

Solar Energy(SE) For ICT And Sustainable Development Of Indian Agriculture

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Abstract - All the way in history, the farmers have strived for better access to information and communication. The rapid technological process has now lead to a variety of new information and communication technologies (ICTs), which have the potential to address the information and communication needs of Indian farmers much faster and with far more accuracy than ever before. The article shows that ICT applications provide tremendous opportunities for food security and sustainability. The Solar energies(SEs) are provided by natural resources (sunlight, wind, water, and geothermal heat) through the use of engineering technologies able to collect the energy and to convert it in a more usable form. ICT can play a significant role in this context, especially if it is considered as a whole thus reusing much of the theories developed in other sector Solar Photovoltaics(PVs) energy generation is the fastest growing sector of renewable energy capacity, increasing at around a rate of 40% annually and reaching an estimated global market size of US\$150 billion Solar Photovoltaics (PVs) are stand-alone energy generation systems that consist of photovoltaic modules that convert solar radiation into electricity. Also it helps to reduced GHG(Green House Gas) emission.

keywords - ICTs, Solar Photovoltaics (PVs), Indian Farmers, Agricultural Practices, Solar Energies(SEs), Geothermal Heat, GHG(Green House Gas) emission

INTRODUCTION:

The purpose of this paper is to systematically examine and draw attention to the potential benefits of solar power generation for access to and use of information and communication technologies (ICT) aimed at sustainable development in Indian agricultural practices. Design/methodology/approach of Solar energy plays a crucial role in the development and use of ICT and in the process of striving to achieve sustainable development in emerging economies of any country. It has been shown that electrical energy is intrinsically linked to economic, environmental and social dimensions of sustainable development. An extensive analysis of the major contribution of solar electricity in various sectors such as economic, social and environmental benefits is provided. The solar electricity in major emerging economies, their planning policies and strategies for promoting solar power generation for increased access to ICT by people and sustainable development of society. The important issues that must be considered and addressed for the successful implementation of solar electricity programs for sustainability and wellbeing in developing nations are pointed out. Practical implications. Solar energy mainly refers to the use of solar radiation for practical ends. However, all renewable energies, other than geothermal and tidal, derive their energy from the sun. Solar technologies are broadly characterized as either passive or active depending on the way they capture, convert and distribute sunlight. Active solar techniques use photovoltaic panels, pumps, and fans to convert sunlight into useful outputs. Passive solar techniques include selecting materials with favorable thermal properties, designing spaces that naturally circulate air, and referencing the position of a building to the Sun. Active solar technologies increase the supply of energy and are considered supply side technologies, while passive solar technologies reduce the need for alternate resources and are generally considered demand side of a series of short dipole antennas, connected with a diode. Microwaves broadcast from the SPS are received by these dipoles with about 80-90% efficiency. With a conventional microwave antenna the reception is even better, but the cost and complexity is considerably greater^[1].

The agriculture is a gigantic sector of the Indian economy as its share to gross domestic product (GDP) is around 30 per cent. Over 60-70 per cent of the population adopts agriculture as main occupation. In spite of a large of Indian economy, agriculture is lagging behind many aspects and characterized by poor connectivity and disintegration of market, unreliable and delayed information to the farmers, small land holdings, non adoption or less adoption of improved technology and so on. It has become indispensable to explore various ways to keep our farmers updated about modern technologies and relevant information. The development and timely dissemination of better personalized technologies specific to different agro-climatic conditions, size of land holding, soil type, type of crops and related pests/diseases is the real issue to brazen out ahead for the agricultural scientists/experts. The timely availability of right information and its proper utilization is indispensable for agriculture. ICT based initiatives can be taken for propagation of information, transfer of technology, procurement of inputs and selling of outputs in a way so that farmers can be benefitted.

The timely information and practical solutions of the agricultural problems helps the farmers to adopt good agricultural practices, make better choices of inputs and to plan the cultivation properly. The Coronavirus pandemic has shown the world a reality far beyond anyone's imagination. That our lives and daily routine would come to such a pass has exposed us to a

completely new reality. Uncertainty is the order of the day and it was only a matter of time before accepted ways of life socially or otherwise were majorly disrupted. Our routine tasks – official, educational, or even leisure activities such as shopping etc have now almost completely gone digital. A digital service is one that is delivered via the internet or electronic network.

