EMERGING CONTEXTS OF AGRICULTURE IN INDIA AND RELEVANCE OF ICTS IN AGRICULTURAL EXTENSION SERVICES: A STUDY OF E-SAGU

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Abstract

Structural transformation of Indian agriculture manifested in the increasing number of marginal and small operational holdings call for responsive agricultural extension services. Weak social base, poor economic conditions and fragile holdings make the small and marginal farmers vulnerable to the vagaries of modern agriculture. With the growing role of market in agriculture need for augmenting extension services is perceptible. In this direction, there have been efforts to make use of information and communication technologies (ICTs) in the agricultural information communication process. It is believed that ICTs enable prompt, appropriate, authentic delivery of agricultural information in both directions i.e. from experts to farmers and vice-versa. The present paper based on the case study of an ICT based initiative named e-Sagu attempts to bring out the social organization of ICTs in agricultural information communication process and analyses the interplay of social and technical processes influencing the functioning of e-Sagu. The paper argues that while ICTs enable the delivery of up-to-date, relevant and appropriate information to the farmers they also limit the role of human factors influencing the performance of successful extension services.

Keywords: Information and communication technology; Agricultural extension, agricultural information and communication.
Introduction

For many generations more than two-thirds of India’s total population is engaged in agriculture. For them agriculture is a way of life and a sense of identity that connects them with the community and the larger village social structure. Though Indian agriculture frequently passed through crises agriculture still continues to be the main source of livelihood even today (Hamilton 1958). It is not only important to understand the prevailing structures of agrarian relations but also agrarian transformation.

One of the important features of Indian agriculture is that it is deeply embedded in the village caste system and agriculture has been viewed as a key source for the reproduction of caste hierarchy. Caste hierarchy is firmly grounded in agrarian hierarchy which is conditioned by access to land and resources. Caste is the primary basis on which economic and political sources, institutions and networks are made available to and accessed by people (Beteille 1974). Caste remains largely common in the rural social and production structures and agrarian relations. Access to land, the key element in agriculture, is determined by the caste one belongs to. It is a well-established fact that upper castes in India continues to hold large proportions of land. Indian agrarian economy thus presents a complex synthesis of caste and class relations. Unequal distribution of land and wealth is a basic feature of agrarian economy which is the outcome of caste (Ambedkar 1948).

Size of the land holding plays a crucial role in agricultural production and productivity. However, the contemporary agrarian social structure presents a skewed distribution of land holdings which have been undergoing significant changes over a period. Data on the changing structure of land holding during 1960-61 to 2000-01 present important trends across different class categories (Das 2004).
### Table 1: Number of operational holdings and area operate

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Number of holdings (%)</td>
<td>40.7</td>
<td>22.3</td>
<td>18.9</td>
<td>13.4</td>
<td>4.7</td>
</tr>
<tr>
<td>Number of holdings (%)</td>
<td>54.6</td>
<td>18.0</td>
<td>14.3</td>
<td>10.1</td>
<td>3.0</td>
</tr>
<tr>
<td>Size</td>
<td>Area operated (%)</td>
<td>Area operated (%)</td>
<td>Area operated (%)</td>
<td>Area operated (%)</td>
<td>Area operated (%)</td>
</tr>
<tr>
<td>Marginal (less than 1 hect)</td>
<td>6.7</td>
<td>12.2</td>
<td>14.3</td>
<td>30.4</td>
<td>10.7</td>
</tr>
<tr>
<td>Small (1.0 to 2.0 hect)</td>
<td>5.4</td>
<td>18.0</td>
<td>19.9</td>
<td>13.4</td>
<td>26.2</td>
</tr>
<tr>
<td>Semi-medium (2.0 to 4.0 hect)</td>
<td>20.0</td>
<td>10.1</td>
<td>14.3</td>
<td>7.2</td>
<td>1.6</td>
</tr>
<tr>
<td>Medium (4.0 to 10.0 hect)</td>
<td>30.7</td>
<td>3.0</td>
<td>26.2</td>
<td>27.2</td>
<td>17.4</td>
</tr>
<tr>
<td>Large (10.0 hect and above)</td>
<td></td>
<td>1.0</td>
<td>14.8</td>
<td>6.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

