



## TECHNICAL REPORT

**Project Title:** **Improving Agricultural Productivity and Climate Change Resilience Using the LandInfo Mobile App Technology**

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## **Executive Summary**

This report provides summary proceedings of the LandInfo mobile app sensitization and training workshop held at Kaguru Agricultural Training Center, Nkubu in Meru County from the 15-16 December 2016. The workshop brought together about 65 participants (extension agents and farmers) from all the sub-counties in Meru County to learn about the LandInfo mobile app and its use in the collection of soil and climate information for sustainable land management and decision-making.

The overall objective of the workshop was to address capacity development needs identified in most Africa's national capacity development strategies by building individual and institutional capacity on the use of emerging Information and Communication Technologies (ICTs) such as mobile phone technology to provide useful information for effective decision-making that will enhance agricultural productivity, sustainable land management and climate change resilience. The workshop aimed at creating awareness and sensitizing extension agents and contact farmers in Meru County, Kenya about the *LandInfo* mobile app technology and its potentials for sustainable land management and to build their capacity to effectively deploy the app for agricultural production, land use planning and climate change resilience.

The LandInfo mobile app sensitization and training project aligns with the current AFAAS - MDTF II Project, which aims to provide human resource development support for advisors and farmers in all AFAAS activities including without limitation the adaptation and piloting of innovations and technologies; scaling up and out innovations from research such as ICT tools; capacity strengthening of agricultural extension agents; and studies on climate change among others.

The workshop provided learning and sharing platforms for networking and discussion on integration of LandInfo mobile app on the agricultural practices in the County among extension agents and contact farmers. It was also an opportunity for participants to provide feedback that may be useful in improving the performance of the App and enhance its scalability and sustainability. Users of the LandInfo mobile app can make informed and accurate decision on agricultural and land management practices from information on soils and climate generated from the app.

## 1. Introduction

There is a growing concern to rethink current land use mechanisms, and devise innovative measures that will ensure that available land under agricultural production becomes more productive and sustainable. It has become imperative for existing arable land to produce more food and pasture to meet growing demands while maintaining environmental quality and resources base upon which the food system depends. Efforts to increase land productivity and subsequently food production will not only come from land expansion and conversion, but will require the use of accurate, robust, and timely agricultural information and knowledge of land potential to support decision-making on land production types at the various scales. Fortunately, advances in mobile phone technology and internet access in Africa presents an opportunity to develop new innovative and technological tools that promote agricultural development to enhance food security and support rural livelihood through the provision of vital information on crop prices, market value-chain solutions, and crop insurance, among others.

In September, 2016, the African Technology Policy Studies Network (ATPS) received a seed grant from the African Forum for Agricultural Advisory Service (AFAAS) to support training and sensitization workshops for extension agents (EAs) and contact farmers on the use of the innovative mobile application LandInfo in Meru County, Kenya. The ATPS in partnership with the Meru County Directorate of Agriculture organized two training and sensitization workshops that brought together about 65 participants from all the sub-counties in Meru County to learn about the LandInfo mobile app and its use in the collection of soil and climate information in the field. 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 documents the sensitization and training workshops for extension officers and contact farmers on the use of the LandInfo mobile app in Meru County, Kenya. The overall objective of the workshop was to address the capacity development need identified in most Africa's national capacity development strategies by building the individual and institutional capacity to use emerging Information and Communication Technologies (ICTs) to provide useful information for effective decision-making that enhances agricultural productivity, sustainable land management and climate change resilience. Specifically, the workshop aimed at creating awareness and sensitizing the extension agents and contact farmers in Meru County in Kenya about the *LandInfo* mobile app technology and its potentials for sustainable land management; and to build their capacity to effectively deploy the *LandInfo* mobile app for agricultural production, land use planning and climate change resilience.

The LandInfo sensitization and training project aligns with the current AFAAS - Multi-Donor Trust Fund (MTDF) II Project, which aims to provide human resource development support for advisors and farmers in all AFAAS activities including without limitation the adapting and piloting of innovations and technologies; scaling up and out innovations from research such as

ICT tools; capacity strengthening of agricultural extension agents; and studies on climate change among others.

## **2. 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 30 participants. This was to ensure maximum engagement through discussions and interactions among participants as well as the facilitators. The workshop entailed both theoretical and practical learnings that allowed the participants to gain both theoretical and practical understanding of the LandInfo mobile app. (See Annex 1 for the workshop programme outline). 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.

## **3. Workshop Opening Remarks**

Dr. Nicholas Ozor, ATPS Executive Director welcomed all participants to the LandInfo mobile app sensitization and 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 through the use of the LandInfo mobile app, extension agents and farmers will gain new knowledge and information on soil and climate conditions that they will be able to apply in their line of duty and farms respectively for increasing agricultural productivity, land-use management and climate change resilience.

