly one-third (32.7%) of the respondents opt to search for agriculture information from the internet. These results indicate that despite the existence of other sources of agriculture information still, some of the farmers opt to search for agriculture information from the internet. Also, during group discussion, the participants said that they use the internet for searching agriculture information but most of the time they get information that usually is not applicable or specific in their local Arusha context. This implies that if experts develop an organized online platform through agriculture apps, then the majority of farmers will be able to utilize the platform for accessing specific agriculture information which will be applicable in their environment. For example, more than 53% of the Indians retrieved the internet from their mobile phones, this encourages experts to develop mobile-based platforms for solving agriculturally based problems<sup>(26,28,29)</sup>. Also, a world bank report<sup>(30)</sup> suggests that it is important for farmers to have agricultural mobile apps that can facilitate the process of accessing agriculture information through reliable online sources. In addition to this, studies conducted in 2014 and 2020 revealed that farmers seek agriculture information via the internet hence they need the right tool i.e., mobile-based apps to ease the process of accessing agriculture information<sup>(13,31)</sup>.

Also, Figure 2 indicates that other respondents preferred to exchange agriculture information within themselves and also via direct contact with extension officers. Such finding implies that still, the methods used by some of the farmers are ineffective because it takes time for agriculture information to spread from farmer to farmer, and also original information can be altered during the process of passing it from the first person to the last one, also, agriculture information can reach to users as secondary or passive and that can affect the quality of the intended message from the source. This finding is related to the 2017 FAO report which revealed that farmers get information through extension officers and farmer to farmer exchange<sup>(32)</sup>.

Moreover, Figure 2 shows that 3.2% of farmers rely on social media for agricultural news. Also, during a focus group discussion those who use social media said that not only do they seek agriculture information on social media but also, they use it as an online market for their agricultural products. This finding indicates that although a small number of the farmers use social media as one of the online platforms still there is a need for a tool like a reliable online platform that can provide agriculture information to the majority of the farmers. The presence of a reliable online source through agriculture apps can help the majority of farmers to get agriculture information easily and hence farmers can fully utilize social media for accessing agriculture information. For instance, the study conducted in Kenya assesses the impact of social media on farmers and they recommend that agriculture information centres like agriculture online platforms need to be created so that farmers can fully utilize social media for accessing agriculture information<sup>(33)</sup>. In addition to this, the research study conducted in 2015 suggested that it is important for an information system for agriculture to be built based on mass media like the internet and mobile apps<sup>(34)</sup>. Furthermore, localization and the indigenous language of agriculturalists are matters to be linked to these systems. The findings indicated that there is a need for farmers to get appropriate information related to their crops and farming methods. More precisely, agricultural methods require timely, precise, and correct information to be delivered to farmers to facilitate

informed decisions on several issues such as the management of farm fields, implementation of improved systems of production, and seizing opportunities that exist in various markets<sup>(5,13,35)</sup>. Figure 2 portrays the Sources of Agriculture Information.