(Source: Das, 2004)

It may be observed from Table 1 that the percentage of land holdings by the marginal farmers increased from 40.7 percent in 1960-61 to 62.3 percent in 2000-01. At the same time, most significantly the percentage of land holdings by all other categories witnessed a decline. Similarly, percentage of operated land increased from 6.7 percent in 1960-61 by the marginal farmers to 18.7 percent in 2000-01. Similar trend is also seen in the case of small and semi-medium farmers. In the case of medium and large farmers there has been a decline in the percentage of area operated. From the point of view of economies of crop cultivation small land holdings held by the marginal farmers (numerically dominant category as per data) is unviable and greatly prone to risks arising out of market, nature and credit.

Different studies (Jodhka, 2012 and Vasavi, 2012) point out that the social category of a majority of the marginal farmers is lowest in the village social hierarchy. In the event of globalization, growth of capitalist markets and rapid urbanization the upper castes, who were otherwise key cultivators in the villages, have moved out of agriculture to non-farm and urban or town based occupations. These changes in agriculture indicate the growing presence of farmers who belong to lower sections of caste hierarchy (mostly Dalits and OBCs) and whose access to economic resources is scarce. Owing to their backward position, both in terms of social and economic, their ability to access knowledge related to fast changing agriculture is limited. Their social, cultural and economic capital, historically and sociologically, has been week in the sense that they lack accumulated knowledge not in cultivation *perse* but in using resources.
Hobsbawn (1994) observes that with the launching of economic reforms based on neo-liberal agenda after 1991 Indian agriculture underwent drastic changes. The practice of cultivation became knowledge intensive, commercialized, competitive and globalized. The change is also witnessed in the form of growing interest among marginal and small farmers for commercial crops such as cotton, pulses, tobacco, etc. However, due lack of awareness, resources and appropriate information small and marginal farmers have failed to reap the benefits of commercialization. Vasavi (2012) maintains that these sections of farmers were caught by the ‘web of risks’ such as low risk taking ability, lack of required technical knowledge, lack of access to working capital and marketing networks, low investment, low productivity, weak market orientation, etc.

Indian Agriculture is on the threshold of a second green revolution luring all sections of farmers irrespective of size of land holdings and irrigated areas. Marginal and small farmers are keen to take up commercial and modern agriculture and this reflects the inevitability of these farmers coming into the clutches of market forces for a range of inputs and services. Thus we see farmers moving from traditional seeds to hybrid varieties, cultivation becoming intensive whereas farmers’ knowledge becoming obsolete owing to greater pace of changes in agriculture. It may be noted that the gap between knowledge and skills is ever increasing in agriculture. The usage of commercial inputs is the onset of interlinked markets (Sriram 2006) which are heavily unsympathetic to marginal and small farmers.

Agricultural extension system is crucial in disseminating agricultural information to farmers. It is recognized as an essential mechanism for delivering knowledge, information and advices which are considered as important inputs into modern farming (Jones 1997). Diverse climate and land patterns in India necessitate distinct guidance based on region and climate. Ludden (1985:61) notes that historically ‘each agriculture zone has its own style of life, for farming routines and material conditions dominated human experience’. The fallacy of conventional agricultural extension system is its predominant dependence on personal exchange of information between farmer and agriculture extension specialist. Ideally the personal exchange would suit Indian context where in a large majority of farmers are illiterate, socially and economically week and ignorant of changes in technology related to cultivation. However, as Mencher (1978) observes, the concerned agricultural extension officers, far from being neutral, cater to the needs of medium and large farmers ignoring the marginal and small farmers. Agricultural extension services are closely tied to large farmers and deliver information to ‘progressive farmers’ who are exclusively large land holders and belong to upper castes (Dasgupta 1977).