Speaking on behalf of the Meru County Director of Agriculture, Mr. Dunstan Kaburu the Deputy County Director of Agriculture welcomed all participants to the training and encouraged them to engage meaningfully in the workshop. He expressed confidence in the potential of the LandInfo mobile app to assist farmers in Meru County through the provision of accurate and vital soil and climate information for decision-making in agriculture, land-use and climate change adaptation. He expressed gratitude to the ATPS for prioritizing Meru County among the few counties which have benefited from the training. On that note, He officially opened the workshop.

## **4. Introduction of Participants and Expectations**

The introductory format allowed participants to pair-up to know more about each other as well as introduce each other to the rest of other participants. Participants were asked to state their expectations for the training workshop. Key among these expectations include:-

1. To gain knowledge on the LandInfo mobile app and understand its practical applicability in collecting soil and climate information.

2. To know the availability and accessibility of the LandInfo mobile app to extension agents and contact farmers.
3. To understand the cost implications of acquiring and using the LandInfo mobile App.
4. To gain insight on the importance, relevance and benefits (socio-economic) of the LandInfo to farmers, extension officers and other agriculture stakeholders.
5. To learn how LandInfo mobile App can be used to improve agricultural productivity.
6. To learn how the LandInfo can help mitigate climate change impact.
7. To know the sustainability of the LandInfo mobile app in agricultural practices.
8. To know more about the geographical coverage of the LandInfo mobile app (is it available country-wide).
9. To gain insights into how the LandInfo mobile app can predict rainfall patterns.
10. To know if the LandInfo mobile app can be used as an information management tool.
11. To know if information produced by the app is secured.
12. 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**

*Overview of the LandInfo mobile app and Prospects for Agricultural Productivity – Presentation by Dr. Nicholas Ozor, ATPS Executive Director*

### **5.1 Current Trends in Agricultural Production and Land Use in Africa**

Agricultural production is the primary source of food and income for many African countries as it accounts for up to 60% of jobs on the continent. With a population of about at 1.1 billion, majority of African 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 system has also suffered due to food price volatility, weak extension system, poor infrastructure, conflicts, climate change impacts, inadequate policies and poor implementation of existing ones.

According to Foresight Africa, food production in sub-Saharan Africa needs to increase by 60% over the next 15 years to meet the demand of the growing population. The continent has full potential, 200 million hectares is home to nearly half of the world's uncultivated land, which can be brought into production; Africa uses only 2% of its renewable water resources compared to 5% globally.

This scenario raises pertinent questions such as:-

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 answers lie in the application of Science, Technology and Innovation for Africa's development. African farmers need new technologies in order to get higher yields and resilient food crops that deliver bountiful harvests. Modern technology can be applied to improve agricultural productivity and resilience through mechanical technology, biological and biochemical technology, biotechnology and nanotechnology, indigenous technology and Information and Communication Technology (ICT). On this occasion, we are deploying the ICT component as a tool for improving agricultural productivity and resilience.

## **5.2 Introduction to LandInfo mobile app**

The LandInfo mobile app is a mobile phone-based application that is connected to cloud-based analytics and cloud storage that allows users to access, share, use an interpret global knowledge and information relevant to the unique potential of each piece of land. The LandInfo mobile app allows individuals and organizations to use smart mobile phones to determine the potential of any given piece of land in supporting crop and pasture production under the prevailing climatic conditions. This is based on accurate soil and climatic information provided by the LandInfo mobile app based on global and local knowledge which enables users identify the suitability of any given piece of land for any particular crop in order to obtain maximum productivity under the prevailing climate.

### **5.2.1 Uses of LandInfo mobile app**

There is a growing interest and demand for the app in Kenya where over 82% of users in Kisumu, Samburu, and Baringo Counties have already confirmed the usefulness of the app in supporting their farm decision-making and boosting crop production. Farmers, pastoralists, rangeland managers, extension agents and rural development planners can use the LandInfo mobile App to:-

1. Generate accurate, robust, timely information and knowledge of land potential.
2. Support effective decision- making on agricultural development and land management strategies.
3. Store, integrate and share relevant knowledge and information about land and climate.
4. Determine land potential at a specific location based on local and global knowledge and information.
5. Connect producers with each other
6. Directly support land management decisions by farmers, ranchers and pastoralists'.
7. Improve cooperation among extension agents and communities.
8. Connect people living in areas of similar land types and similar land potential so that sustainable land management practices are shared.



### 5.2.3 Target Beneficiaries

The LandInfo mobile app provides information for different user groups at varied scales. At the field level, individual farmers or producers are able to use the app to answer questions about sustainable land management options. Extension workers are able to instantaneously access the best available information and interpret it in the context of local socio-economic conditions and local values, including crop preferences.

By using the LandInfo mobile app policymakers are able to aggregate data across larger areas without losing key pieces of information, such as the presence of small, highly productive or vulnerable sites within a region. It also enables policymakers make informed decisions for agricultural development and land use planning, e.g. Community Mapping Initiative.

