TECHNICAL REPORT

Training of Trainers (TOT) of Agricultural Extension Agents and Contact Farmers on the use of *LandInfo* mobile app in Lilongwe, Malawi

Bridging Climate Information Gaps to strengthen Capacities for Climate Informed Decision-making

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Executive Summary

The African Technology Policy Studies Network (ATPS) successfully organized the *LandInfo* mobile app training workshop for farmers and extension agents at the Crossroads Hotel in Lilongwe, Malawi on 11th September 2018. The training workshop brought together a total of 90 participants (extension agents and farmers) from Lilongwe to gain knowledge and skills on the use of the *LandInfo* mobile app technology for the collection of soil and climate information. The workshop aimed at creating awareness about the *LandInfo* mobile app as well as strengthening the technological capacity of extension agents and farmers to generate reliable soil and climatic information that can inform decision-making on sustainable land management and land use planning.

This report provides detailed proceedings of the *LandInfo* mobile app training workshop. The workshop sought to address capacity development needs to build individual and institutional capacities to take advantage of emerging opportunities in the area of Information and Communication Technologies (ICTs) such as mobile phone technology to accelerate access to and application of reliable information for decision-making on agricultural production, land use planning and climate resilience.

The workshop provided a learning and knowledge exchange platform for networking and discussion among extension agents and contact farmers on the use of *LandInfo* mobile app to support agricultural production and sustainable land management practices in Malawi. The training was successful in engaging farmers and extension agents to understand the collection, use and interpretation of climate and soil data, as well as know how to identify the different types of soils and the suitable crops for these soils. Participants at the training workshop were satisfied with capabilities of the *LandInfo* mobile app in providing accurate information on soils and climate. Participants also expressed confidence in the ability of the *LandInfo* mobile technology to contribute positively to the agricultural production and climate resilience in Lilongwe and other parts of Malawi.

The training workshop also provided participants with an opportunity to provide feedback that may be useful in improving the features and performance of the app. Through this training workshop, we anticipate that participants especially extension agents will train other extension agents and farmers on how to use the *LandInfo* mobile app to collect soil and climate information and use the information to make important decisions on land management and planning.

1. Introduction

As part of the activities for component two of the Clim-Dev Special Fund (CDSF) project on "Bridging Climate Information Gaps to Strengthen Capacities for Climate Informed Decision-making", the African Technology Policy Studies Network (ATPS) organized a training of trainers' (ToT) workshop for extension agents, farmers and university students on the use and application of the *LandInfo* mobile app technology in Lilongwe, Malawi. The workshop was organized in partnership with the Lilongwe University of Agriculture and Natural Resources (LUANAR), National Commission of Science and Technology (NCST) of Malawi and the Ministry of Agriculture. It brought together approximately 90 participants drawn from selected farmers and extension agents. The training workshop aimed to build the capacity of participants to acquire knowledge and skills on the use and application of the *LandInfo* mobile app; farmers are able to collect soil and climate information through the use of the app to make farm management decisions. The *LandInfo* mobile app is a product of the Land Potential Knowledge System (LandPKS) project, which was developed through a collaborative effort by the ATPS and the United States Department of Agriculture's Agricultural Research Service (USDA-ARS) and other partners.

This report provides an overview of activities at the training workshop including the expected outcomes of the workshop and feedbacks from the participants. The workshop was designed to address capacity development needs in Malawi by contributing to the development of individual and institutional capacities to gain knowledge and skills in the application of the *LandInfo* mobile technology so as to generate useful data and information that can effectively inform decisions at different levels to improve agricultural productivity, sustainable land management and climate change resilience. The workshop aligns with the Climate for Development in Africa Program (ClimDev-Africa), which aims to address the problem of lack of reliable climate information required for decision-making at all levels, bridge the gap between climate services and national development priorities and lastly, to establish a continuous flow of climate information between providers and users.

The training workshop responds to the growing concerns in many African countries on the need to rethink about current land use mechanisms, and to devise innovative measures that will ensure that the available land under agricultural production becomes more productive, sustainable and resilient to the impacts of climate change. It is now evident that efforts to increase agricultural productivity will not only come from land expansion and conversion, but rather the generation of accurate, robust, and timely information and knowledge of land potential will be key in supporting decision-making for sustainable land management and improved agricultural production.