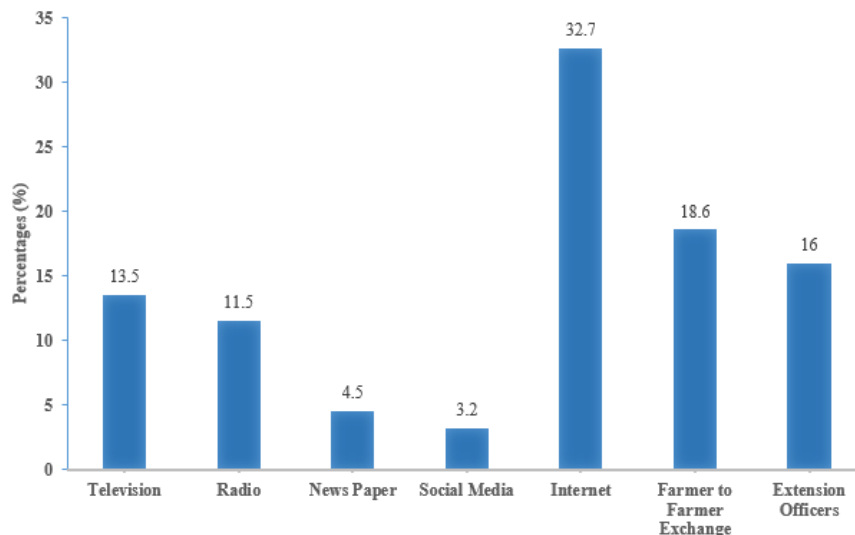


Fig 2. Sources of Agriculture Information

### 3.4 Views on Accessing Agricultural Information Online

In this section, all respondents were welcome to give their views on what they think about accessing agriculture information through an online platform. All respondents were allowed to answer more than one question in this section. About 80% of the respondents claim that they will prefer to retrieve agriculture information via an online platform while 75.6% responded that they will appreciate it if experts will develop agriculture mobile apps to help them access agriculture information. Such finding indicates that online platforms through agricultural mobile apps can be a strong tool for farmers to get access to agriculture information especially if such agriculture apps are availed online through an organized platform, farmers would use them frequently to ease the process of accessing agriculture information. For instance, a study conducted in Kenya reveals that the majority of farmers seek agriculture information through different online sources and therefore farmers need a tool that will help them to obtain agriculture information from online sources easily<sup>(33)</sup>. This finding holds a different view from the study that shows that farmers were not bothered to use online sources to search for agriculture information they need. Instead, they were concerned about the price of fertilizers, insecticides, seeds, and transportation. Also, the study claim that farmers need accessibility and fair cost of fertilizers, seeds as well as irrigation<sup>(36)</sup>. Table 2 shows different views on accessing agriculture information online.

Table 2. Views on Accessing Agriculture Information Online

Requirement	Types of replies	Respondents (n)	Percentage (%)
I search for various agriculture information via online sources	Yes	83	53.2
	No	73	46.8
	Total = 156		100%
I think I can retrieve agriculture information via an online platform	Yes	125	80.1
	No	31	19.9
	Total = 156		100%
I would appreciate having agriculture mobile apps for accessing agriculture information	Yes	118	75.6
	No	38	24.4
	Total = 156		100%

### 3.5 Views on Mobile Application Platform as a Solution

This study aims to enrich access to agriculture information through the mobile application platform. Respondents (farmers) were allowed to provide their opinion on this matter whereby more than 80% of the respondents agree that the mobile application platform would be a solution. This finding implies that farmers have a positive attitude towards this approach of using agriculture mobile apps. This is because the farmers need a tool that will facilitate access to agriculture information as well as provide information which is applicable or specific in their local environment context<sup>(37)</sup>. For instance, a study conducted in Australia shows that farmers are eager to have an online platform that can ease access to agriculture information. In addition, the study indicates that Australian farmers have a positive attitude towards using agricultural apps because, they believe the platform will increase efficiency and help them make more informed decisions<sup>(13)</sup>. Furthermore, a study conducted in Indonesia about the use of the online platform through the mobile-based app to motivate farmers to share agriculture information online during the covid 19 pandemic, indicates that farmers are keen to have an online platform for them to share agriculture information especially during the lockdown as well as the marketing of agricultural products<sup>(38)</sup>. Figure 3 below depicts the views on the online platform as a solution.