Scientists can access geo-referenced database for calibrating remote sensing imagery and testing hypotheses globally. Researchers conducting researches in areas of soil and crop sciences will find the app very useful for data collection especially, soil and climatic information which is provided instantly by the app. Users of the LandInfo mobile app will have the opportunity to provide data to feed into the app through a tiered, iterative series of questions, observations and field soil testing. Together with additional information on local management practices, this information will be used to provide a set of site-specific management options with an indication of potential production choices, productivity and erosion risk.

### 5.2.4 Benefits of LandInfo

**Social Benefits:** LandInfo mobile app is gender- friendly and inclusive. It can be used for data collection in any parts of the world.

**Environmental Benefits:** Information provided by the App can be used for climate change adaptation and mitigation planning; the technology has zero emission to the atmosphere, supports erosion control, land restoration, and natural resource management.

**Economic Benefits:** By making informed decision based on the results from the LandInfo mobile app, there is a high probability of increasing agricultural yields through sustainable management practices, hence improve farmers' income. Development agencies and policymakers will be able to aggregate data across larger areas without losing key pieces of information such as the presence of small, highly productive, biodiverse or vulnerable sites within a region.

## **6. Functional Abilities of the LandInfo Mobile App**

*The functions and operation of the LandInfo mobile app – Presented by Dr. Ernest Acheampong, Research Officer, ATPS*

Participants gained a deeper insight into the concepts that informed the development of the LandInfo mobile app as well as the operation of the app on a smart phone. Participants were taken through each interface of the app and how it operates in the collection of information on the field.

Tapping into recent advances in cloud computing, digital soil mapping, and 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. The app in turn obtain site-specific data including rainfall and temperature distributions per year, average annual precipitation, available soil water retention capacity, elevation, longitude and latitude, length of growing period in days, the aridity index, and the type of soil (by name) at any point given location. The LandInfo mobile app is freely accessible on android platform and Mac Operating System (OS), and can be used to collect information globally.

### **6.1 Field Demonstrations**

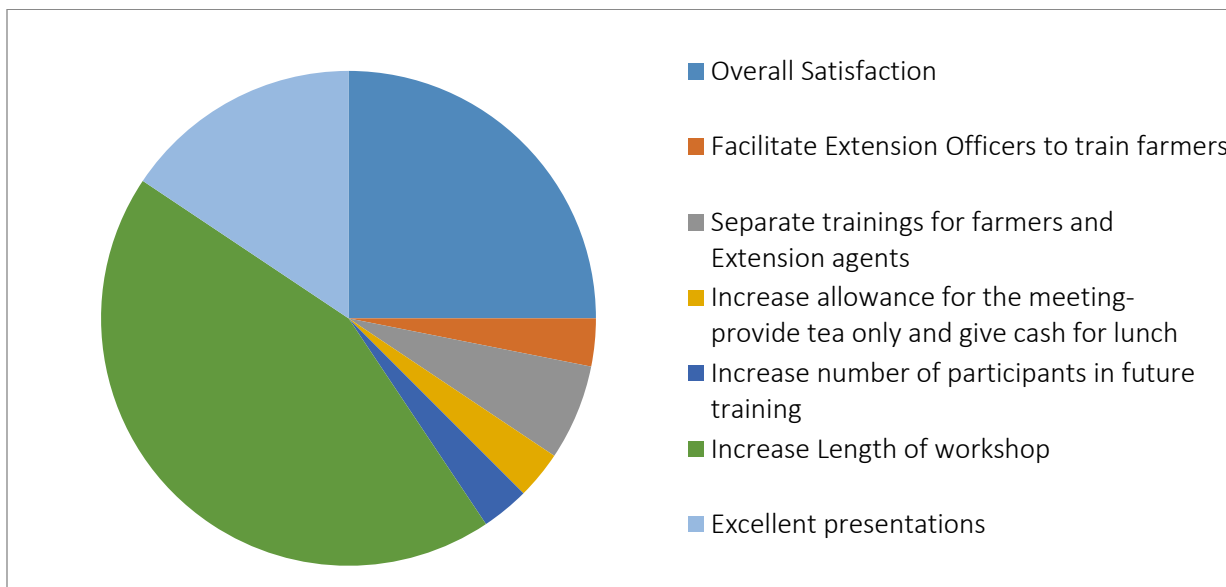
After the theoretical exposition of the LandInfo mobile app, there were field demonstrations on how the LandInfo mobile app works. This practical session provided a better understanding on how the App can be used in the collection of soil and climatic information. Participants were taken through a step-by-step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

- First, through an observational assessment of the land cover type, use, slope, slope shape, occurrence of soil erosion, runoff and soil conditions.
- Second, 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 was provided to help farmers and extension agents to be in a position to match the identified soil texture type with the most suitable crops.

