

Utilizing Information Technology resources for enhancing of agriculture produce in India

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Abstract: India is stepping towards new digitization and Information Technology era but still agriculture plays a vital role in the Indian economy. Whether it comes to contribution to gross domestic product (GDP) as well as a source of employment to millions across the country agriculture is a dominant sector of the Indian economy. AS the principal means of livelihood over 70 percent of Indian rural household depends on agriculture or agriculture associated work. This paper gives an overview about the usage of Information technology (IT) resources for improving the efficiency and productivity of agriculture in India. It also highlights global trend of eAgriculture. This paper is based on secondary data.

Keywords: eAgriculture, ICT, FAO, IFAD)

I. Introduction

The average food consumption per person per day has increased from 2200 Kcal/person/day in 1960s to 2800 Kcal/person/day [United Nations Food and Agriculture organization] indicating increase in food consumption over the years. Two of the world's most populated nation China and India too has witnessed dramatic rise in food consumption – 57% percent of the population in these countries consumed about 2000 Kcal/person/day in 1960s while current statistics indicates that 61% of the population in these two countries consume about 2700 Kcal/person/day^[1]. Not to forget that about 820 million people in the developing countries still fall under undernourished category.

It is important to understand these figures in terms of increase in world's population i.e., as compare to current population of about 6.7 billion, the population in 1960s was just about half of it – 3.5 billion^{[1][2]}. It is predicted that the world's population would be 9 billion by 2050 and therefore to cater to these large population 70% more food will be needed. This rise in population will mean more need for agriculture produce within the same (or smaller) field size, new and improved techniques, faster reach to the market, better storage and preservation techniques^{[2][3]}.

India lives in villages with 52% of its population having farming as main occupation. They completely rely on agriculture for their livelihood and sustenance^[3]. The performances of this sector contribute majorly to the composition of Gross Domestic Product (GDP).

Increasing populations with corresponding longer life expectancies, land conversion, biofuel production, and impact of climate change has led to serious issues and challenges that require immediate attention and subsequent solution lest it will lead to further food shortages and growing food prices. India is far more vulnerable, driving farmers with heavy debts towards committing suicides^{[3][4]}.

There are uncontrollable parameters such as less to moderate monsoons, increasing infertility of soil, unseasonal rains, and insurance to the damages that governs the agriculture sector. Under these negative constraints, can information and communication technology (ICT) applications – collectively referred to as eAgriculture - provide a mechanism to address the issues pertaining to the agriculture sector? Many, still perceive it as a hype and irrelevant.

The Food and Agriculture Organization (FAO) and the International Fund for Agricultural Development (IFAD) have envisaged a road map that guides in development of e-Agriculture applications. These ICT backed solution is aimed at identifying major causes of the problems and provides with immediate, effective and possible course of action to resolve the issues at hands^[4].

With *Government* changing its role from *being controller* of infrastructure and technology to *facilitator* of infrastructure and technology, IT has changed its characteristic from fulfilling external demand to creating internal demand. Information Technology has entered, expanded and diversified. The present information revolution with satellite and computers has led to shrinking of the world. The facility like Internet Access Node has now become necessity of life to keep pace with fast developing and rapidly changing world. The immense benefit of transacting on Internet, by way of huge saving in cost, time and effort not to mention increased choice

and convenience has made more and more people switch to the web as primary vehicle of information exchange.

II. Global trends in eAgriculture

- **Technology-based Solutions**

Increase in population (with increase in food consumption per person/day) has naturally and will continue to put pressure on demand for agriculture produce globally (see Table 1). Unscientific production pattern to meet the demand will definitely impact global crop production and threaten biodiversity.