The traditional agricultural extension services (such as radio and television newspapers, magazines, journals, seminars, broad cast media, call centers and web sites) with its network of agricultural agents and motivators have declined and are ineffective in reaching all the farmers of different agricultural zones (Reddy and Ankaiah 2005). At the same time the growing dependence on commercial agricultural inputs led to the emergence of market agents of various national and international agri-business companies involved in seed, fertilizer, pesticide and herbicide. There is a large network of about 2.82 lakh agriculture input dealers in the country, who have emerged, over the years as the most prominent source of agriculture information to the farming community. It may be noted that nearly 90 percent of the agriculture input dealers operating in our country do not have any formal agricultural education (NSSO 2005). According to the NSSO Survey 499, only 8.4 percent farmers access information from Krishi Vignan

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Kendras (state funded agriculture knowledge centres), 17 percent from neighboring farmers and 13 percent from input dealers (who sell seeds, fertilizers, pesticides, etc.).

The real challenge before the policy makers is to overcome the ever widening knowledge-information gap in agriculture. Although conventional agricultural extension services were goal oriented they failed to achieve the goals at the desired level due to the complex and large organizational structure, irrelevance of the delivered information, inability of the system to cover all the farmers, the lack of avenues to improve the performance, and unaccountability for the advice given by the system. Additionally, these systems do not consider the cases at the individual farmer’s field level as each farmer needs a distinct guidance based on his/her socio-economic conditions, soil type, irrigation, date of sowing etc. It is also envisaged that ICTs build a strong relationship between scientist and farmer and would enable farmers to access new knowledge (Reddy & Ankaiah 2005).

ICTs in agriculture enable two-way communication between scientists and farmers via multiple media, particularly, the Internet. ICTs are believed to play a very important role in agricultural extension in the emerging agriculture context in the country. It is viewed that an expanding assembly of ICTs can be used to collect, store and share information between people using multiple devices and multiple media. Using the ICTs agricultural information/knowledge gained in research, may be transferred in a meaningful and comprehensive way, so that it reaches the end-user, i.e. farmer without much loss of time and content, avoiding distortion of information. However, it is felt that there is a need for an organizational mechanism to facilitate effective and efficient transfer of agricultural information. An extension approach developed using ICTs, called e-Sagu, has been providing continuous, relevant and latest technological information to farmers through computer and internet in Andhra Pradesh.

The present paper aimed at understanding the social organization of ICTs in agricultural information communication is based on the findings from the study on e-Sagu. The study looked at the social organization of agricultural information using ICTs with an aim to understand the structure and functioning of e-Sagu system of agricultural information functioning in Andhra Pradesh. Data were collected from the functionaries of e-Sagu and registered farmers in the study village. Primary data were collected using interviews, semi-structured questionnaires and observation methods from the functionaries of e-Sagu working at the main lab (located at the IIIT, Hyderabad) and at the local centre i.e. Malkapur village in Warangal district.

**e-Sagu: Case Study**

A personalized agricultural advisory system called e-Sagu was developed to improve the performance and utilization of agricultural technology and help farmers by providing information at their door-step or farm level. It is a web based personalized agro-advisory system, which uses information and communication technologies to provide scientific solutions to the farmers. “Sagu” means cultivation in Telugu local language. In e-Sagu farmers receive specific expert advice on the agricultural problems at regular intervals. It was developed in 2004 and has been implemented in various districts of Andhra Pradesh since then.
### Table 2: Phase-wise processing of agricultural information and communication in e-Sagu

