What to Implement in India for E-Agriculture

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Geographic Information Systems (Gis) for Soil Resources

• to use soil resources sustainably.
• collecting a wider spectrum of data in a short span of time.
• makes soil management
  ○ Less tedious
  ○ Less costly
Advantages

• Better than labor- and time-intensive traditional on-site soil surveys and monitoring approaches
• Asian countries are still in the process of evolving a GIS-driven baseline data, while building their human resources to strengthen their GIS capability in the future.
Why GIS?

• The main Aim is counteracting the negative effects of development, such as soil erosion, soil salinity, soil pollution and flooding.
• a significant tool to help countries manage their land and soil resource sustainably, restoring their productivity for future generations.
Applications of GIS

• precision farming approaches
• small-farm agriculture
• GIS-based soil erosion models
• land classification and suitability evaluation
• remote sensing and GIS for soil resource management
• Internet service system of agro-soil environmental information.
Precision Agriculture

- Remote Sensing
- Winds
- Soil
- Crop Yield
Precision Farming

• Precision farming originally developed for large farming units, such as those found in the United States, has been adapted to the needs of small-scale farms in Asia, which in some countries have an average size of only one hectare (2.6 acres).

• three technology levels:
  ○ describing variability
  ○ using variable-rate technology (VRT) for adjusting agricultural inputs to site-specific requirements
  ○ applying a decision-support system (DSS).
How they do Precision Farming?

• Japan has recently developed automated measuring variability within fields, using a real time soil spectrophometer.
• Satellites collect the data.
• It is now possible to apply precision farming to small as well as large farms, and make it part of Asian rural development programs.
Some more Facts

- Taiwan has a strong island-wide soil testing service. Small-scale rice farmers in Taiwan improve their fertilizer applications by knowing the nutrient status of their soils, particularly with regard to nitrogen, phosphorus, and potassium (N, P and K).
- Decision support systems are being developed which will provide site-specific fertilizer recommendations.
- Initially, detailed information for farmers will be provided through the existing agricultural information services.
- Later, this information will be directly available to farmers over Internet.
Gis-Based Mapping and Modeling of Soil Erosion

• Conventional surveys of soil erosion in the field are costly in time and labor.
• To get a reliable estimate of the rate of soil erosion and the main factors influencing it, surveys of erosion usually have to cover several years.
• GIS-assisted physical models are now available which can predict where erosion "hot-spots" are likely to occur.
Some Real Examples…

• In the Mapawa catchment area in the Philippines, this approach was applied
• The main erosion factor was found to be “rainfall intensity”. Road construction was also important. The model could thus be used to identify sites which were very vulnerable to erosion, and where conservation measures were urgently needed.
GIS – Satellite view

• GIS could also be used to predict the effects of surface cover on the discharge of water and soil sediments from the catchment area. The rate of soil and water loss from bare soil was compared to vegetative cover with minimum conservation measures, the same cover with full conservation measures, and forest cover.
• There was a close agreement between predicted and observed measurements, which implies that the model is a valid predictive tool. Interestingly, it was noted that canopy cover was not very effective in containing erosion. What was important was cover which lay in direct contact with the soil surface.
Using Satellites to Monitor Changes in Land Use

• All Asian governments have legal restrictions concerning the use of public land, especially the cutting of forest, and the conversion of forest to arable land. In practice, it is difficult to monitor what are usually remote areas, and detect changes in land use at an early stage before environmental damage has become serious.

• Satellite remote sensing is an effective way of monitoring resource management and changes occurring over large areas. The "Gram-Schmidt Orthogonalization (GSO)" technique is being used in Malaysia to detect and monitor changes in land use, using data transmitted by satellite.
Boon for Policy makers

• This type of analysis is also very useful for showing the sustainability of different agricultural systems. Policy makers can only promote sustainable land use systems if they know which ones they are. GIS facilitates the classification of land into different land use classes, and can monitor the long-term impact of different kinds of land use.