Table 1: Per capita food consumption (Kcal/person/day)

Year	1964/66	1997/99	2015	2030 (expected)
World	2358	2803	2940	3050
Developing countries	2054	2681	2850	2980
Sub-Saharan Africa	2058	2195	2360	2540
Near East/North Africa	2290	3006	3090	3170
Latin America/ Caribbean	2393	2824	2980	3140
South Asia	2017	2403	2700	2900
East Asia	1957	2921	3060	3190
Industrial Countries	2947	3380	3440	3500
Transition Countries	3222	2906	3060	3180

[Source: Source: Adapted from World Bank (2001c)]

Agricultural extensification and intensification are the options that can help increase production. Clearing additional lands for crop production is referred to as “Agriculture extensification” while increasing inputs to achieve higher yields, improving crop varieties and agronomic practices mostly through technological innovations gets bracketed under “Agriculture intensification” [5][6][10].

eAgriculture and its application come under agriculture intensification with the aim of improving quantity and quality of production and profits margins for farmers. In order to protect the environment, improve cost benefits ratio and sustain agriculture business, field farmers are extensively using biotechnology, computers and satellite technologies. E-commerce and e-marketing help the farmers to push their produce with greater convenience using electronic network [6][7][10].

Sustainability in agriculture gets identified through the manner in which production is maintained over period of time and its impact on capacity of agro-ecosystem (agriculture land). All these can be viewed through the lenses of scientific agriculture, first propagated by Liebig in 1840 and Johnston in 1842, which defines the role of chemistry in agriculture. The year 1865, saw the concepts of Mendelian inheritance and genetics (identification of traits that follow a particular law) getting into agriculture that subsequently stimulated biological basis for modern agriculture (Pesek, 1993).

Productivity and stability in agriculture is largely going to depend on technology development and innovation. Institutions in Europe and North America responded quickly to the anticipated change and included the study of application of biological and chemical sciences to agriculture, new technologies and approaches towards improving agro produce for advocating the use of scientific techniques into farming as a part of their curriculum. (Hutchins and Gehring, 1993) [10].

Furthermore, use of biotechnology has enabled the use of direct renewable and abundant natural energy to increase of quality food products. Using biotechnology short term objectives like yield, quality and input reduction has been achieved. For Agricultural productivity/ stability technology use and improvements are essential. Current innovations and growth in use of technology ensures that the key to sustainable endeavor is discovery and development of new technology [8][9][10].

III. Precision Agriculture

Precision agriculture balances the productivity with the environmental concerns and gives the new solution to the problems faced while using traditional agricultural techniques. In precision agriculture farmers can take takes help of IT and satellite technologies for cost saving, improving field yields and ways to protect the environment. Figure 1 explains the concept of precision farming.

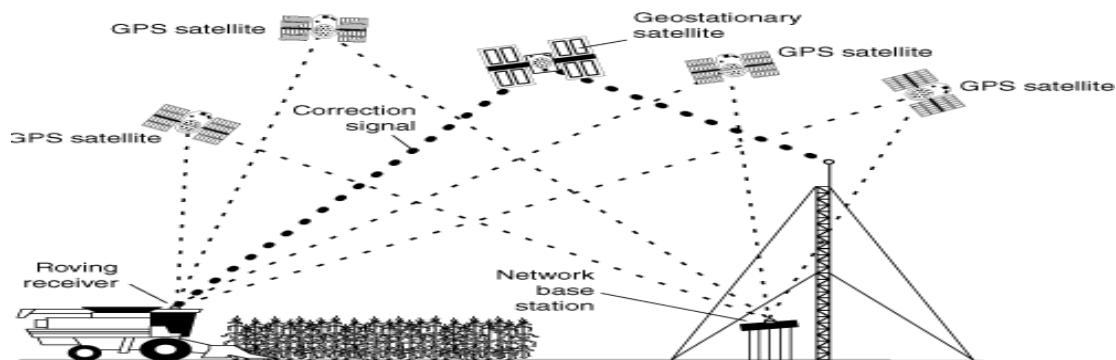


Figure 1: Precision Farming

Precision farming has become an effective solution to soil degradation in cultivated lands and has also resulted in reduction of chemical use in the crop production.

Precision agriculture has major advantages in agronomical perspective, technical perspective, environmental perspective, economical perspective as it helps look for a specific requirement of any produce.

