Overview of eSagu and Future Plan

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Overview of eSagu^{TM} and Future Plan[1]

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Abstract: **The eSagu^{TM} system is an IT-based personalized agro advisory system. In this system, the agricultural experts generate the advice by using the latest information about the crop situation received in the form of both photographs and text. The agricultural expert advice is delivered to each farm on a regular basis (typically once in a week/two weeks depending on the type of crop) from the sowing stage to the harvesting stage to the farmer without farmer asking a question. Since 2004, the eSagu system is being developed by operating on several crops and farms in Andhra Pradesh state of India. It has been found that the agriculture expert can prepare the expert advice in an efficient manner based on the crop photographs and the related information. The impact results show that the expert advices helped the farmers to achieve significant savings in the capital investment and improvement in the yield. Encouraged by the results of eSagu experiment, a country-wide integrated agri-service program is planned by Media Lab Asia to provide expert advice and other agri-related services to Indian farming community. In this paper we briefly explain the development of eSagu system, advantages and future plan.**

Keywords--- **e-Farming, eSagu, IT in Agriculture, Computers in Agriculture, Personalization, Information and Communication Technologies for Development (ICT4D), IT for Development, IT for Rural Development, Agricultural Extension, Information Dissemination, Digital Divide, Last-mile Problem, Personalization, Scalable Systems, Query-less Systems.**

I. INTRODUCTION

Indian farming community is facing a multitude of problems to maximize crop productivity [1] [2] [3] [4]. In spite of successful research on new agricultural practices concerning crop cultivation, the majority of farmers is not getting upper-bound yield due to several reasons. One of the reasons is that expert/scientific advice regarding crop cultivation is not reaching farming community in a timely manner. It is true that India possesses a valuable agricultural knowledge and expertise. However, a wide information gap exists between the research level and practice. Indian farmers need timely expert advice to make them more productive and competitive.

It can be observed that recent advances in ICTs [5] [6][7] provide new opportunities to improve the utilization and performance of livelihood technologies like agriculture. The eSagu^{TM} system [22] ("Sagu" means cultivation in Telugu language) is developed to bridge the information gap by exploiting developments in ICTs. The eSagu is an IT-based personalized agro-advisory system [8]-[17]. In eSagu, the developments in IT such as (database, Internet, and digital

photography) are extended to improve the performance of agricultural extension services. The objective of eSagu is to improve farm productivity by delivering high quality personalized (farm-specific) agro-expert advice in a timely manner for each farm without farmer asking a question. In this system, the agricultural experts generate the advice by using the latest information about the crop situation received in the form of both photographs and text. The advice is provided on a regular basis (typically once a week) from sowing to harvesting. The system has several advantages besides reducing the cost of cultivation and increasing the farm productivity. The eSagu system offers next generation agro-advisory tool, and supplements and integrates into the existing agricultural extension system.

The development of eSagu system has started in 2004. Since 2004, we have implemented the system on several crops and farms in the state of Andhra Pradesh, India. In this paper we briefly explain about eSagu system and its advantages. We also explain the summary of the eSagu development since 2004 and discuss the future plan.
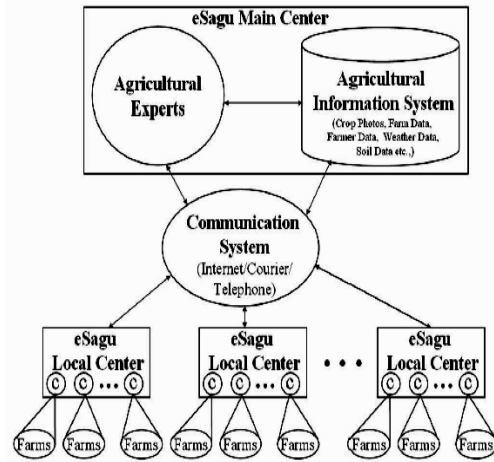

Figure 1. The parts of eSagu system. Here, 'C' indicates coordinator. A double arrow indicates information flow.