1.1 Overall goal and objectives

The workshop aimed to build the capacity of agricultural extension agents and farmers on the use and application of the *LandInfo* app for the collection of valuable information (climatic and soil) so as to improve agricultural productivity. Specifically, the workshop:
- Introduced participants to the underlying principles of the *LandInfo* mobile app including the biophysical characteristics of soils, vegetation and the concept of land potential;
- Informed participants about the different features, components and characteristics of the *LandInfo* mobile app as well as the operation of the mobile app for data collection;

- Undertook participatory field demonstrations of *LandInfo* app with participants at a selected site and;
- Guided farmers on how to identify different soil types, their crop suitability and appropriate land management practices needed to contribute to improved agricultural productivity, sustainable land management, and climate change resilience.

1.2 Expected Outcomes

The expected outcomes for the training workshop were:
- Participants to deepen their knowledge of the biophysical characteristics of soils, vegetation and land potentials;
- Participants to gain knowledge of the *LandInfo* mobile app operation and its application in the field;
- Participants to utilize knowledge to make informed decisions on land use planning and farm management to sustainably increase agricultural productivity;
- Participants to have open access to the *LandInfo* mobile app at any time and anywhere;
- Participants to instantaneously access the best available information and interpret it in the context of local socio-economic conditions and local values, including crop preferences for a particular farm location;
- Participants to contribute to future app improvement by providing valuable feedback to the app; and
- Participants to be able to capacity build their colleagues who did not attend the training on the importance and usage of the app.

2. Workshop Opening Remarks

Dr Kingdom Kwapata, ATPS Malawi Chapter Coordinator welcomed all the participants to the workshop. He led the introduction session by allowing participants to introduce themselves. He thereafter invited Mr Alick Manda the director of planning in the NCST Malawi to give his opening remarks.

Mr Manda, the director of planning in the NCST Malawi, representing the Director General Mr Anthony Muyepa, started by appreciating the effort done by ATPS in Africa and allowing Malawi to host this important training. He provided a sneek preview of the work done by NCST in colaboration with other partners including ATPS especially in the Science Granting Council initiative (SGCI) funded by IDRC and other donors. He acknowleged the importance of Science and Technology in transforming a country's economy. Malawi needs to embrace more Technology to compete with other African Countries. He retiarated that NCST will continue to support such initiatives in Malawi.

Dr Nicholas Ozor, ATPS Executive Director also welcomed all participants to the training workshop. He expressed delight at the commitment and interest shown by participants to learn about the innovative *LandInfo* mobile app. He was optimistic that the adoption and use of the *LandInfo* mobile app can significantly contribute to improved agricultural productivity and climate change resilience by providing reliable information on soil and climate which can support decisions on sustainable land management practices. He also introduced ATPS a trans-disciplinary network of researchers, policymakers, private sector actors and civil society actors who promote the generation,

dissemination and use of Science, Technology and Innovation (STI) for African development, environmental sustainability and global inclusion.

In his concluding remarks, he informed participants that ATPS is excited to be working with the LUANAR and NCST to share the *LandInfo* mobile app with both officials and people of the Lilongwe, Malawi. He emphasised that the ATPS will continue to improve the understanding and functioning of STI policy research and policymaking processes and systems to strengthen capabilities, social responses, and governance of STI-led sustainable development in Malawi and in Africa.

Prof Kanyama-Phiri the Vice Chancellor of LUANAR officially commissioned the training. The VC in his opening remarks reiterated on the importance of using technology for evidence based decision making. He thanked the ATPS for choosing Lilongwe for its pilot training in Malawi so that farmers, extension agents as well as the University students to be able to benefit from the *LandInfo* mobile app technology training workshop. He expressed confidence at the potential of the *LandInfo* mobile app to assist farmers in the country through the provision of accurate soil and climate information for effective decision-making in agriculture, land-use and climate change adaptation. He encouraged participants to share the knowledge and skills acquired from the training workshop with their colleagues across Malawi and Africa.

LUANAR as a university, is always excited to be part and parcel of new technologies aimed at spearheading agriculture sciences and innovation for the betterment of our farmers. This particular training workshop has come at an opportune time when we are experiencing an exponential decline in agricultural land area use and soil fertility due to rapid urbanization, land degradation and the impact of climate change. In view of this, there is a growing concern to rethink current land use strategies and to devise innovative mechanisms to optimize the productivity of land under crop and pasture production while boosting resilience. Africa's continued agricultural growth over the last couple of years came from land expansion rather than increased productivity. Efforts to address these challenges will not only come from agricultural intensification and land conversion, but the capacity of farmers, pastoralist and land use planners to access and utilize accurate, robust and timely information on land potential to support decision making on land management and productivity.