• In this way, policy makers can be helped to distinguish land where agriculture can be intensified or expanded, from land where rehabilitation and diversification are needed. The information from GIS is now becoming detailed enough to show which areas are suitable for specific crops.
Farmers & GIS

- Farmers can also be a key source of information. Often the local knowledge of farmers is more relevant and useful than the academic knowledge of scientists. GIS can also show gaps in infrastructure, such as a scarcity of roads or marketing centers, that may cause agricultural development programs to fail in an area which otherwise seems suitable.
Disseminating the Information

• Korea and Taiwan are pioneering the use of information technology in environmental management for agriculture. Sources of data are land use surveys, aerial photographs, detailed soil survey maps etc. Maps are generated from these sources and encoded in central computers. The system is linked to related institutes and centers throughout Korea and Taiwan, and is then made available on the Internet.
What is the Information on the web?

- Internet users, including farmers or extension staff, can easily find information at a provincial, county or district level. Information include *land use, drainage, soil type, soil depth and soil chemical properties*. *Recommendations for each type of land use* are also being provided for farmers and other clients.
Future of GIS

• In adopting GIS, it is necessary to identify the specific clientele whom it will be serving. These may be small- or large-scale farmers, extension staff, or institutions who will be adopting GIS. Will these be the small- or large-scale farmer, the extension worker, or an institution?
• If farmers are the main beneficiaries of GIS, their socio-economic background must be considered.
• Soil management based on GIS should have the marketing aspect and risk management factored in.
• The benefits of participatory GIS development should be explored further.
• A network for GIS should be established among Asian countries.
• In developing a GIS-based system, a decision needs to be taken about the best mode of information dissemination, based on the country's present situation. This might be a decision support system (DSS), stand alone or web pages.
• Farmers should be asked for feedback on the validity of the GIS-derived data.
Examples - Expert Systems

- **GRAIN MARKETING ADVISOR** is an expert system for determining marketing alternatives and optimal strategies for grain producers. In this system individual farm conditions are considered. Information on storage and dryer availability, price level, price trends, government program eligibility, and timing are required as input data for deciding the optimal marketing recourse for the crops.

- **COMAX**: provides information on integrated crop management in cotton. The system uses a combination of expert derived rules and results generated by the cotton crop simulation model.

- **GOSSYM**: It requires external information such as weather data, soil physical parameters, soil fertility levels, and certain pest management information. Based on this input data, the system makes recommendations on the daily management decisions.

- **POMME**: provides information about pest and orchard management of apples. External information such as weather data including forecasts and crop symptoms are utilized by the system to generate management decision recommendations.

- **PLANT/ds**: supports the diagnosis of soybean diseases

- **SUBERMAX**: is an expert system prototype that can help storage managers, especially during hectic harvest times by taking information on potato quality, bin environment, outside environment, bin facilities, and give recommendations.

- **SOYEX**: is a soybean oil extraction expert system. Justifications and certainly factors for remedies help the user to select an effective solution.

- **FINDS**: a Farm-level Intelligent Decision Support system was developed to address the integration of weather and land management systems for farm-level decision support.
Gyandoot: Community-Owned Rural Internet Kiosks

- Started in the Dhar district in central India having a population of 1.7 million; where 60% live below the poverty line.
- The goal of the Gyandoot project was to establish community-owned, technologically innovative and sustainable information kiosks in a poverty-stricken, tribal dominated rural area of Madhya Pradesh. Gyandoot project was launched on January 1, 2000 with the installation of a low cost rural Intranet covering 20 village information kiosks in five Blocks of the district; later, extending to 11 more kiosks. For establishing the kiosks, villages that function as block headquarters were chosen.
Services offered at kiosks

- Agriculture Produce Auction Centres Rates: Prevailing rates of prominent crops at the local and other recognized auction centres around the country are available on-line for a nominal charge of Rs. 5.
- Copies of Land Records: Documents relating to land records including khasra (record of rights) are provided on the spot at a charge of Rs. 15.
- On-line Registration of Applications: Villagers had to make several visits to the local revenue court to file applications for obtaining income/caste/domicile certificates.
- On-line Public Grievance Redress: A complaint can be filed and a reply received within 7 days for a cost of Rs 10.
- Village auction site: This facility began in July 2000. It makes auction facilities available to farmers and villagers for land, agricultural machinery, equipment, and other durable commodities. One can put one's commodity on sale for a charge of Rs. 25/- for three months.
- Transparency in government: Villagers could step on the same platform and understand the functioning of the government better.
- Other services: Other services offered at the kiosks include on-line matrimonial advertisements, information regarding government programs, a forum for school children to ask questions, ask an expert, e-mail (free for information on child labour, child marriage, illegal possession of land belonging to Scheduled Tribes, etc.)
- Some kiosks also have added photocopy machines, STD PCO, and horoscope services.
Success of Gyandoot !!!