<table>
<thead>
<tr>
<th>Stage</th>
<th>Form of Information</th>
<th>Nature of Information</th>
<th>Personnel Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>Personal observation, inputs from the farmer, digital photographs and brief data related to farm, seed, stage of crop and situation of crop and weather report.</td>
<td>Nature of problem, for e.g., pest or disease infestation, deficiency, etc.</td>
<td>Coordinator and farmer</td>
</tr>
<tr>
<td>Phase II</td>
<td>Digital photographs, information in the form of text</td>
<td>Detail information regarding history of the crop, transferring of data and photos through e-mail</td>
<td>Computer operator</td>
</tr>
<tr>
<td>Phase III</td>
<td>Analysis made by the scientists with the help of photographs</td>
<td>Diagnosis of problems, finding solutions</td>
<td>Agricultural expert/scientist</td>
</tr>
<tr>
<td>Phase IV</td>
<td>Processing the solutions sent by the expert</td>
<td>In the form of text sent via email</td>
<td>Computer operator</td>
</tr>
<tr>
<td>Phase V</td>
<td>Solutions made available to the coordinator who in turn conveys them to the farmer.</td>
<td>Oral and text suggestions</td>
<td>Coordinator and farmer</td>
</tr>
</tbody>
</table>

**Figure 1: Agricultural information communication: e-Sagu model**

*(A diagrammatic presentation)*

Digital photographs/text  
Information sent through internet/courier  

![Diagram of e-Sagu model](image)
e-Sagu provides expert advices on problems related to cultivation to the registered farmers. The information communication process, as depicted in Table 2 begins with the collection of information about the field problem at the farmers’ field level. When a farmer approaches the coordinator with a specific problem the coordinator visits the particular field along with the farmer. Coordinator records information in text form as explained by the farmer and as observed by the coordinator him/herself. The nature of damage, for example, a pest or disease infestation, is photographed by the coordinator using digital camera which allows for digital transfer of photograph. Photograph is the most critical tool in the e-Sagu advisory system as the experts at the main center suggest solutions by careful observation of the photograph. The coordinator is trained in taking quality and appropriate photographs. Along with the photograph, the coordinator also records other features of the farm in the format developed by e-Sagu experts. The observations of coordinator, the digital photographs and information provided by the farmer form part of the problem sent to the main centre seeking solutions from experts. This information is uploaded into the computer by the computer operator according to the farmers’ identification number which is available at the local centre for all the registered farmers.

The process of analysis of the problem begins at the main centre where the computer operator downloads the information received from local centre. Such information is collated with the historical account of farm and farmer and sent to the concerned agricultural expert. The agricultural expert analyzes the problem considering the text and pictorial data and arrives at a suggestion. The suggestions are then sent by the computer operator to the local centre through email. As solutions are small in size and do not have photographs which occupy huge digital space the solutions are always sent by email.

The solution is then downloaded by the computer operator at the local centre and transfers it to the coordinator. The coordinator, after careful analysis of suggestions, prepares a note which is then communicated to the concerned farmer. This communication is necessarily personal in nature and often oral and sometime written. The coordinator makes it a point to hand over or give communication to the farmer. It was also observed that the coordinator not only communicates the solutions but also ensures its application.

**Organization of Information Communication in e-Sagu**

e-Sagu functions at two key levels. One, at the local level, i.e. at the village level and another at the nodal level located at Hyderabad. The nodal level is known as main centre where e-Sagu lab is located. Local center is the one where the project is implemented. It is staffed by three members. They are the Administrator, the Computer Operator and the Coordinators. Each local centre is equipped with two computers and other related equipment.

**Local center**

Coordinator, computer operator and administrator are the key personnel involved in the functioning of e-Sagu at local center (Village level). Among these three the crucial role is played by the coordinator in e-Sagu agricultural information system. Coordinator is the one who facilitates information flow from farm to the lab and vice-versa. The role of the coordinator becomes critical due to two reasons. One, the coordinator must constantly interact with the farmers who have registered with e-Sagu. The coordinator should be able to communicate with farmers in their own language. The coordinator should be familiar with the local agricultural
practices, conditions, culture, customs, etc. The familiarity with the local conditions, customs, and culture helps him/her in efficient communication with farmers. Second, the coordinator should be able to use technology and process data. S/he is supposed to use digital camera, computers and Internet (on certain occasions), and knowledgeable in taking appropriate pictures and collecting relevant facts.