Prof Kanyama-Phiri expressed confidence that the LandInfo app will produce the much desired knowledge and information that explicitly define land potential by identifying climatic and non-climatic conditions such as rainfall and temperature distribution, average annual precipitation, available water capacity, elevation, longitude and latitude, length of growing period in days and the aridity index and the type of soil at any given location. He further noted that he is convinced that shared knowledge and understanding of land potential by governments, farmers, pastoralists, and development workers through this mobile application for decision-making has the capacity to sustainably increase agricultural production and pasture land restoration.

He expressed his optimism that the partnership that exists between LUANAR, NCST and ATPS is ideal and strategic and will yield the desired objectives and outcomes to empower and build capacities of agricultural extension agents and farmers for farm decision-making and land use planning for agricultural production and climate change resilience in Malawi. He concluded his remarks by declaring the training workshop officially open.

Prof Kayama-Phiri, the VC LUANAR addressing participants during the LandInfo Mobile app Training Workshop

3. Workshop Methodology

The workshop employed a participatory approach that consisted of classroom presentations, discussions and field demonstrations. Two training workshops were organized with each workshop accommodating about 60 participants. This was to ensure maximum engagement through discussions and interactions among participants as well as with the facilitators. The workshop entailed both theoretical and practical learnings that allowed participants to gain both theoretical and practical understanding of the *LandInfo* mobile app. **(See Annex 1 for the workshop programme outlines)**. As part of the training package, a training guide containing step-by-step instructions on the functionality of the *LandInfo* mobile app was provided for the participants.

A cross-sectional view of participants who attended the workshop training

4. Introductions and Expectations

The introductory format allowed participants to pair-up to know more about each other and their expectations for the workshop as well as introduce each other to other participants. Participants were asked to state their expectations for the training workshop however some went ahead to state their acreage of land and also the current problems they were facing with their farmland which include: crop infestation by pests, problems in marketing their farm produce and exploitation by middlemen, effects of climate change particularly hailstones which destroy crops and, fluctuating market prices of crop products and fertilizers amongst others.

Participants listed the following as some of the expectations they hoped to realize from attending the training workshop:

i) To gain knowledge on the *LandInfo* App and understand its practical applicability.
ii) To know the availability and accessibility of the *LandInfo* mobile App to farmers and Extension agents.
iii) How to use the *LandInfo* app to mitigate the effects of crop infestation and climate change.
iv) To know how they can use the *LandInfo* app to improve their agricultural productivity.
v) To acquire knowledge about the new technology and share it out with other farmers and extension agents as well as advise farmers on good agricultural practices.
vi) To know the importance, relevance and benefits (socio-economic) of the *LandInfo* app to farmers, extension agents and other agriculture stakeholders.
vii) To acquire knowledge on how they can assist farmers in the region.
viii) To know more about the geographical coverage of the *LandInfo* mobile app (is it available country-wide).
ix) To gain insights into how the *LandInfo* mobile app can predict rainfall patterns.
x) To know if the *LandInfo* mobile app can be used as an information management tool.
xi) To gain knowledge about the potential of *LandInfo* mobile app in order to enhance the agricultural value chain in terms of increased market access for farmers' produce and job creation for women and youth.

5. Setting the Context

Prospects for Agricultural Productivity and Introduction to the LandInfo mobile app – By Dr. Nicholas Ozor, ATPS Executive Director

Agricultural output in Africa is slowly diminishing because of the low application of science, technology and innovation in Africa. The African population is currently at 1.1 billion and majority of farmers still use traditional crude systems and the percentage of land degradation and soil erosion is high hence the result of low yields from the farm. The agricultural sector has also suffered due to food price volatility, weak extension systems, poor infrastructure, conflicts, climate change impacts and inadequate policies and poor implementation of existing ones. According to Foresight Africa 2016 report, *Banking on agriculture for Africa's future* about 200 million hectares in Sub-Saharan Africa is uncultivated yet the continent is full of abundant resources and an energetic youth population. In order to increase food production in the coming fifteen years to feed Africa's growing population, food production must increase by over 60%.
This scenario raises pertinent questions including:-

1. Why is it that the tree that produces paper grows freely in Zambia but Finland is the World's leading producer of paper?
2. Why is Nigeria the leading producer of cassava in the world but a major importer of starch?
3. Why is the population of farmers in Africa high and yet we cannot feed ourselves?