U.S. corn and soybean farmers are seeking and adopting guidance and auto steering solutions in their farming culture which makes the leader of in precision agriculture and top user of Information Technology resources in farming. With this rate it is expected that the precision agriculture technique will grow at a rate of 10 to 15 percent in the U.S. in near future. European continent is more focused on efficient use of precision farming to address the environmental issues and to combat with the negative public perception. Brazil is more concerned about making software product which will focus on impact of data and fleet management on the management of the sugarcane crops.

Within this ecological, economic and social limits, sustainable agricultural practices assures to provide required supply which can manage and maintain the production on long term basis for entire population. Crops, soils and farmer's insight are the basis of precision agriculture it has become a cornerstone of sustainable agriculture.

IV. E-Commerce in Agriculture

In a simple term E-business is the market place which uses digital computing, network and internet technologies to securely transform:

- Processes which manages entire business (via Intranets)
- Relationship which are important to do business (via Extranets) and
- Import and export of information, services and goods through E-commerce. For e-commerce both buyers and sellers need to have an internet access ^{[9][11]}.

Mobile telephony and e-commerce has become an integral part of people's life. Through better communication and greater access to the information, cheaper internet and mobile phones facilities the living style of farmers can be considerably improved. Having access to the market-information, farmers are now able to receive better prices for their crops.

E-commerce helps the farmers by reducing the risk factor associated with the under-selling and over or under-supplying their crops by having access to information about process and stock on regular basis and realistic manner. Early warning system to migrate the risk of losses due to extreme weather conditions or to the spread of disease also can be avoided using information transmitted by mobile phones. This way eAgriculture incorporates IT technologies into agriculture and increases the capability of impacting positively the efficiency of agriculture with less cost and there by promoting the sustainable agriculture practices ^{[9][11][12][13]}.

V. ICTs Policy Implications for Developing Countries such as India

When it comes to low cost eAgriculture applications mobile phones becomes very significant. It was really is for research experts to anticipate in future that for private sector agribusiness - market information and market intelligence applications are going to play a big role. On the contrary part though the mobile device use has been increased and other digital resources has been increased eAgriculture project have not been able to produce effective visible outcomes majorly because lack of concrete policies from governing bodies as well as eAgriculture practices are limited to smaller scale smaller geographical area covering only few hundred of farmers.

Following are some suggestions for eAgricultural policies which should include:

1. National and State Governments e-Agriculture Policy: Leveraging ICT in India for the agricultural extension IT services provision should explore and outline the possibilities.
2. Human Resource Development: For creating awareness, development of skill and capacity among the farmers and other stakeholder in the private and public extension which will result in facilitation and encouragement to better usage of ICTs.
3. Utilizing and sharing farm information among the farmers and other stakeholders it is necessary to the respective extension organization or personnel be equipped with ICT which will facilitate the information sharing and utilization.
4. Localization and Customization of Content: As per farmers and other stakeholders requirement there should be a mechanism to process and gather appropriate information continuously. Research and educational institutions systems should work towards this continuous content localization and customization requirements.
5. Integration of ICTs with Public-Private Extension System: To complement ongoing efforts of the public and private system there is a need of identifying appropriate ICT and deploying it or centralize it with existing extension system. Such collaboration will result in more information utilization and finding better solutions efficiently.
6. Farm Research and Developmental Institutions Collaboration: Information as a whole makes sense and creates more value so establishing such collaboration of research and development institutes or IT services providers who has ICT initiatives leads better environment for fulfilling ICT initiatives and strengthens whole system to achieve better agricultural results.