II. SYSTEM ARCHITECTURE AND OPERATION

In e-Sagu, rather than visiting the crop in person, the agricultural scientist delivers the expert advice by getting the crop status in the form of digital photographs and other information. The description of eSagu is as follows (Figure 1): The **farmers** are the end users of the system and can be illiterate. A **coordinator** is an educated and

experienced farmer who is stationed in the village. The coordinator is able to visit the farm without much difficulty. Each coordinator is attached to **eSagu local center** which contains few computers and a computer operator. **Agricultural Experts** possess a university degree in agriculture and are qualified to provide expert advice. **Agricultural Information System** is a computer based information system that contains all the related data. **Communication system** is a mechanism to transmit information from farms to agricultural experts and vice versa. If enough bandwidth is not available, photographs from the village to the main system can be transmitted through courier service. However, the advices (text) can be transmitted from the main system to the local center through dial-up Internet connection.

The operation of eSagu is as follows. A team of agriculture experts work at the eSagu (main) lab (normally in a city) supported by agricultural information system. One eSagu local center (few computers and one computer operator) is established for a group of about ten to twenty villages. Educated and experienced farmers (who are from the villages) work as coordinators. Depending on the crop, each coordinator is assigned with a fixed number of farms. The coordinator collects the registration details of the farms under him including soil data, water resources, and capital availability and sends the information to the main eSagu system. After registering the farm, the coordinator visits to the farm at regular intervals and collects crop observation data. The duration of visits depend on the crop type and crop stage. Every day, the coordinator visits a fixed number of farms and takes four to five photographs for each farm. In addition, the feedback farm is filled-in by coordinator which contains the details of the crop problems and feedback from the farmer regarding previous advise. The data is uploaded through Internet. If bandwidth or Internet is not available, a compact disk is prepared with the photographs and other information and transported to the main system by a regular courier service. The Agricultural experts, with diverse background (Entomology, Pathology, Agronomy…) at the eSagu (main) lab analyze the crop situation with respect to weather and other agronomic practices and prepares expert advice for each farm. At the local eSagu center, the advice is downloaded electronically through a dial-up Internet connection. The coordinator collects the advice print out and delivers it to the concerned farmer. If the farmer has the internet access, he/she can download the advice. The advice is also transmitted through SMS. In this way each farm gets the proactive advice at regular intervals starting from pre-sowing operations to post-harvest precautions.

III. SUMMARY OF ESAGU DEVELOPMENT (2004 to 2009)

The eSagu project has started in 2004. The progress of eSagu project is briefly as follows.

A. Prototype for 1051 cotton farms (2004-05)

Development of eSagu has started in March 2004. The eSagu sysem was implemented for 1051 cotton farms. The working of eSagu system was demonstrated. The impact study showed that the farmers got the additional benefit of Rs 3,820/- per acre by saving fertilizers, pesticide sprays and getting extra yield. The cost to benefit ratio was 1:3.

B. Scaled-up experiment on 5000 farms and six crops (2005-06)

A scaled-up experiment was implemented for 5000 farms for six crops (cotton, chilies, rice, groundnut, castor and red gram) in 35 villages spread over six districts in Andhra Pradesh. The impact study showed that the farmers got the additional benefit of Rs 3874/- per acre. The cost to benefit ratio was 1:4.

C. Optimizations to eSagu system (2006 onwards)

From 2006 onwards, efforts are being made to develop a business model. In parallel, efforts are being made to develop a efficient and robust eSagu system. For this, few eSagu local centers are operationalized through public/private organizations and NGOs. The eSagu service is provided on a subscription basis.

Investigations are going on to enable agricultural experts to improve both quality and efficiency of advice delivery by building tools to provide different kinds of information. Regarding quality aspect, the system should provide all the required information to help agriculture scientist to prepare the high quality expert advice. The quality of advice should be equivalent to that of the advice he/she delivers by physically observing the farm. Regarding efficiency aspect is concerned, the system should help the agricultural expert in delivering the advice to more number of farms (more is better).
It has been identified that the agricultural expert should have a knowledge of the location-specific problems to deliver the expert advice. Investigations are being carried out to develop a location-specific content preparation framework which contains the description of problems and practices in the corresponding agro-eco situation.

To improve the throughput of agricultural expert, the notion of "virtual agricultural expert" is developed. The software tools such as "static advisory content" and "help desk" are developed. In addition, the notion of "dynamic crop visits" is added to make the system more cost-effective.

IV KEY RESULTS AND ADVANTAGES

The key results and advantages of the eSagu system are summarized as follows.

The farmers are happy with the expert advice as it is helping the farmers to improve input efficiency by encouraging integrated pest management (IPM) methods, judicious use of pesticides and fertilizers by avoiding their indiscriminate usage. The impact study results show that the farmers are getting significant monitory benefits.