The answer to all these questions is the poor application of science, technology and innovation; African farmers need to use new technology such as improved seeds, modern irrigation technologies, increase yields and add value to raw agricultural products. Fortunately, advances in technology and internet access in Africa are paving way for new innovative and technological tools that promote agricultural development to enhance food security and support rural livelihoods through the provision of vital information on crop prices, market value-chain solutions, and crop insurance, among others.

Dr Nicholas Ozor, ATPS Executive Director doing his presentation on the prospects for agricultural productivity and an introduction to the LandInfo mobile app

5.1 Functions and Operation of the LandInfo mobile app

By Dr Ernest Acheampong, Senior Research Officer, ATPS

5.1.1 Description of the LandInfo Mobile App

The *LandInfo* App is a mobile technology application produced from the Land Potential Knowledge System (LandPKS). The App allows individuals and organizations to use a smart mobile phone to determine land potential at a specific location based on local and global knowledge and information about the potential of similar types of land (i.e. land with similar climate, soils and topography). The *LandInfo* App currently operates on google android and iOS platforms, connected to a more sophisticated web tools that can be accessed via personal computers and linked with other decision tools.

Tapping into recent advances in cloud computing, digital soil mapping, Global Positioning System (GPS) enabled camera phones, the *LandInfo* mobile app allows users to enter point-specific

information about soil texture, topography and easily observable soil properties and in turn obtain site-specific data including temperature, rainfall, estimated amount of water the soil can store for plants, and growing season length. The *LandInfo* mobile app can be downloaded at a google play store or iTunes store. It functions on both android and iOS platforms. Participants were taken through each interface of the app and how it functions.

Dr Ernest Acheampong leads a presentation on the functionality of the LandInfo mobile app

6. Field Demonstrations of the LandInfo Mobile App

After the theoretical exposition of the *LandInfo* mobile app, there were field demonstrations on how the app works. This practical session provided a better understanding of how the app can be used in the collection of soil and climatic information. Participants were taken through the process of using the *LandInfo* mobile app to collect information from the field. Field data was captured into the *LandInfo* mobile app in following ways:

- Through an observational assessment of the land cover type, use, slope, slope shape, the occurrence of soil erosion, runoff and soil conditions.
- Up to 1 meter pit was excavated to identify the different layers and types of soil layers by examining the soil texture at different depths. Soil testing was done at different layers of 10 cm intervals (starting from 0-10 cm) from the top level soil to the bottom of the pit, soil texture analysis involved basic actions on soil texture analysis following a set of leading questions (with video tutorials incorporated in the app) that guide users on how to form a soil ball and make soil ribbons. By following instructions and prompts on the app, participants were able to test the physical characteristics of the soil and determine the type of the soil at different soil layers.
- Geo-referenced photographs are taken to serve as benchmarks for future monitoring.
- Based on the available information on soil generated by the *LandInfo* mobile app, a soil-crop matrix developed by the ATPS is used to assist farmers and extension agents to match the identified soil texture type with the most suitable crops.

Mr. Alfred Nyambane, ATPS Research Officer leads participants in the field demonstrations

7. Open Forum

In the open forum session, participants were given an opportunity to comment, ask questions and critique the content of the *LandInfo* mobile app presentations.

A participant asked why the app does not consider soil organic matter especially in the top layer of soil. In response, the resource persons indicated that the app is still being worked on to consider other soil components including soil organic matter, soil moisture among others. Another participant asked whether the app uses GIS as part of the app. In response, the training team explained that it uses Geospatial data through GPS and that why the app is able to accurately pinpoint the specific area where it is being used. Another question asked was in regard to the type of data provided by the app. The participant pointed out that average weather conditions of an area are known and have been published. In response, the resource persons explained the importance of increased accessibility of data to farmers and other users of climate and soil data. Farmers would not need to visit weather stations or take soils samples for analysis to get weather data or identify their soils respectively. The app taps into a well synthesized climate data that extends to over 100 years from reliable global, regional and national sources providing a robust database that assures reliability and accuracy of the information derived from the app.