## 7. Discussion and Feedbacks

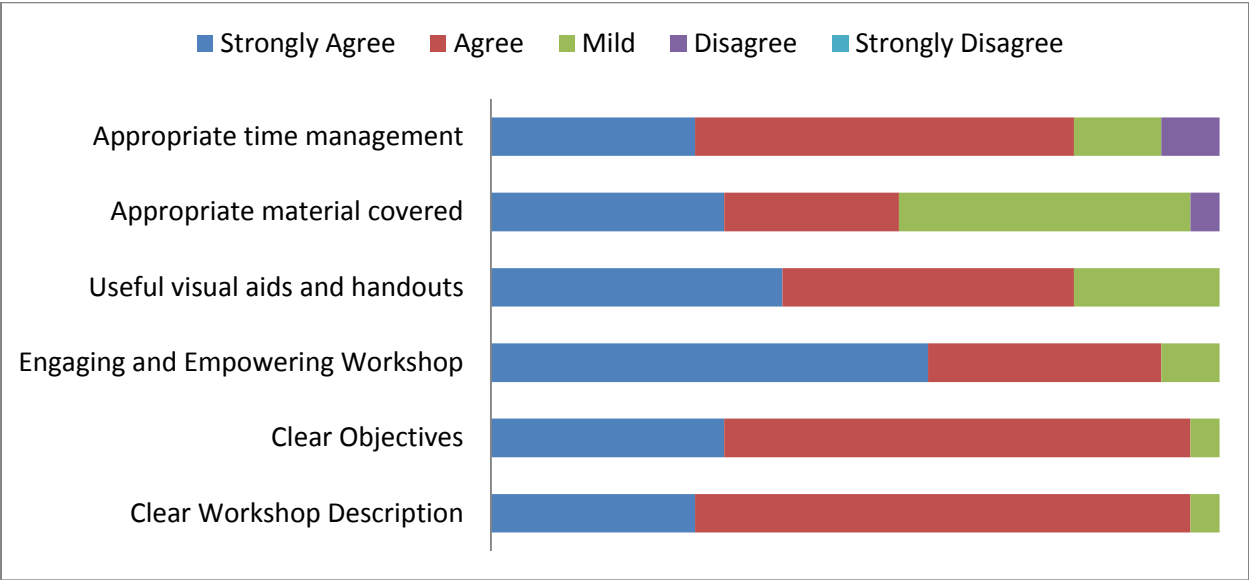
The uniqueness of the LandInfo mobile app is in its community-driven approach, which offers room for inclusion of user and stakeholder feedbacks and ideas into its development and application. It is envisaged that a shared understanding of land potential through the use of the LandInfo for effective decision making has the capacity to sustainably increase agricultural production. This approach allowed stakeholders to make contributions by providing instant feedbacks on the operation of the app, whether outputs from the app meet their expectation, and to ensure that participants make positive suggestions that can be used to improve the functioning of the app.

At the end of the training workshop, participants were asked to evaluate the workshop and its content as well as its contribution to their skills and knowledge base. Generally, participants expressed positive satisfaction about the content of the workshop. In terms of time management, the majority of participants felt that the duration of the workshop was short and therefore there was the need to increase the length of the workshop. They recommended that future training workshops should last for more than one day to allow for effective delivery of the content within the period and to avoid information overload. Other views of the participants are expressed in figure 1.



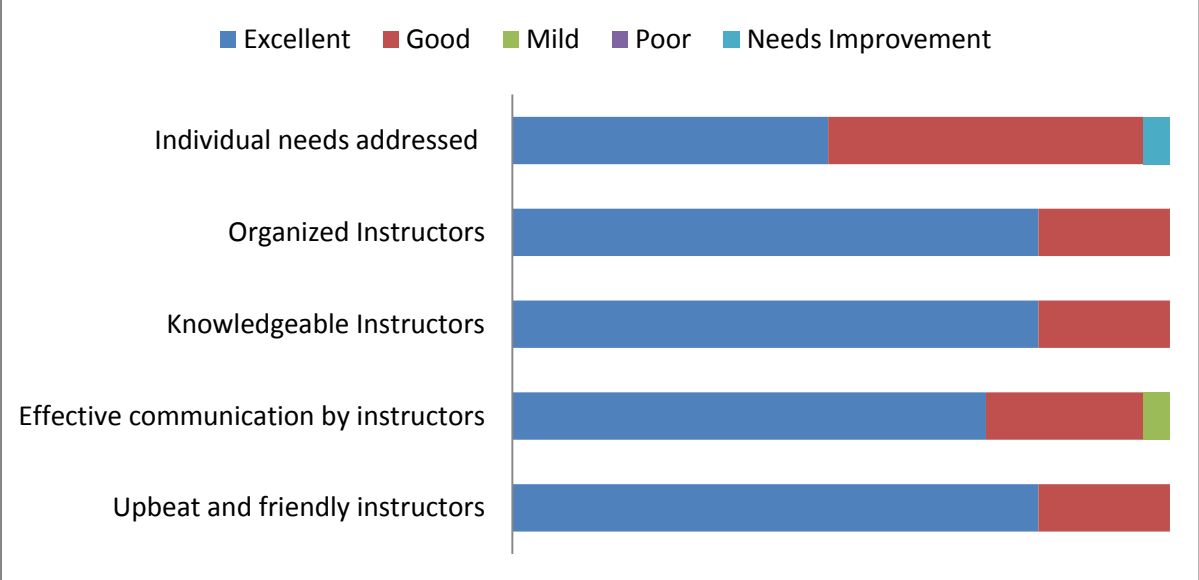
**Figure 1:** General response of participants on the workshop