Today, there is no option but to use online or digital transactional systems. While for most people digital transformation was so far more of an abstract concept, something far off in future, the Covid-19 pandemic has brought it into sharp focus. Indeed, in such difficult times, information and communication technologies (ICT) and digital platforms have ensured that the world does not come to a grinding halt and that some semblance of order remains in our daily lives. We must face the fact that things may not go back to 'normal' once the pandemic abates.

Firstly, the time frame itself is uncertain and secondly there is a widespread belief that going back to older ways of doing businesses involves great risks, both societal and economic. It's clear that digital services are going to be central to developmental discourse with a distinct possibility of several recovery and rebuilding initiatives built around these services. Hence, it is time to get ready for what the United Nations Conference on Trade and Development terms as a 'digital economy'. A key factor in wide-scale user reliance on digital services would be the reliability of ICT infrastructure and of digital services' delivery. These systems should be reliable for 24x7x365 uptime for users even in the remotest corners of the country. Conventionally, the focus has remained on the upstream side, on data centers for example, but studies have shown that it is the last-mile delivery that matters the most and is often neglected. If one looks at the ICT value chain from telecom towers to cloud and hyper scale data centers to data transmission networks to digital platforms to user devices; or points of use of services, may they be common service centers in villages, primary health centers, rural schools, homes, or neighborhood kirana shops doubling as payment banks. The solar energy emerges as the key driver for digital economy to function. A couple of months ago, India's Department of Telecommunications too had asked telecom service providers to use renewable energy solutions. Indeed, there are solar power companies in India that are working with telecom tower companies for optimized business models. There are hundreds of rural branches of micro-finance institutions that run on solar power because of erratic grid electricity. Small shops and homes in many villages have been using solar lighting for long and there is no reason why the same cannot be augmented to power other utilities. The feasibility has already been demonstrated, what is required now is to build solar energy as an essential element of this big picture. As a bargain, this would also help digital economy move towards inspirational Sustainable Development Visions (SDVs) via a low-carbon pathway.

OBJECTIVES OF THE PAPER

To provide the information to the farmers on quality of the inputs and its availability through ICT.

To scatter or spread widely, as though ICT sowing seed, promulgate extensively; broadcast; disperse time to time information with preventive measures to farmers^[2].

To provide the facilities about the information of various government schemes and recommending fertilizers w.r.t soil testing proper seeds, weather forecast, agricultural equipment subsidies, solar promotion subsidies etc.

To provide information on latest solar based agricultural technologies for increasing productivity in agricultural practices.

To create an awareness among the farmers about storing solar energy for later use

To prevent the global warming in efficient and organized manner.

SIGNIFICANCE:

- ICT in improving agricultural production and productivity of Indian Farmers
- Understanding and addressing global agricultural developments, both advantageous and disadvantageous is not only essential but also it is necessary.
- The continual process in increasing in globalization and integration of food markets has intensified competition and efficiency.
- Indian farmers are facing series of modern and serious challenges, particularly in developing countries exposed to price factors^[3].
- Unreliable supply of electricity is one of the top concerns for many agriculture practitioners, many have even dealt serious losses.
- It is lot of cheaper than fossil fuels
- An effective solution to drought related problem
- The most efficient way to prevent global warming
- Getting more advanced
- Storing solar energy for later use

APPLICATION OF SE FOR ICT IN AGRICULTURE AS FOLLOWS:

Power generation and to devise remedial measures the majority of the farmers carry out crop farming, animal husbandry and horticulture in their agro forestry farms. The farmers use both indigenous and modern technologies as per their requirements. That they have a good record of renewable solar energy in their farming systems, despite their lack of appropriate access to new modern renewable technologies to enhance the efficiency of renewable energies in agricultural practices. Increase production many folds by providing prompt, reliable and locality based information services to the farmers. Hence, ICT in agriculture has become a budding field of research and application related to e-agriculture^[4].

Few ICT application through Solar Energy is as follows:

- Accomplishment and Planning of the applied ICT and suggestion for ICT application for ICT App.