8. Workshop Evaluation

At the end of the training workshop, participants were provided with an evaluation form to give their opinions about the content of the training workshop and the skills and knowledge they had acquired. Overall, participants expressed satisfaction with the content of the workshop and recommended that the training should be extended for at least two days for effective delivery of the content. Majority of the participants were of the view that the app should be upgraded to test the soil pH while others were of the opinion that more effort needs to be put in place to create more

awareness about the *LandInfo* mobile app technology especially in rural areas. Other views of the participants are expressed in figures 1, 2, 3, 4 and 5.

**Figure 1: Workshop Training Content**
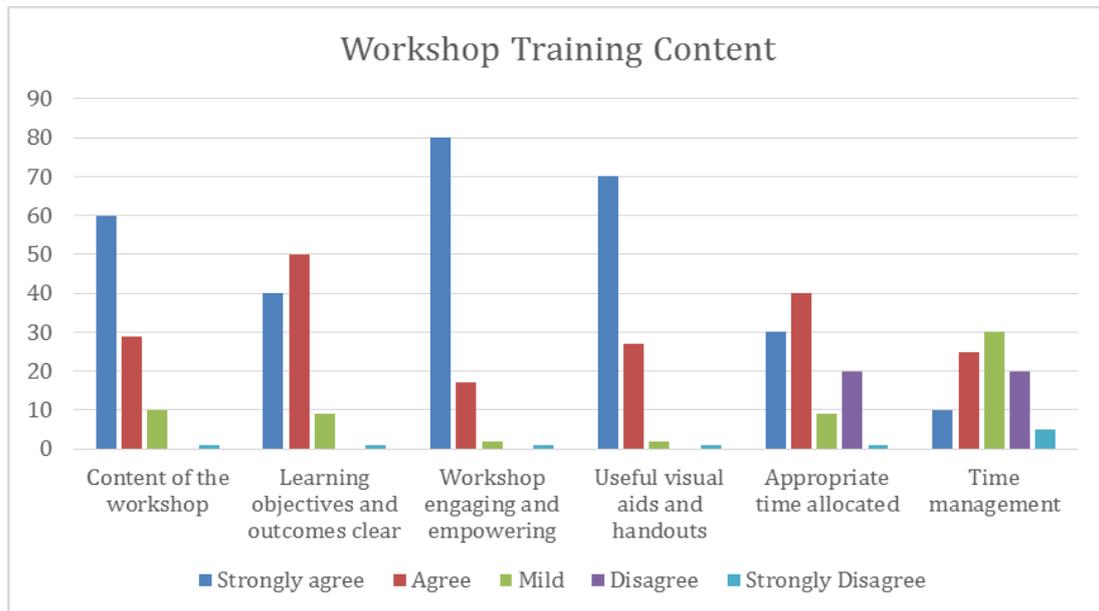
In figure 1, majority of the participants agreed that the content of the workshop clearly conveyed its meaning and; the workshop objectives and outcomes were clear. Participant's strongly agreed that the workshop was engaging and the ATPS team had provided useful visual aids and handouts to facilitate their understanding of the *LandInfo* mobile app however, some of the participants were of the opinion that the time allocated for the workshop was not enough and it should be extended to for at least two days. In regards to time management, there were mixed reactions from the participants some commended the ATPS team from ATPS for effectively delivering the training on time while others were of the opinion that there is need for improvement.