Majority of the participants agreed that the workshop had a clear workshop description and objectives as well as appropriate time management. Most participants strongly agreed that the workshop was engaging and empowering while a significant portion had a mixed feeling that appropriate material was covered. The expressions of participants are captured in figure 2 below.



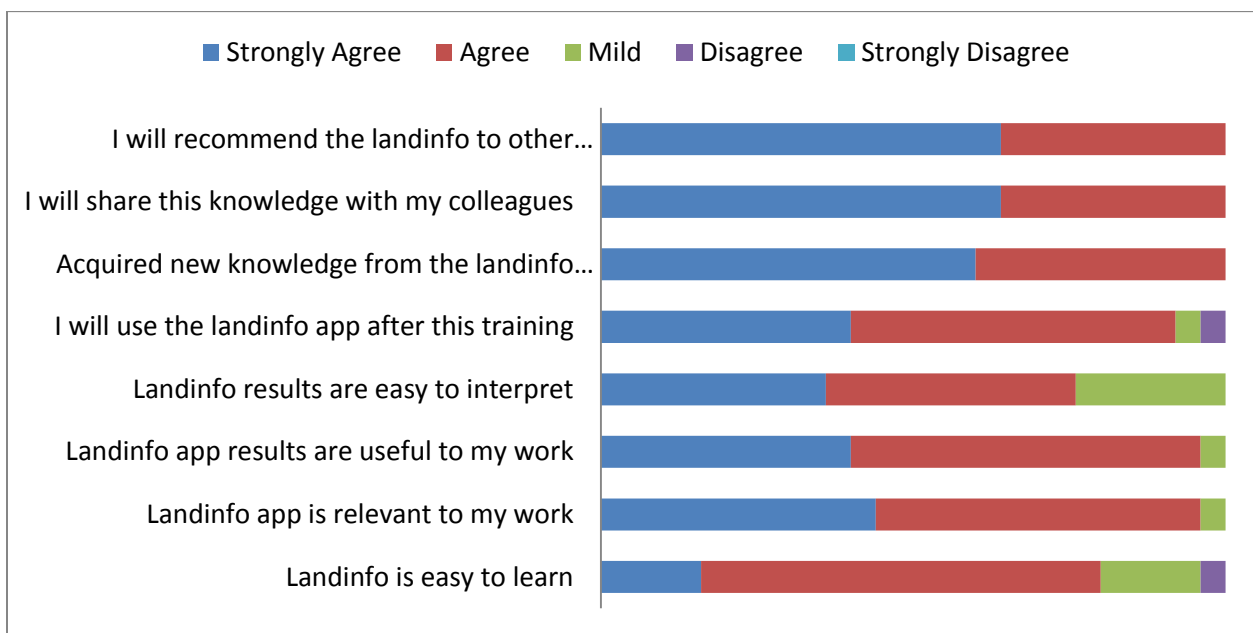
**Figure 2:** Response from participants on the training content

In figure 3, participants expressed satisfaction with the level of organization and insightfulness of the instructors with a majority giving an excellent ratings. The participants split ratings between excellent and good on whether their individual needs were met in the workshop.



**Figure 3:** Response from participants on Training Modalities

With regards to the LandInfo mobile app technology, participants expressed high level of satisfaction with the app interface, its simplicity and the comprehensive nature of the LandInfo mobile app. Participants showed a generally positive response regarding the ease of use and the flexibility in learning how the LandInfo mobile app operates. They commended the LandInfo mobile app as a valuable tool for generating useful information on soil and climate to assist decision making by farmers, extension agents, and land use planners. Participants also expressed a high level of satisfaction on the use of the LandInfo mobile app, the information produced by the app, ease of applying it in the field and the duration it takes to receive feedbacks/results. As seen in figure 4, majority of the participants strongly agreed that they will share and recommend the LandInfo mobile app to other users.