The eSagu system provides a quality personalized agro-advice to the farmers. The system provides agro-advice by following a proactive approach and averts problematic situations. Through eSagu, accountable advice can be provided with two-way communication. The advice is comprehensive, complete and regular in terms of diagnosis, analysis, advice delivery, follow-up and feedback.

The eSagu is a scalable system. It is a three layer system. One agriculture expert can manage several coordinators and each coordinator can manage several farms. The advice is prepared in an asynchronous manner. Also, different components of the network are connected through Internet.

The eSagu system enables farmers (marginal and poor) to cultivate with the same efficiency as agricultural experts. Most important, the system provides strong database to support decision making and documents success stories and new problems.

The performance of the agricultural banking system can be improved through eSagu [18]. It also can aid in successful implementation of crop insurance scheme by making farm as a unit of insurance [19]. It also enables quick deployment of services during the times of crisis.

The eSagu system capacitates rural livelihoods and generates rural employment. The system can be used to validate agriculture technology. It significantly reduces the lag period between research efforts and field application. Finally, eSagu system shows a great promise in the era of globalization, as it can provide the expert advice that is crucial to the Indian farmer to harvest different kinds of crops based on the demand in the world market with quality and assurance.

V. FUTURE PLAN

Based on the encouraging results from eSagu project and its benefits to the farming community, an effort is being made by Media Lab Asia [20] to start the integrated agri-service programme (IASP) to carry out mass delivery of custom solutions (by means of personalized agri services) to farmers at their farm gate by harnessing the power of ICTs. The scope of the services include personalized agro-advisories continuously from seed to harvesting; facilitating availability of high quality inputs at fair prices; enabling financial Institutions to provide agri-credit; facilitate post-harvest management facilities and various marketing channels at the disposal of the farmer. The system will address, at key leverage points, the issues such as producing the best quality output matching market requirements, proper pre-harvest management and post-harvest handling, scientific storage, better market intelligence for improved risk mitigation, value addition and exports.

The broad objectives of the programme can be summarized as:

- Enabling the farmers to practice scientific farming by providing a bundle of products and services at his farm gate which will improve the farm productivity including quality of the produce.
- Enabling availability of high quality inputs at fair prices at his arms length
- Facilitate the small and marginal farmers get institutionalized finance/credit without hassles at his village itself
- Help the farmer in his risk mitigation efforts against natural calamities and vagaries of the weather and price fluctuations
- Facilitate creation of infrastructure at village level for aggregating the outputs of small holder farmers for cost effective post-harvest management, packing and warehousing
- Facilitate creation of forward integration modules to link the output to consumers and processors to ensure higher realizations for produces of the farmers.

The key and integral parts of the programme that would operate on a commercial basis, through public and private partnerships, are

- A knowledge network integrating the expertise and experience of the scientific community in the Universities and research institutions and offer a bundle of products and services to farmers to enable

them to practice scientific farming, thereby increasing the farm productivity
- An integrated and comprehensive service delivery system to meet all the farming requirements of the farmer like input, finance, insurance, marketing, value addition, etc.
- An efficient and vibrant value chain to connect the farmers to the national and international markets.
- An ICT network that connects all the constituents of the programme seamlessly.

VI. CONCLUSIONS

The eSagu system is under development since 2004. We are making efforts to design an efficient system to deliver a quality agricultural expert advice by considering farm as unit. The advice is provided at regular intervals to each farm. Through eSagu experiment, it has been shown that it is possible for the agricultural expert to provide the expert advice by observing the crop status through digital photographs and text. It has been shown that the agricultural knowledge can play crucial role in improving the farm productivity. The impact results show that the system is encouraging IPM, judicious use of pesticides and fertilizers by avoiding their indiscriminate usage. The gains accrued to the farmers were significant.

It can be observed that all the farmer and farm history data is stored in computer information system which can be accessed around the clock. Several stakeholders of agriculture and related domains can get significant benefits through eSagu system and the database. Encouraged by the results and possible benefits of eSagu system, Media Lab Asia is making efforts to develop an integrated agricultural service program (IASP). Under IASP, along with agricultural advisory service, other services such as input, finance, insurance and marketing will be provided to the farmers for more profitability and inclusive economic development.

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