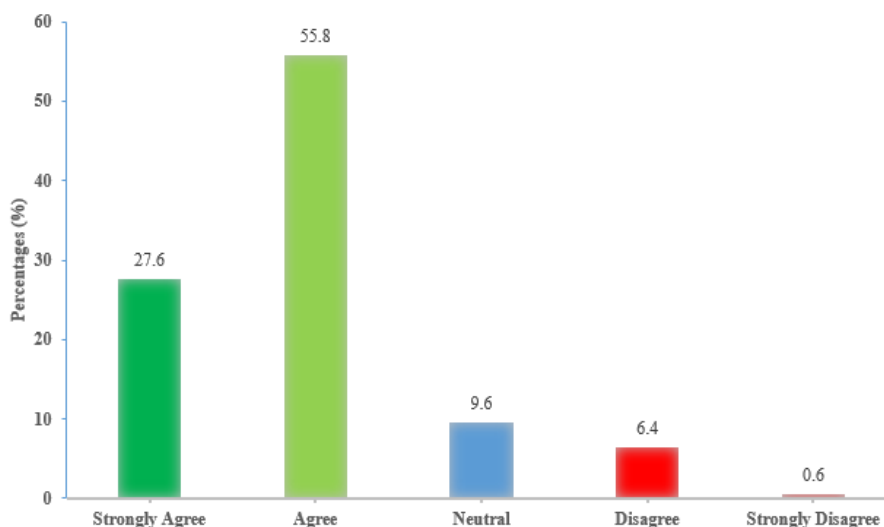


Fig 3. Views on the Online Platform as a Solution

## 4 Conclusion and Recommendation

This study concludes that the development of online platforms through mobile-based apps will be a strong tool that will provide a high possibility to improve the current agriculture information sharing process. Also, agricultural mobile-based apps have full potential to enrich access to agriculture information, this is because the majority of farmers 77.6% have smartphones and already 32.7% are currently using internet-based platforms to search for agricultural-based information.

Furthermore, it has been found that most farmers about 80% have a positive attitude towards the approach of using the online platform through agriculture mobile apps as a way forward towards enriching access to agriculture information. This is because farmers need agriculture information and some of them go further and seek such information through online sources like the internet, and social media so that they can fulfil their needs. Hence this study realizes that if experts develop a reliable online platform through agriculture apps, then the majority of the farmers will fully utilize such platforms for accessing agriculture information.

Therefore, due to the advancement of technology, this study realizes that it is essential for farmers to have agriculture apps as a major tool to facilitate the process of retrieving agriculture information. The online platform through mobile-based apps will be a tool of high benefit as a reliable source of agriculture information which is also cheap and convenient for the users of such platform.

Forthcoming research studies should concentrate on developing an online platform through agriculture apps so that farmers can use it to get immediate feedback from the information sources such as universities, research institutes, and extension officers hence enriching access to agriculture information.



## Study Limitation

This study takes into consideration only individuals who were mentally fit and willing to share their views and opinion in this study. Moreover, the information has been collected within the Arusha region only which is located in northern Tanzania.