Figure 2: Response from participants on Training Modalities
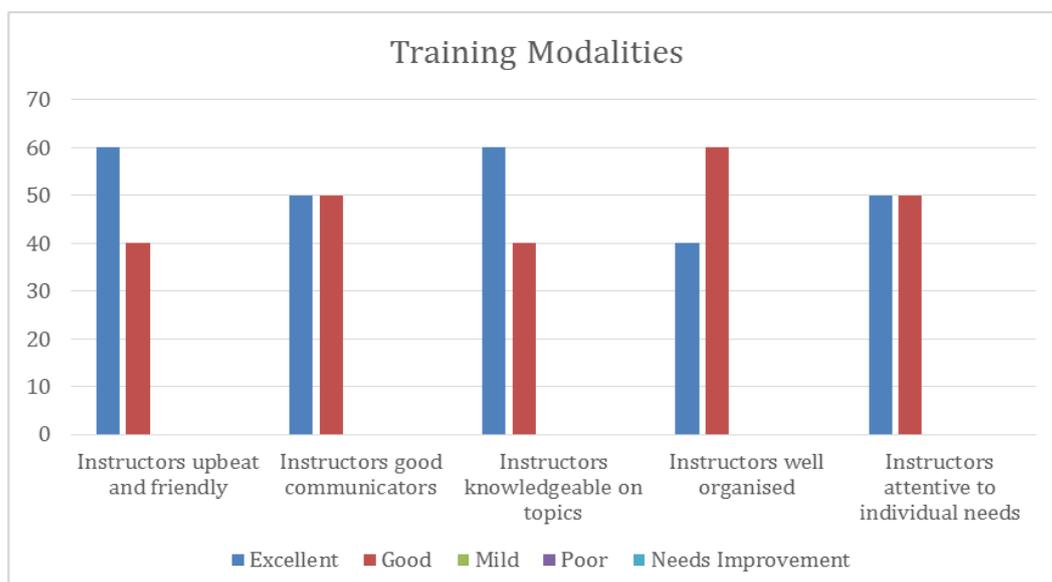
In **figure 2**, participants unanimously agreed that the workshop instructors were friendly, good communicators, well knowledgeable and well organized in facilitating the workshop and also on the presentations they made. Participants commended the ATPS team for solving their willingness to solve their individual needs in regards to the use of the *LandInfo* app.

Figure 3: Response from participants on the use of LandInfo App
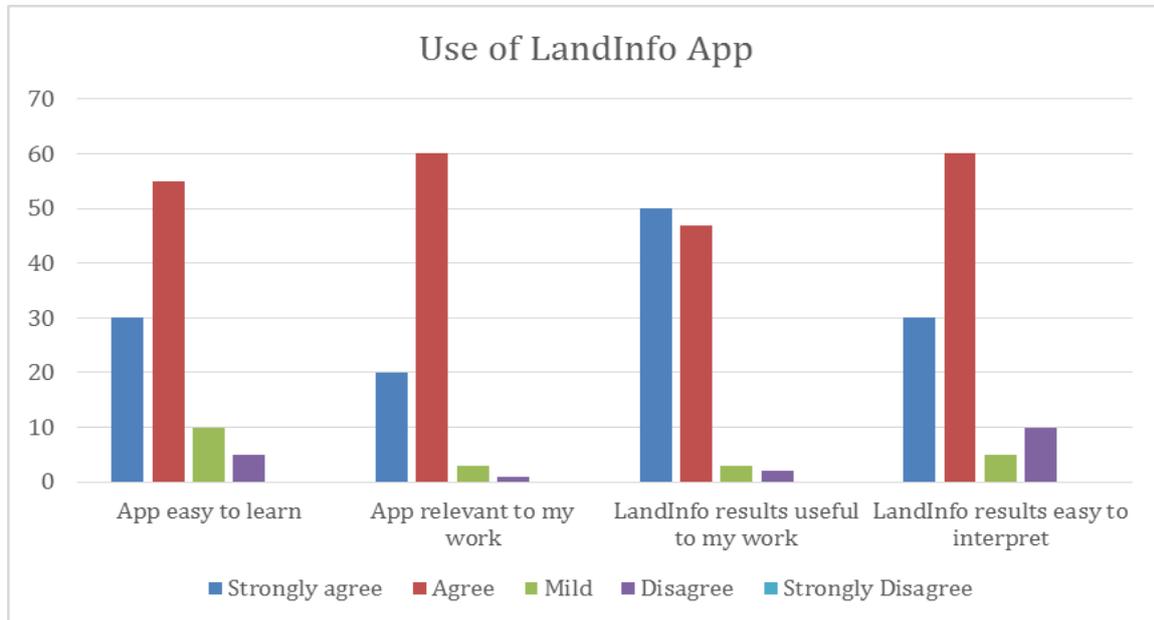
In figure 3, more than 80% of participants agreed that *LandInfo* app is easy to learn and the results easy to interpret. Approximately, 90% of the participants agreed that the app is relevant to their work and less that 10% of the participants were of the opinion that the app was not relevant to their work.