- Sharing of information of various Govts from time to time through ICT to the Indian farmers & internet utilization.
- Index of information, OHP, Mobile Vedios.
- Internet connection method of ADSL, SCADA, MIS, ERPs.
- RTD & Modem systems through PLCs.
- Means of information acquisition and through social medias, face books etc.
- TV, Radio and public announcement systems.
- PC Network, Internet and other clouds.
- Internet utilization section E-mail & Watsp.
- Search for information through Google.
- e-business utilization and GeM^[5].
- Education of information systems on farming.
- Precision agriculture through informatics of cultivation and mechatronics technology.
- Management of agricultural environment.
- Marketing informatics for increasing ago marketing informatics for increasing ago-products products value-added.
- Informatics of the agricultural technology and Informatics of the agricultural technology and agricultural science digital library agricultural science digital library.
- Cyber extension and agricultural, weather forecasting, govt subsidies, PM KISAN, PM KUSUM Yojana an educational system to be reached with farmers^[6].

ROLE OF ICT IN INDIAN AGRICULTURE:

Information and Communicational Technology (IT) has many roles to perform for agricultural development starting from decision support system to the trading of crops.

- **Decision Making Support System(DMSS):** ICT has a great role as decision support system to the farmers. Through ICT, farmers can be updated with the recent information about agriculture, weather, new varieties of crops and new ways to increase production and quality control. The dissemination of adequate, efficient and tailored technologies related to agro-climatic zone, size of farm and soil type etc. to the farmers is deficient in Indian agriculture and it is the real challenge in front of policy makers in India.
- **Market Access is to be scattered:** One of the major drawbacks in Indian agriculture is complex distribution channels for marketing of agricultural produce. Farmers do not get acquainted with the updated prices of commodities, proper place for selling their inputs and consumer trends also. ICT has the great potential to widen marketing horizon of farmers directly to the customers or other appropriate users for maximum benefit. Farmers will connect directly with many users and may get information about current prices for their commodities^[7].
- **Agricultural Community is to be Strengthened and empowered:** ICT technologies can help for strengthening agricultural communities through wide networking and collaborations with various institutes, NGO's and private sectors. Further, farmers may enhance their own capacities through updated information and wide exposure to scientific, farming and trade community.
- **Reward & Initiatives of ICT is to be made for Agriculture in India:** Approximately 55 per cent ICT projects of the whole world have been implemented in India and also maximum number of information kiosks has been employed in rural India. Nevertheless, it was found that majority of the ICT projects in agriculture were put into action in socio- economically developed states of South and North India, while deprived states are not benefitted by ICT initiatives. Some of the e-Agriculture initiatives in India are indicated below.
- **The Web-portal of Agrisnet:** It is a comprehensive web portal to broadcast relevant information to farmers, which was initiated and funded by the Ministry of Agriculture, Government of India. It serves farming community by disseminating information and providing services through use of Information & Communication Technology (ICT)^[8].
- **Digital green international organization:** It works with the participatory approach by engaging rural community to improve their livelihood using digital platform. Interactive and self explanatory videos are prepared for farmers by progressive farmers with the assistance of experts. These videos are shown to the farmers at individual level or in groups. The videos are prepared concentrating the requirements and welfare of the rural masses.
- **Digital photographs systems (eSagu):** The eSagu provides customized solution to the farmers problems and advice them from sowing to harvesting. Farmers send their farm condition in the form of digital photographs and videos, which were analyzed by the agricultural scientists and experts. The expert advice is conveyed to the concerned farmer within short time. The queries of illiterate farmers are dealt with the help of educated coordinators at village level. The farm situation or problem is communicated to the agricultural experts and they transmit accurate information to the farmers^[9].
- **Providing agricultural information and services to farmers Warana:** The Prime Minister's Office Information Technology (IT) Task Force with the objective of providing agricultural information and services to farmers for increasing productivity.
- **Iffco Kisan Sanchar Ltd (IFFCO Kisan):** It delivers relevant information and custom-made solutions to the concerned farmers through voice messages on mobile phones. The farmers can also communicate directly to the agricultural experts on explicit themes via phone-in programmes.