One of the important duties of the coordinator is to maintain regular contacts with the farmer and farm during the crop season. Regular visits to the farmer as per the scheduled dates are given highest priority by e-Sagu. Regular farm visits enable the coordinator to assess the crop situation. The key factor that contributes to the efficient functioning of e-Sagu is the regular visit by the coordinator on scheduled dates. This not only develops rapport with the farmers but also reinforces the confidence of the farmer on the system and leads to efficient functioning of the system. In fact the regular and periodic visit is what differentiates e-Sagu from the conventional agricultural extension system.

Computer operator deals with the computerization of the photos collected by the coordinator. In other words all the data/facts in the form of photographs, text information, etc. is transferred to the computer. S/he is also responsible to the transfer of the data to the media lab using Internet. Computer operator prepares the schedule of visits by the coordinator and sends the weather report of the village to the main lab. Administrator looks after the functioning of the local e-Sagu center. Generally a person with good knowledge about the agricultural practices and the occurrence of the pests and diseases in the area is selected as administrator. S/he concentrates mainly on arranging the meetings with local e-Sagu farmers, and is also responsible for conducting the meetings where farmers and agricultural expert interact directly.

**Main centre**

e-Sagu at the main centre is responsible for analyzing the problems reported by the coordinator. This is done through examination of digital photographs received from the local e-Sagu centre. The main centre also maintains an up-to-date socio-economic and farm profile of the registered farmers which helps the agricultural experts in providing appropriate solutions. Diagnosis of the problem, for example, insect or disease damage or deficiency damage is done by using a number of digital photographs sent by the coordinator. Unlike conventional agricultural extension system where in the agricultural extension functionaries offer solutions relying on their general understanding of the region and farmers’ background. In the case of e-Sagu the agricultural expert offers specific suggestion based on authentic and up-to-date information about farmers’ as well as farm’s conditions.

Generally the agricultural experts specialized in entomology, pathology, agronomy, etc. are offer suggestions. The advices are uploaded to the e-Sagu website which is accessed by the computer operator at the local centre. When data in the form of a digital photograph and text comes to the agricultural expert s/he makes intense observation of the picture by zooming in and out. Zooming of the photograph enables close examination and adds an extra dimension in correct diagnosis. This has been found to be more useful in cases of pest and disease attacks. By the careful observation the expert provides the advice either in English or in Telugu. The most difficult cases will be solved by referring to the literature, farm history and through discussions with other scientists and experts.
Another key feature of e-Sagu is data storage and retrieval. Data on each registered farmer is maintained with great care at the main centre. Each registered farmer’s details are digitized and uniquely coded. The problems presented by the coordinator to the main centre seeking solutions are stored based on the codes given for each farmer and each crop.

Table 3: Example of farmer’s registration in e-Sagu

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Name of the Farmer</th>
<th>Farmer ID</th>
<th>Date of Registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Krishna</td>
<td>ap_war_gha_mal_001_jul08_cott_a</td>
<td>7/07/08</td>
</tr>
<tr>
<td>2</td>
<td>Narsaiah</td>
<td>ap_war_gha_mal_010_oct07_chil_a</td>
<td>6/09/07</td>
</tr>
</tbody>
</table>

For example, as shown in Table 3 each farmer is given a unique ID which indicate the state of domicile, district, mandal (a revenue division covering 10-15 village), identity number of the farmer, month and year of registration and the crop including the seed type used in the crop. In the case of farmer by name Krishna (refer Table 3) the ID is 3ap_war_gha_mal_001_jul08_cott_a. Here the initial part of code ap_war_gha_mal stands for Andhra Pradesh, Warangal District, Ghanapur mandal, and Malkapur village referring to the location of the farm. 001 is the identification number of the farmer Krishna which is given by e-Sagu. ‘jul08’ refers to the period when the farmer registered with the e-Sagu. ‘cott’ refers to the specific crop i.e. cotton for which the farmer needs advices. ‘a’ refers to the seed type the farmer is using.