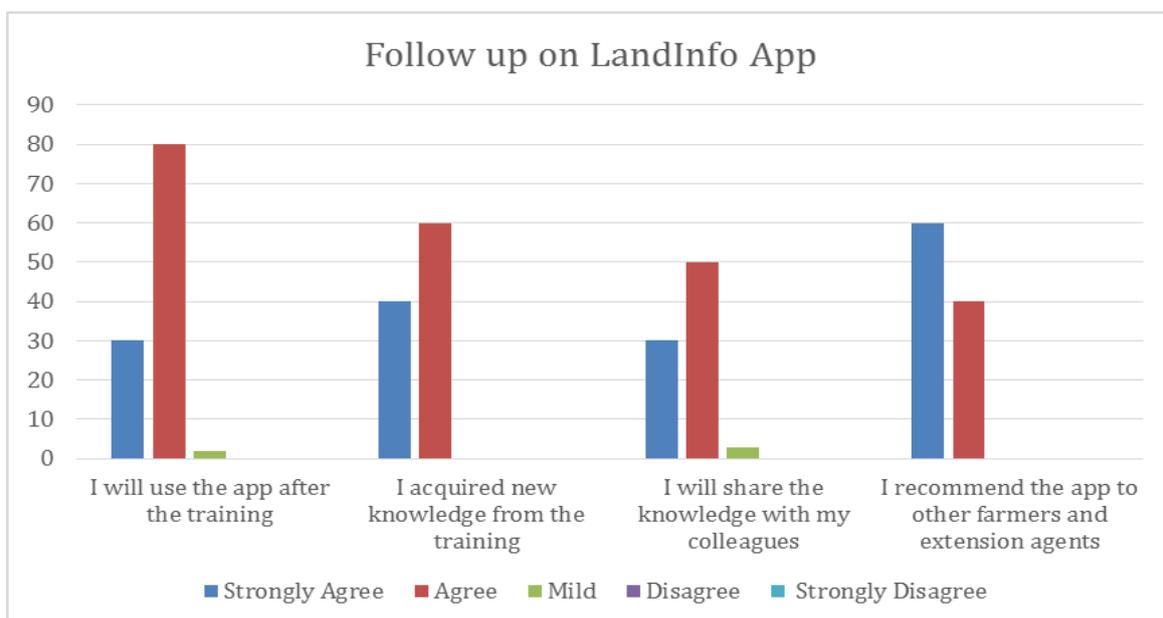**Figure 4: Next Steps from participants on the use of LandInfo App**

Figure 4 shows more than 80% of the participants admitted that they had acquired new knowledge from the training, which they will share with their colleagues and other farmers. Over 60% of the participants were optimistic about the capabilities of the app, stating that they will continue using the app after the workshop and also recommend it's usage to other farmers and extension agents.

Figure 5: Response from participants on the use of LandInfo App
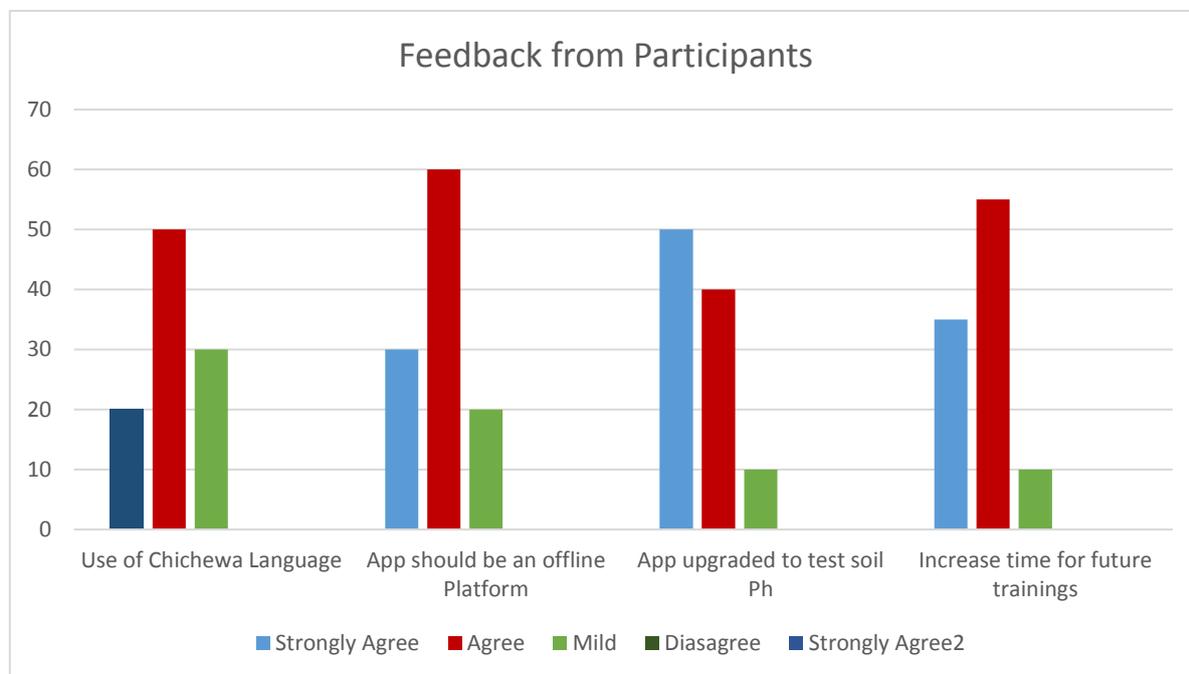
In **figure 5**, the major concern raised by participants was the language barrier, more than 50% were of the opinion that Chichewa language could have been used and at least an interpreter should be present to enhance effective communication and also ATPS should do a follow up in future on the usage of the app in Malawi. Additionally, more than 60% of the participants were of the opinion that the app should be an offline platform because of challenges on the use of internet and purchasing internet bundles. Less than 10% of the participants felt the app should be translated into different languages