**Figure 4:** Response from participants on LandInfo

During the field demonstrations, some types of smartphones (particularly Huawei and Techno smartphones) were not compatible with some features of the LandInfo mobile app like the camera and compass. Participants urged ATPS to enhance the LandInfo mobile app compatibility to all phones, they also felt that the agro-climatic information generated should be more detailed and recommended that aspects such as the soil PH should be incorporated into the app.

## **8. Concluding Remarks**

The increasing role and contribution of mobile phone-based applications for transforming agricultural production cannot be overemphasized. In this report, we have documented activities of the sensitization and training workshop for extension agents and contact farmers on the use of LandInfo mobile app in Meru County, Kenya. The report shows positive responses from participants on the value, impact, and user-friendliness of the LandInfo mobile app. There is a good level of satisfaction among participants on the potential of the LandInfo mobile app to assist them in making important farm management decisions to improve productivity and build climate change resilience.

The LandInfo mobile app is a unique innovation that integrates local knowledge with scientific information to generate accurate and robust results. The LandInfo mobile app is a community-driven technological tool that relies in part on the feedbacks and responses received from users to improve the functional abilities of the app. Maximizing the benefits of the LandInfo mobile app in Kenya to achieve sustainable agricultural production requires greater investments in networking, advocacy, capacity building and lobbying to promote transfer of this technology, its adoption and deployment.

## ANNEXES

### Annex 1: Workshop Programme Outline

#### LANDINFO TRAINING AND SENSITIZATION WORKSHOP

15-16 December 2016

#### PROGRAMME OUTLINE

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##### 08:00 – 08:30 Registration

##### 08:30 – 09:00 Opening and Welcoming Remarks

- County Director of Agriculture, Meru
- Dr Nicholas Ozor - Executive Director, ATPS

##### 09:00 – 09:20 Introductions

- Teasers and Expectations from Participants

##### 09:20 – 09:40 Setting the Stage

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

##### 09:40 – 10:20 Setting the Context

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

##### 10:20 – 10:35 HEALTH BREAK

##### 10:35 – 12:00 Introducing the *LandInfo mobile app*

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

##### 12:00 – 13:00 LUNCH

##### 13:00 – 15:30 Field Demonstration of LandInfo mobile app

##### 15:30 – 16:00 Feedbacks, Responses and Comments

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END OF THE TRAINING WORKSHOP