## References

- 1) FAO F and AO of the U. The future of food and agriculture: trends and challenges . 2017. Available from: <http://www.fao.org/3/a-i6583e.pdf>.
- 2) Mwitwa M. A framework for enhancing sustainable access and use of agricultural market information by small-scale farmers in Tanzania. 2018. Available from: <http://dspace.nm-aist.ac.tz/handle/20.500.12479/307>.
- 3) Chongela J. Contribution of Agriculture Sector to the Tanzanian Economy. *American Journal of Research Communication [Internet]*. 2015;3(7):58.
- 4) Stefano LA, Hendriks SL, Stilwell C, Morris C. Printed information needs of small-scale organic farmers in KwaZulu-Natal. *Libri*. 2015;55(1):56–66. Available from: <https://www.degruyter.com/document/doi/10.1515/LIBR.2005.56/html>.
- 5) Chhachhar AR, Chen C, Jin J. Mobile Phone Impact on Agriculture and Price Information among Farmers. *Indian Journal of Science and Technology*. 2016;9(39). Available from: <https://dx.doi.org/10.17485/ijst/2016/v9i39/98432>.
- 6) Harris DR, Fuller DQ, Shekara C, Balasubramani N, Sharma R, Shukla C, et al. Farmer’s Handbook on Basic Agriculture A Holistic Perspective of Scientific Agriculture. Desai Fruits & Vegetables Pvt Ltd Navsari. Gujarat India. 2016. Available from: <https://www.manage.gov.in/publications/farmerbook.pdf>.
- 7) Vidanapathirana NP. Agricultural Information Systems and their Applications for Development of Agriculture and Rural Community, a Review Study. The 35th Information Systems Research Seminar in Scandinavia-IRIS. *Internet*]. 2000;p. 1–14.
- 8) Prasetya. Access and use of mass media by small-scale farmers in accessing agricultural information for poverty alleviation in Tanzania. *Pontificia Universidad Catolica del Peru*. 2014;8(33):44–44.
- 9) Mtega WP. The Usage of Radio and Television as Agricultural Knowledge Sources: The Case of Farmers in Morogoro Region of Tanzania. *International Journal of Education and Development using Information and Communication Technology*. 2018;14(3):252–266. Available from: <http://files.eric.ed.gov/fulltext/EJ1201501.pdf>.
- 10) Mtega WP. Understanding the knowledge sharing process among rural communities in Tanzania: A review of selected studies. *Knowledge Management and E-Learning*. 2013;5(2):205–222. Available from: <http://kml-journal.org/ojs/index.php/online-publication/article/view/204/0>.
- 11) Sanga C, Mussa M, Tumbo S, Mlozi MR, Muhichel L, Haug R. On the Development of the Mobile based Agricultural Extension System in Tanzania : A Technological Perspective. *International Journal of Computing and ICT Research*. 2014;8(1):49–67.
- 12) Chhachhar AR, Memon B, and. Challenges in Usage of Mobile Phone Regarding Agricultural and Marketing Information among Farmers in Sindh, Pakistan. *Indian Journal of Science and Technology*. 2019;12(6):1–9. Available from: <https://dx.doi.org/10.17485/ijst/2019/v12i6/141300>.
- 13) Schulz P, Prior J, Kahn L, Hinch G. Exploring the role of smartphone apps for livestock farmers: data management, extension and informed decision making. *The Journal of Agricultural Education and Extension*. 2021;p. 1–22. Available from: <https://dx.doi.org/10.1080/1389224x.2021.1910524>.
- 14) Nirojan. Smart Cultivation Partner Mobile Application ( Android ) Service to Increase Cultivation and Sales. *International Journal of Scientific and Research Publications*. 2017;7(12):111–117. Available from: <http://www.ijr.org/research-paper-1217.php?rp=P727009>.
- 15) TCRA Report October - December 2020. 2020. Available from: [https://www.plm.automation.siemens.com/legacy/video/Teamcenter2008\\_Web\\_English/PublishFolder/collateral/RA\\_WP.pdf](https://www.plm.automation.siemens.com/legacy/video/Teamcenter2008_Web_English/PublishFolder/collateral/RA_WP.pdf).
- 16) TCRA. January-March 2019 Operators. 2019.
- 17) Masuki K, Mowo KR, Tnui J, Mogoi J, Adera J, T J. Role of mobile phones in improving communication and information delivery for agricultural development : Lessons from South Western Uganda. *ICT and Development - Research Voices from Africa International Federation for Information Processing (IFIP), Technical Commission 9 - Relationship Between Computers and. International Federation for Information Processing*. 2010;p. 1–13. Available from: <https://www.mak.ac.ug/documents/IFIP/RoleofMobilePhonesAgriculture.pdf>.