On the issue of testing the soil, participants were of the opinion that the app should be upgraded to test the soil pH; soil depth should not be predetermined and there is need for ATPS to think of integrating a sensor onto the app which can capture the soil texture and interpret it.

Lastly, majority of participants were not satisfied with the time allocated for trainings, in their opinion the trainings should be increased to cover at least two days.

9. Concluding Remarks

The increasing role and contribution of mobile phone-based technology towards the transformation of the agricultural sector cannot be underestimated. In this report, we have documented the proceedings of the LandInfo training workshop, organized by the ATPS in collaboration with the LUANAR, NCST and the Ministry of Agriculture, Malawi. Overall, participants showed positive response to the workshop and embraced the *LandInfo* mobile app as a valuable tool that can

significantly impact on the State's agricultural production and land use management. As a community-driven tool, the feedbacks and responses received from the participants will be vital in informing the future upgrade of the app. The ATPS will continue to monitor the progress of the adoption and use of the *LandInfo* mobile app in the Lilongwe by engaging with the different stakeholders, including agricultural officials, lecturers and farmers in Lilongwe and in Malawi.

Participants who attended the LandInfo Mobile App Training

Participants keenly following during the LandInfo app field demonstrations

Annexes
Annex 1: Workshop Programme

LANDINFO TRAINING AND SENSITIZATON WORKSHOP

11th September 2018, Crossroads Hotel, Lilongwe, Malawi
PROGRAMME

09:00 – 09:30	**Arrival and registration of participants**
09:30 – 10:00	**Introductions of participants**
10:00 – 10:20	**Opening and Welcoming Remarks**

- Dr Kingdom Kwapata, Malawi National Chapter Coordinator, ATPS
- Mr Alick Manda- Director of Research National Commission for Science and Technology, Malawi
- Dr Nicholas Ozor - Executive Director, ATPS
- Prof Kanyama- Phiri – Vice Chancellor Lilongwe University of Agriculture and Natural resources (LUANAR)- Declare workshop open

10:20 – 10:30	**Teasers and Expectations from Participants**
10:30 – 10:40	**Setting the Stage**

- Introduction and objective of the training workshop
- Activities and expected outcomes

10:40 – 10:50	**Setting the Context**

- Overview of the *LandInfo*, uses and prospects for agricultural productivity

10:50 – 12:00	**Introducing the *LandInfo* App**

- Principles underlying the LandInfo app
- Functions and features of LandInfo App
- How to use the LandInfo App

12:00 – 12:30	**BREAK**
12:30 – 14:30	**Field Demonstration of LandInfo App**
14:30 – 15:00	**Feedbacks, Responses and Comments**
15:00 – 15:30	**Award of certificates**
15:30	**Vote of Thanks**

END OF THE TRAINING WORKSHOP

Annex 2: List of Participants

PARTICIPANTS LIST- ATPS LANDINFO MOBILE APP TRAINING
LILONGWE, MALAWI- 11th SEPTEMBER 2018

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PARTICIPANTS LIST- ATPS LANDINFO MOBILE APP TRAINING
LILONGWE, MALAWI- 11th SEPTEMBER 2018

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