• In the year 2000, the kiosk network was accessed 1,200 times for a variety of services.
• That number reached nearly 9,000 within six months.
• During the first 11 months, the 31 Gyandoot kiosks were used nearly 55,000 times.
Zinc Status of Rice Fields in Central Taiwan
(Pink=Deficiency, Brown=Excess)
Some INDIAN initiatives !!!

• The “Positive Solutions” Private Limited an A.P. based company working in association with A P Farmer’s Association has developed an agriculture-based portal, www.indian-farmers.org.

• The site aims at disseminating information and educating farmers in various sectors of agriculture by introducing them to areas like IT and Biotechnology.

• The latest happenings and news in the field of agriculture will also be available on the site.
More Indian Future Projects !!!

• Agricultural Projects being undertaken by the Centre for Data Engineering at International Institute of Information Technology, Hyderabad, India, are:
  
• Web-based Agricultural Expert Advice Dissemination System: In this project, an effort is being made to build a cost-effective agricultural information dissemination system to disseminate expert agriculture knowledge to the farming community to improve the crop productivity.
  
• Pest Prediction Systems: In this project an effort to understand pest population dynamics and build pest prediction systems by applying data mining techniques on pest surveillance data set of Helicoverpa Armegira, Bacterial Leaf Blight, Groundnut leaf miner regarding Chickpea, Pigeonpea, Cotton, Groundnut, and Rice crops is being made. This project is carried out in collaboration with ICRISAT (The International Crops Research Institute for the Semi-Arid Tropics), Patancheru, Hyderabad (India) and CRIDA (The Central Research Institute of Dryland Agriculture), Hyderabad (India).
Changes in Soil Erosion between 1987 and 1992, Wusan Watershed, Taiwan (Green=No Increase)
Technology @ Service

• Web-based marketing:
  ○ B2C: A direct marketing system between farmers and consumers
  ○ B2B: Bridges farmers and wholesalers, substituting for fresh markets by providing virtual market places over the Internet.
  ○ Web-based marketing is typically successful in Korea.
Small-scale farming is typical in the Asian region. It is a main cause of the inefficient agricultural productivity and the lack of its global competitiveness. A simple solution is to merge small-scale lands to a big scale one. The land ownership, however, makes it difficult as the number of landowning farmers increased based on modernization. One solution we can expect is to virtually integrate those small-scale farmers while keeping their financial independency.

For example, a group of farmers can purchase chemicals with cheaper price than they can when they order individually. Or, if they can share machineries, the total cost on them can be reduced. We can expect similar cost reduction in marketing, logistics, risk management etc. as merits of scale. To realize such cooperation, the help of IT is inevitable in many ways.
Remote consultation network of the Rural Development Administration (RDA), Korea
A Web-Based Camera Server System,
Field Eye: User Interface for the Remote Camera System (Left and Middle),
User Interface for the Automatically Acquired Image Database System (Right)
Mobile Phone-Based Web Applications
Weather Database Access (Left) and Farm Management Diary (Right)
Fieldserver, Wireless Lan Autonomous Field Monitoring System
Coverage of a Region by Fieldservers
Farmers' Information and Technology Service (FITS) information system, Philippines. Intended for quick information retrieval and exchange to facilitate delivery of services by extension agents.
Plant Condition Diagnosis System
Navigation Search: Users Do Not Need to Use Keyboards
In agriculture, the World Wide Web holds the promise of reducing the barrier of distance and time, improving access to information and facilitating transaction and integration among research, education, extension, agribusiness, farming and rural development.

[Database on crop production and pest management (www.rda.go.kr)]
Web marketing with remote camera
Web Marketing with Remote Camera
Some good News

• NSE is listed in top ten global markets for Futures & Options segment.
• The marked entry of Reliance as retailer for better
  ○ Intra country supply chain management of agri-produce & logistics management.
  ○ Better Distribution & Stocking mechanism.
Schematic Diagram of an Agricultural Grid System

- Case Base
- Farm Management
- Agterm Dictionary
- Meta Database
- Data Broker
- User who needs Decision
- Growth Model 1
- Weather Data 1
- Field Data Monitoring
- Weather Data 2
- Growth Model 2
Challenges !!! (to be overcome)