## Annex 2: Photos of the Sensitization and Training Workshops

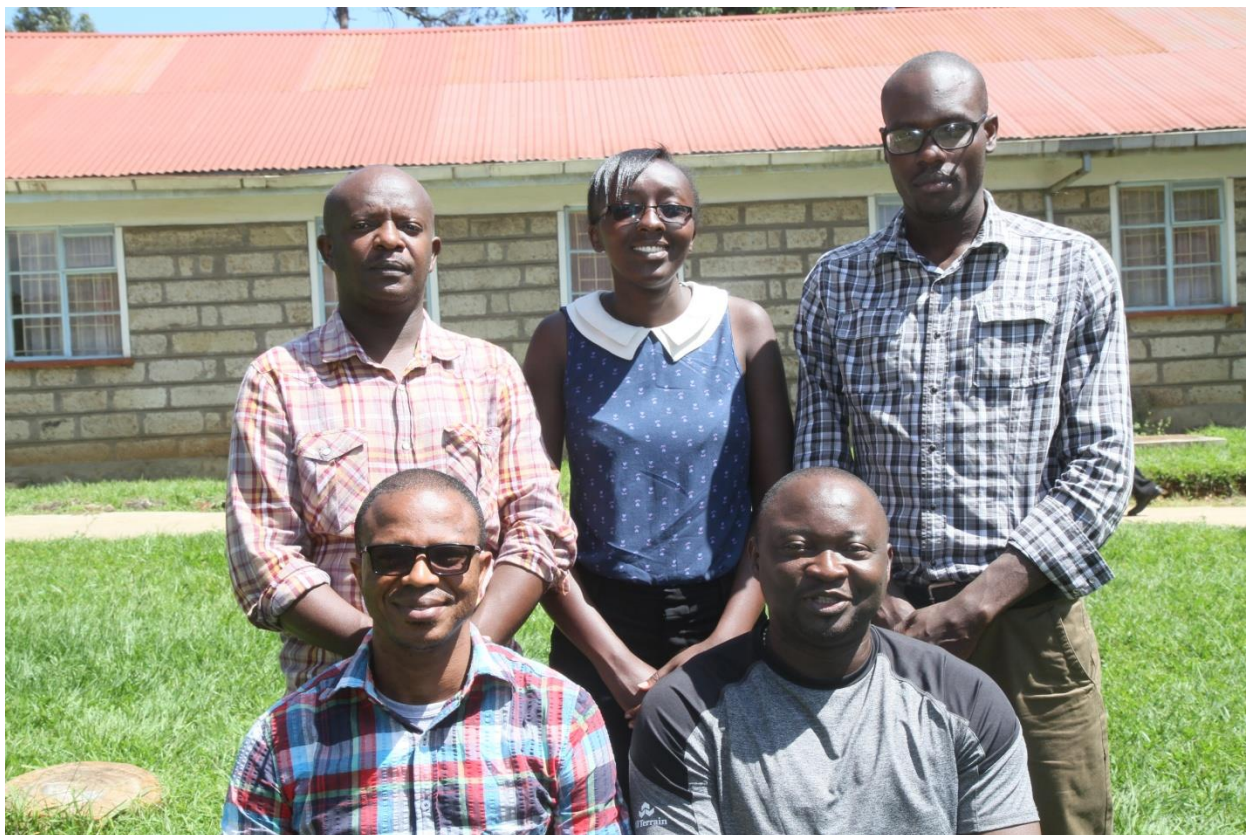


*Day one participants who attended the LandInfo mobile app training workshop*



*Day two participants who attended the LandInfo mobile app training workshop*





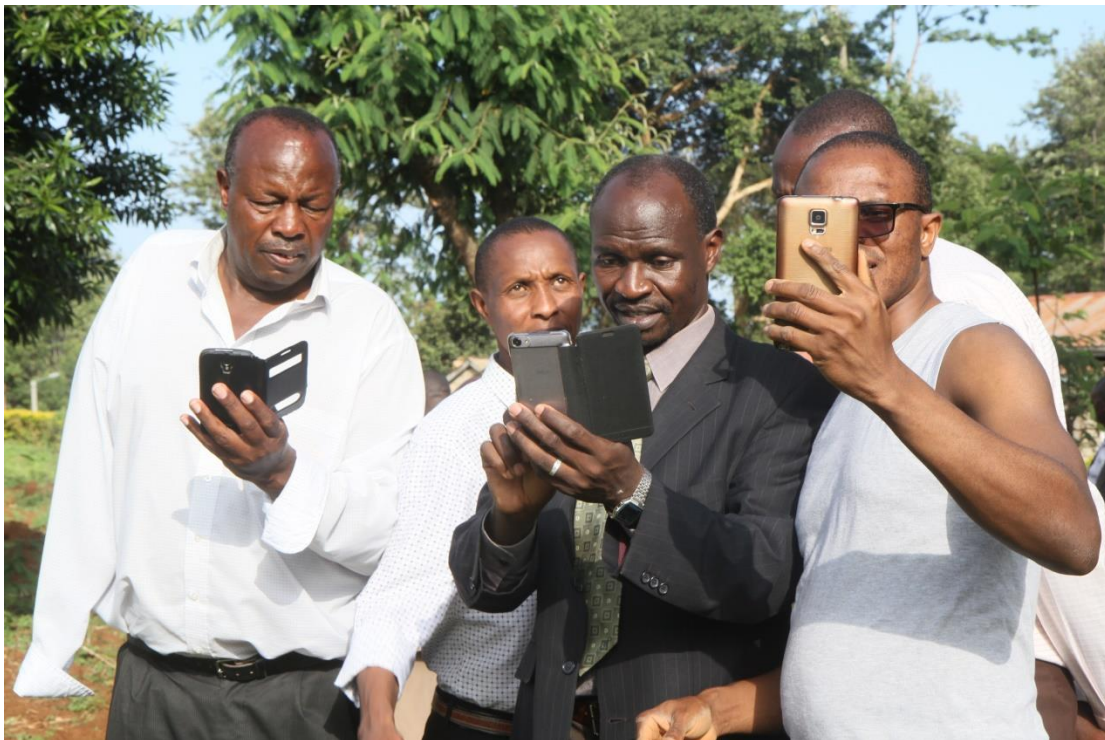
*ATPS staff who attended the LandInfo mobile app training workshop*



*Dr. Ernest Acheampong, ATPS Senior Researcher gives insights about the LandInfo mobile app technology*



*Dr. Nicholas Ozor, ATPS Executive Director leads the team during field demonstrations*



*From left: Dr. Ernest Acheampong, Mr. Dunstan Kaburu Deputy County Director Department of Agriculture and other participants analyse findings from the field using the app*



*Dr. Catherine Kunyanga, facilitating one of the training sessions*



*Dr. Nicholas Ozor, ATPS Executive Director doing a presentation on the LandInfo mobile app technology*



*A participant digs a pit for LandInfo mobile app demonstrations at the field*

### Annex 3: List of participants of the Meru LandInfo Training workshop

15<sup>th</sup> December.