- **Agricultural Marketing Information Network:** The Ministry of Agriculture, Government of India with the aim of empowering decision-making ability of the farmers regarding selling of their produce. This portal was developed to pace up the agricultural marketing system through broadcasting information about influx of agricultural commodities in the market and their prices to producers, consumers, traders, and policy makers transparently and quickly^[5].
- **Indian Farmers Digital Mandi:** Digital Mandi is an electronic trading platform for facilitating farmers and traders to sell and procure agricultural produce beyond the geographical and temporal limitations effortlessly. Various financial institutions also participate in online trading of agricultural output to remove cash crisis also.
- **Smart agricultural practices and to achieve food security through eArik:** Aims to disseminate climate smart agricultural practices and to achieve food security.
- **Implementation of UGC Akashganaga:** This ICT project makes possible the milk collection, fat testing, and payment timely and user friendly manner. It augments the income generation of dairy farmers through incorporation of advanced technology.
- **All Questions Answering :** is solving their problems and answering their questions related to agriculture. Farmers have to register on AQUA platform online or telephonically.
- **Fisher Friend Planning:** The Fisher Friend Planning(FFP) to protect fisher folk from occupational hazards and to empower their livelihoods. The relevant information on wave height, wind speed and director, potential fishing zones, relevant news, government schemes and market price is provided to fishermen in local language.
- **Reuters Market Light:** Reuters Market Light (RML) was initiated to deliver customized information to the registered farmers via mobile-SMS.
- **SMS Portal/mKisan Portal:** This portal is designed aiming to serve farmers in three ways
 - a) To disseminate information about diverse agricultural activities to the farmers.
 - b) To provide seasonal advisories from time to time
 - c) To provide various services directly to farmers through SMSs in their local languages and national languages.
 - d) The SMS Portal endows with a platform for amalgamation of service delivery under different sectors viz. Agriculture, Horticulture, Animal Husbandry and Fisheries and weathers^[10].
- **Mahindara Kisan Mitra:** This portal provides information to the farmers on price of commodities, weather forecast, crop advisories, loans, insurance, cold storage and warehouses along with success stories of progressive farmers.
- **Kisan Call Center :** The Department of Agricultural and Co-operation with the main intend of endowing extension services to the farming community in the local languages. The queries of farmers are tackled by agricultural graduates on help line, toll free number in their local language.
- **Village Knowledge Centers :** The information is disseminated through public address system to the Village knowledge centers of MS Swaminathan research foundation, initiated in 1998 as a gateway of technical information related to agricultural inputs, price of outputs, crop rotation, use of fertilizers and pesticides.
- **Agronxt:** AgroNxt thrives to contribute to agriculture industry by delivering farmers usable, reliable and timely information that maximizes farm profitability. It assists upholding the agricultural productivity and sustainability.

SUMMARY

On large farms, solar energy harnessed will result in low cost than fossil fuels. The installation will be costly but once you recover the invested amount the energy you used will be free of cost. Additionally, you get subsidies from state and central government which will help you to easily pay off the cost of installation. Every year farmers worry about drought and power cuts occurring with it. With solar energy panels in place, you don't have to rely on a third party to carry out your farming activities. Solar panels require minimal water and prove very beneficial in areas with water scarcity. Agriculture has sometimes been slow to adopt technological benefits when compared to other sectors. With using solar energy to power agriculture activities, the farming sector proves that they are ready for more technological advancements. With solar energy on the rise, more farmers use solar energy to run their agricultural activities and this will provoke businesses and researchers to provide farmers with more technologically equipped apparatus.

- Evaluation of the effectiveness of existing strategies and policies to run ICT projects in agriculture based on the feedback of grass root level workers/officers working directly with farmers in rural regions.
- Transforming agriculture sector into the modern digital agriculture to further improve social and economical benefits.
- Improving the digital access by farmers with technological advances and skills improvement.
- Adopting more advanced ICT tools in agriculture such as GPS, GIS, RFID, Remote sensing, Smart device for precision agriculture, sustainability, environment, food safety, etc.
- Analysing and managing Big Data in agriculture

As agricultural land always lives under the fear of interrupted power failures, using solar energy can prove beneficial for many. With new advancements, it is becoming easier to store solar energy for later use. Farmers can store solar energy using batteries during its peak hours and use it later when needed. Global warming is the hot topic of the 21st century. Each sector is trying to reduce its carbon footprint in one or the other way. With farmers adopting solar energy for their agricultural land it will become easier for us to fight the dangerous effects of global warming. Farmers are at the center of the problem regarding global warming; since the rise in temperature affects the climate change which in turn affects the agriculture produce. World population is continuously increasing and the demand for food products is witnessing a significant rise. Using solar power can help us to curb climate change and help us fight the problem effectively.

The study has to conduct to investigate application of renewable solar energy in the smallholder farming systems. The basic source of income of the people living in this area is agriculture and related jobs.

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