Conclusion

Conventional extension services though goal oriented failed to deliver on account of a multiple factors. It is not just the organizational aspects but the conventional extension system lagged behind in keeping pace with changes. The practice of agriculture is fast changing but the extension approaches have not adapted to meet the changing needs of farmers. They have become structures of irrelevance in the context of small and marginal holdings. e-Sagu founded on the ICT platform initiated agricultural extension services to farmers.

It was found in the study that e-Sagu has been functioning as an information driven organization. As the information exchange is in the electronic form, i.e. ICT based, the number of levels in the organization is small and the structure is simple. It was also found that using ICT e-Sagu is able to provide appropriate, scientific, farmer-specific and farm-specific solutions by the agricultural experts without actually going into the field. The e-Sagu organization ensured the services of local people in collecting and delivering the information at the village level. The key to the functioning of e-Sagu is the role of coordinator whose visits are monitored and ensured by the organization.

It may be suggested that the coordinator though employed by e-Sagu acts more as a farmer’s representative than as an employee of the e-Sagu. This is because of two reasons; one, being a member of farming community of the village the Coordinator feels more responsibility towards farmers of the village thus delivering services promptly. Second, unlike in the conventional agriculture extension system where in the extension workers may or may not have the working knowledge on agriculture, the Coordinator of e-Sagu is a full time farmer and part-time
employee. This feature of e-Sagu appeared to have ensured greater levels of satisfaction in terms of services among farmers.

Is it merely the organizational factor i.e. selecting one of the farmers as Coordinator that has ensured greater delivery of agriculture information services to the farmers? The answer to this lies in the technology part of the e-Sagu and it is the nature of technology adopted that enabled the selection of a farmer as a coordinator. In other words, it may be suggested that as ICT used in e-Sagu enables constant and immediate response from the agricultural experts for any reported problem from the field. Any person even with rudimentary knowledge in handling a digital camera and communicating with the local level computer operator is sufficient to discharge the functions. In contrast an extension worker in the conventional system needed to be qualified in basic degree (about 15 to 16 years of formal education), preferably in agricultural sciences, because of lack of immediate and continuous support from the agricultural experts. Extension services in conventional system are delivered by the extension workers who are provided with information which is general in nature and relatively old. Here the extension worker has to use his/her formal and tacit knowledge to make judgments at the field level and pass it on to the farmers.

In e-Sagu ICTs enabled transcending the human and social barriers of communication by limiting the role of human discretion in the delivery of agricultural information at the farmer level. ICT in e-Sagu not only delivers relevant, appropriate and timely information to the needy farmer it also helps overcoming the problem of information distortion and seepage. Conventional agricultural extension while centering the extension worker in the exchange of agricultural information had been successful to a great extent as it was operating within a normative framework wherein the focus was on single crop (for example, rice or wheat) in a homogenous geographical region and farmers belonging to similar social and economic status. However, the present context of agriculture demands information to cater to diverse needs. In other words a small farmer’s needs are different from that of a large farmer. Similarly, a cotton grower’s needs are different from that of a rice grower. Within a homogenous geographical condition needs of farmers are increasingly becoming diverse. In this context ICT based e-Sagu could provide suitable, appropriate information and meet the needs of diverse farmers. Positioning such diverse information requirements within the conventional extension system would prove to be highly inefficient given the fact that it is personal based agricultural information exchange. Thus ICT based e-Sagu proves to be a relevant method of agricultural extension.

Farmers’ confidence in any extension system depends greatly on the consistency and predictability of farm visits by the concerned personnel. Any extension programme can gain the confidence of the farmers only through proper interaction. The key to agricultural Information transfer in e-Sagu is the regular contact with farmers and meeting them on a predictable and regular schedule forms the basis of the core of activities in e-Sagu.
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