LIST OF PARTICIPANTS  
ATPS LANDINFO MOBILE APP TRAINING  
KAGURU ATC 15 - 16 DECEMBER 2016

	NAME	ORGANIZATION	CONTACTS	SIGNATURE
1	Patricia M. Nganga	Agriculture, Livestock & Fisheries	0738376383	<i>[Signature]</i>
2	PETER MWAKI NGUY	ALF	0727107582	<i>[Signature]</i>
3	CORNELIUS GIKUNDA MIRITI	ALF	0720201776	<i>[Signature]</i>
4	PETERS GICHUHI NJERU	ALF	0714165995	<i>[Signature]</i>
5	PAUL MUGWKA	DOALF	0729044085	<i>[Signature]</i>
6	KIRIMI MWITI J	DOALF	0725-890300	<i>[Signature]</i>
7	KWYANJUI PETER	DOALF	0721946098	<i>[Signature]</i>
8	LYDIA M. GUIDO	DOALF	0721881045	<i>[Signature]</i>
9	MARI N MBURU	DOALF	0720388032	<i>[Signature]</i>
10	TERESIA G KINOTI	DOALF	0721398304	<i>[Signature]</i>
11	Maj. (Retd) GIDEON GITONGA	FARMER	0721-244946	<i>[Signature]</i>
12	JOSEPH MURAGE	DOALF	0702-659011	<i>[Signature]</i>
13	JOHN MUTHAMBA	DOALF	0722-241105	<i>[Signature]</i>

15<sup>th</sup> December, 2016



LIST OF PARTICIPANTS  
ATPS LANDINFO MOBILE APP TRAINING  
KAGURU ATC 15 - 16 DECEMBER 2016

	NAME	ORGANIZATION	CONTACTS	SIGNATURE
14	ROSEBETH KAWIRA MARANGU	Farmer.	0726668157	
15	JOSHUA MUTWIRI MERU	Lead Farmer (FOF)	0725016929	
16	SUSAN GAKU ISIAH	Lead Farmer	0712948720	
17	LUCY MKIROTE GITONGA	FARMER	0727471271	
18	BESSI MUKIAMA	D.O.A	0722982364	
19	Francis CHABARI	FARMER / Dev. Consultant	0722-206275	
20	JUVENARAY KAREMU	T.A	0729589437	
21	JEREMY M. THUO	D.O.A	0714926225	
22	HARRIET M. MAGASU	ALF - Agric.	0717425981	
23	MAINA S.N	WAA BUNDI	0721296350	
24	GERALD MUTWIRI MARWA	D.O.A	0726886572	

15<sup>th</sup> December, 2016



African Forum  
for Agricultural  
Advisory Services  
Knowledge is Novelty  
for Africa's Livelihoods



LIST OF PARTICIPANTS  
ATPS LANDINFO MOBILE APP TRAINING  
KAGURU ATC 15 - 16 DECEMBER 2016

	NAME	ORGANIZATION	CONTACTS	SIGNATURE
25	DUNSTAN KIBURU MUKHOCK	DEPT OF AGRIC - MERU	0721271046	
26	PETER GITARI THAMBURA	Dept of Agri - Meru	0724296841	
27	MICHAEL WASIKE	ACRONOMY L AGRISTEP DEPT OF AGRIC - MERU	0723410712	
28	WANTONY NYONGESA ANTONY	VERT LTD - T.A	0728754838	
29	Rarebeth Kariwa Nrang'u			
30	Antoney Abonki	VEGPRO	0724211030	

occupied the venue.

16<sup>th</sup> December



LIST OF PARTICIPANTS  
ATPS LANDINFO MOBILE APP TRAINING  
KAGURU ATC 15 - 16 DECEMBER 2016

NAME	ORGANIZATION	CONTACTS	SIGNATURE
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GERALD KINYUA	Dept. of Agriculture	0721609260	
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Robert M. Mburugu	Agriculture.	0720119636	
ABIAH M. KIRIMANIAH	Agriculture.	0721567779	
AMOS KIRIMI MWEBIA	Dept Agriculture-Meru	0725238750	
MARTHA WAMBUI THUKU	Agriculture	0722433742	



16th December, 2016



LIST OF PARTICIPANTS  
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KAGURU ATC 15 - 16 DECEMBER 2016

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PESHA UGHE	ATPS	0720425746	
Ernest Acheampung	ATPS	0705343711	
Sharon Anyango	ATPS	0722720674	

16<sup>th</sup> December, 2016



LIST OF PARTICIPANTS  
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DANIEL KOBIA BATIRI	FARMER	0724345796	<i>[Signature]</i>
BONIFACE MUYIINGA	AGRICULTURE	07227339720	<i>[Signature]</i>
MORRIS KODME	AGRICULTURE	0721382327	<i>[Signature]</i>
DOROTHY K. MWIRICI	AGRIC, LIVESTOCK & FISHERIES	0721876556	<i>[Signature]</i>
BUNDI EUGENE KIRIMI	DEPT OF AGRIC, LIV & FISH	0725364288	<i>[Signature]</i>
BENSON N. NYAGAH	DEPT OF AGRIC, LIV & FISH	0722277773	<i>[Signature]</i>