• **ICT For sustainable agriculture**

In terms of applicability and use of most sophisticated technologies ICT is very advance and turned out to be universal and very affordable. In India situation is not so far good as there is no such mechanism which address the issues related to equity and sustainability in agriculture. Only few organizations have achieved the goal of building services which can be scaled up to have long term sustainable impact on the society by taking ICT initiative in comprehensive manner e.g. (Jhunjhunwala and Aiyar, 2006). ICT’s concern on sustainability has rarely addressed in India. ^[17]

▪ **The goal and challenges for sustainable agriculture:**

Optimum resource use and simultaneous profitability this contradictory concerns offers the challenges in sustainability of agriculture therefore any ICT program which is sustainability focused have to follow than that of the conventional transfer of technology initiative. There are factors like security, satisfaction, of material needs, health, social relations, freedom of choice by which human wellbeing could be measured and this become the goal of sustainable development policy. To meet this it becomes very necessary to generate and distribute wealth in ways that reduce poverty and provide a decent standard of living to people everywhere (IISD, 2010) ^{[15][17]}

▪ **Sustainability of Agriculture Using ICT: Interventions and Action Points**

To achieve agricultural production and environmental sustainability policies, technologies and institutions need to increase on poverty reduction initiatives at macro level. Also requires an information supports which includes closing knowledge gap, including means of measurements and monitoring. For yield-increasing and resource conserving technologies-generation as well as appropriation there is a need of information on community level property rights and resource management. Also information related to institution, people’s network, market channels, value chains adds a big advantage. ^[17]

Table 2: ICT programmes for sustainable resource management: An illustrative compilation

Name of the project	Agency and Area	Major Focus	Mode of action
Application of ICTs in land surveys and registration systems Participatory 3D mapping in the Philippines	The Philippine Association For Intercultural Development (PAFID)	Conservation of ancestral domains	Participatory mapping and GIS integration
Logging Off	Malaysia	Conservation of forest	Mapping and modelling to represent land and the associated resources and integrating into GIS maps for community level learning and action

Hanoi Land Information Management	Vietnam	Easy access to information on land parcels	Maps and GIS Community training on mapping
Mekong Info - Information System for Natural Resources Management in the Mekong River	Mekong River Commission, South East Asia	Providing access to information about participatory natural resource management	Building information repository and providing access to various stakeholders for formulating action plans
Integrated Water Resource Management	Thailand	Water resource management	Development of a computerized information system on water resources and promoting the linkage of information

[Source: (Saravanan, 2010a; Saravanan et al., 2011; Sulaiman, 2012) www.ekrishinaip.in]

Key components of the ICT for agricultural sustainability

- Information access Enhancement: To provide information the use of knowledge kiosks for credit availability, inputs for cultivation, market opportunities, process, package of practices, training programs, certification processes.
- Online and off line transfer of technology and e-learning: There must be an online and offline communication facilities because in many developing countries there are lack of infrastructure facilities, people don't get relevant content in local languages and there are pedagogical limitation in virtual learning also.
- Interactive multimedia facilities for rural people: Crops based multimedia interactive products, practices of cultural aspects and conservation for rural people is the most important key component. E.g. Call centers, Video conferencing.
- Resource database and maps at grass root level: Grass root level resource databases, resource maps and development databases can benefit a poorest of poor farmer in rural areas.
- E-governance: For better coordination of development agencies the e-governance facilities importance is big. MIS based development administration and grass root planning gives the better results and platform. Also office automation, transaction based database generation and report transfer provides a better services.

[15][17]

VI. Conclusion

The provided facts about global technology based solution, precision farming, e-commerce and ICT shows that world agriculture has been succeeded so far in improving yield quality and input reduction. This results in agricultural productivity and stability which has resulted in sustainability of agriculture. With the use of efficient innovative technology in precision agriculture became the cornerstone of sustainable agriculture which seeks to assure a continued food supply of all necessary sustain production using high tech system used in precision farming. E-commerce incorporating IT technologies which benefited positively and efficiently to the agriculture which has cost less and there by promoted the sustainable agriculture. ICTs for sustainable agriculture require exclusive interventions guided by the principles of sustainable growth. Research and development agencies should focus on developing paradigms of information support for sustainable resource use. ICT enabled transfer of technology models should address information required for sustainable production. Development administration should be facilitated by robust information systems for improving efficiency.

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