- Constraints and Remedies for Effective Dissemination
- Some of the major constraints delaying the spread of e-revolution to rural India
- are listed below:
  - 1. Haphazard development: It is observed that some initiatives have already been made to provide IT-based services to rural community. However, duplication of efforts are witnessed as most of the services revolve around limited subjects. Keeping in view the giant task involved, it is necessary to form a coordination mechanism to strive for a concerted effort to support farming community in the country. Such a coordination agency may only have advisory powers such as user interface, broad design, delivery mechanism of the content,
  - standards for setting up kiosks.
  - 2. User friendliness: The success of this strategy depends on the ease with which rural population can use the content. This will require intuitive graphics based presentation. Touch screen kiosks are required to be set up to encourage greater participation
  - 3. Local languages: Regional language fonts and mechanisms for synchronisation of the content provides a challenge that needs to be met with careful planning.
Challenges !!! (to be overcome)

• Restrictions : Information content based on remote sensing and geographical information systems can provide timely alerts to the farmers and also improve the efficiency of administration. These applications can have a major impact on the farmers and help them to appreciate the potential of information technology. However, government’s map restriction policies often threaten to stifle the optimal utilisation of these tools.

• Power Supply : In most of the rural India, power supply is not available for long hours. This will reduce the usefulness of the intended services. Since almost entire country receives sunshine for most part of the year, it is useful to explore solar power packs for UPS as well as for supply of power. The Ministry of Non-conventional Energy Sources may pay special attention in this area which can be a major contributor to the growth of IT in villages.
Connectivity: Despite the phenomenal progress made in the recent years, the connectivity to rural areas still requires to be improved. Reliable connectivity is a prerequisite for a successful penetration of IT into rural areas. Many private ISPs are setting up large networks connecting many major towns and cities. Since some of these networks pass through rural areas, it is possible to provide connectivity to a large number of villages. Several technologies exist that can be utilised for connecting rural areas. Cable network is a possible medium for providing the last mile connectivity to villages.

Bandwidth: Even in areas where telephone and other communication services exist, the available bandwidth is a major constraint. Since internet-based rural services require substantial use of graphics, low bandwidth is one of the major limitations in providing effective e-services to farmers. As already stated, networks with high bandwidth are being set up by several companies passing through rural segments which can be utilised. Until this materialises, a two-pronged strategy of storing static information at the kiosks and providing dynamic information from remote locations can be examined. The graphic-oriented content which does not change frequently, such as, demonstration clips for farmers, can be stored on the local drives at the kiosks and arrange for periodic updation of this information over the network during non-peak hours. The dynamic information which changes more frequently can be accessed from remote locations to obtain the latest status.

Challenges !!! (to be overcome)
Some Challenges

- Poor Broadband connectivity in rural areas because of absence of commercial competition. This also limits the IT extension in the rural areas, as the Internet is apparently an inevitable core infrastructure in IT utilization.
- Factors to consider for IT in agriculture are as follows:
  1. How to adjust software to the special features of agricultural information
  2. How to enrich digital contents
  3. How to utilize the Internet, especially to reduce time and monetary costs
  4. How to provide easy-to-use systems for computer literacy?
  5. How to convince farmers of the potential benefits of IT?
Java Applet to Obtain Weather Data Mediated by Metbroker. Users Can Obtain Weather Data from Several Heterogeneous Weather Databases by Using This Application through Setting Query Options.
Choosing the right Software

- Software packages must be thoroughly evaluated before they can be used as a foundation for a new information system.
- Check the functionality of the package in all aspects.
- Flexibility aspects:
  - User friendliness, Hardware & Software Resources, Database requirements, Installation Effort, Maintenance, Vendor Quality and Cost.
Crop Models As Metbroker Applications Such As a Japanese Pear Growth and Disease Prediction and a Rice Growth Prediction
MetBroker Application

- Shows Spatial Weather Data from a Region Over the Map. the Same Application Can Display Weather of Completely Different Databases. the Left Shows the Data for the Wakayama Prefecture from a Prefectural Local Database and Amedas for the Region, and the Right Shows the Data for the Korean Peninsula from the Seoul National University Weather Database and the Amedas DB of Japan. the Map Data Is Dynamically Downloaded from a Map Server in the Us, Using Chizubroker
Sample Metbroker Applet …

References

- http://www.agnet.org
Any Feedbacks/Suggestions?

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