- 18) Blank CA. SAGE handbook of mixed methods in social & behavioral research. *Journal of Music Therapy*. 2013;50(4):321–325.
- 19) Cohen L, Manion L, Morrison K, Publishers R. *Book Reviews Research Methods in Education*. 2000.
- 20) Gauhati UM. Chapter 2 Determination of appropriate Sample Size. *International Journal of Applied Mathematics and Statistical Sciences*. 2013.
- 21) Micah A. Sampling Techniques & Determination Of Sample Size In Applied Statistics Research. *Inwood Magazine*. 2014;2(96):32–35.
- 22) Zorrilla S. Data Analytics with Tableau: The Trend Lines Models. *SSRN Electronic Journal*. 2018.
- 23) Ngirwa CC, Ally M. An ICT Based Solution for Pesticides Authenticity Verification: A Case of Tanzania. *Journal of Information Systems Engineering & Management*. 2018;3(4). Available from: <https://dx.doi.org/10.20897/jisem/3938>.
- 24) *Tera Report on Internet and Data Services in Tanzania A Supply-Side Survey*. 2010;p. 1–36.
- 25) Kashiwazaki D, Ubipal E. Emangiopericytoma With Marked E Xtramedullary Growth : Case Report. *C Ase R Eport*. 2019;61(6).
- 26) Barh A, Balakrishnan M. Smart phone applications: Role in agri- information dissemination. *Agricultural Reviews*. 2018;38(01). Available from: <https://dx.doi.org/10.18805/ag.r-1730>.
- 27) Pour MK, Fotouhi R, Hucl P, Zhang Q. Development of a Mobile Platform for Field-Based High-Throughput Wheat Phenotyping. *Remote Sensing*. 2021;13(8):1560. Available from: <https://dx.doi.org/10.3390/rs13081560>.
- 28) Sharma S, Patodkar V, Simant S, Shah C, E-Agro. 2015. Available from: <http://pnrsolution.org/Datacenter/Vol3/Issue3/61.pdf>.
- 29) Ravichandran G, Koteeshwari RS. Agricultural crop predictor and advisor using ANN for smartphones. *2016 International Conference on Emerging Trends in Engineering, Technology and Science (ICETETS)*. 2016. Available from: <https://ieeexplore.ieee.org/document/7603053>.
- 30) Qiang CZ, Kuek SC, Dymond A, Esselaar S. Mobile Applications for Agriculture and Rural Development. 2016. Available from: <https://openknowledge.worldbank.org/handle/10986/21892#:~:text=For%20both%20agricultural%20supply%20and>.
- 31) Stenberg P. Broadband Internet Use by Economic Actors in Rural Regions. 2011. Available from: [https://www.researchgate.net/publication/254457518\\_Broadband\\_Internet\\_Use\\_by\\_Economic\\_Actors\\_in\\_Rural\\_Regions](https://www.researchgate.net/publication/254457518_Broadband_Internet_Use_by_Economic_Actors_in_Rural_Regions).
- 32) FAO. Reducing rural poverty through farmer-to-farmer exchange. 2017. Available from: <http://www.fao.org/3/i5862e/i5862e.pdf>.
- 33) Kipkurgat T, Onyiego M, Chemwaina S. Impact of Social Media on Agricultural Extension in Kenya: a Case of Kesses District. *International Journal of Agricultural Extension and Rural Development Studies*. 2016;3(1):30–36.
- 34) Jain L, Kumar H, Singla RK. Assessing Mobile Technology Usage for Knowledge Dissemination among Farmers in Punjab. *Information Technology for Development*. 2015;21(4):668–676. Available from: <https://dx.doi.org/10.1080/02681102.2013.874325>.



- 35) Mitchell S, Weersink A, Erickson B. Adoption of precision agriculture technologies in Ontario crop production. *Canadian Journal of Plant Science*. 2018;98(6):1384–1388. Available from: <https://dx.doi.org/10.1139/cjps-2017-0342>.
- 36) Vassalos M, Lim KH. Farmers' willingness to pay for various features of electronic food marketing platforms. *International Food and Agribusiness Management Review*. 2016;19(2):131–180.
- 37) Emeana EM, Trenchard L, Dehnen-Schmutz K. The Revolution of Mobile Phone-Enabled Services for Agricultural Development (m-Agri Services) in Africa: The Challenges for Sustainability. *Sustainability*. 2020;12(2):485. Available from: <https://dx.doi.org/10.3390/su12020485>.
- 38) Rosita T, Suryaman D. Online Training on Using Videodroids and Smartphones To Increase Motivation of Sauyunan Women Farmer'S Group. 2021;10(2252):40–46. Available from: <http://e-journal.stkipsiliwangi.ac.id/index.php/empowerment/article/view/2072>.