SMART AGRICULTURE: A PATHWAY TO PROSPERITY OF FARMERS

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ABSTRACT: *Agriculture is one of the important sector that plays a strategic role in the socio-economic development of any country. In India also agriculture is not a profession but it is a tradition. This sector not only provides food security to the country's ever growing population but also provide raw materials to the industries, influences internal and external trade, commerce and national income. Farm mechanization is very less in India as compared to other developed countries in the world .According to the (United Nation,2012) study the earth population will reach 9 billion people till 2050. The demand for more food will be increased with the growing population. But agricultural productivity is not increasing with that speed. To balance the demand and supply modern and advance technologies should be deployed in the field to improve the agricultural productivity. Emerging modern technologies has touched the agriculture field as well and introduced new concept called smart agriculture*

Key Words: *smart agriculture , ICT , Climate change , GIS , GPS*

I INTRODUCTION

Agriculture is the one of the oldest and crucial occupation since the history of humankind is maintained, as there is direct dependency between man and agriculture. This sector and its allied sectors are primary source of income to the majority of population in India and across the world. This sector plays a very important role in social and economic development any country in the world. In India also more than half of the country's population directly depend on the farming for their livelihood. This sector not only provides food security to the country's ever growing population but also provide raw materials to the industries, influences internal and external trade, commerce and national income. Also this sector holds a very special place in the hearts of the rural people, many festivals like Onam , Lohari are celebrated for good crop all over India. Rural development in India is increasingly associated with agriculture, and is responsible for economic growth and development in rural areas. According to the census 2011, 54.6% of the population is occupied in farming and related activities. This sector contributes 17.4% to the India's Gross Value Added(GVA) for the year 2016-17 at current prices. Value of GVA is decreased from 18.6 in 2013-14 to 17.4 in 2017-18. India contributes only 40% in farm mechanization and 55 % in farm labor which makes farming less remunerative and leads to poverty to Indian farmers . While in other developed countries of the world like USA and Europe farm mechanization is 95% and labor is only between 2 % to 4% .Keeping the importance of agriculture in mind the present government has started several schemes for farmers. To retain our food producers in the rural area , new technology , new ways of additional income , modern agricultural concepts must be introduced to farmers. [1][2]

II MAJOR CHALLENGES IN AGRICULTURE

Despite of this rosy picture of agriculture , farming sector is facing several challenges all over the world. The four primary advancements setting weight on horticulture to satisfying the needs of things to come: shortage of natural resources , world population is increasing , atmosphere change and wastage of food.

POPULATION GROWTH- According to the United Nation Report , world population will reach 10 billion by the year 2050. In order to feed the growing population food production need to be boosted by 70 percent according to UN Food and Agriculture Organization . Urbanization is increasing and rural population is getting shrinking day by day. Due to this incomes are increasing and there will be more demand of processed food and animal food.

Figure1 -Population growth and demand for food [3]

SCARCITY OF NATURAL RESOURCES-

Primary natural resources like land, water etc give food , habitat and societal security to mankind. But these resources are getting diminishing day by day. Water resources are getting reduced and are highly stressed , farmland is degrading and becoming unsuitable for production. Due to farm land shortage , farm are getting small and production is getting reduced per person. All these factors will increase rural poverty.

CLIMATE CHANGE-

Environmental change is a reality—and it is quickly adjusting the earth. The level of artificial emanations of ozone harming substances (GHGs) has come to the most highest ever, as indicated by a 2014 report of the Intergovernmental Panel on Climate Change (IPCC). Agriculture , forestry and other land use contributes in GHSs . Due to climate change situation like drought and flood will occur and crop yields will be reduced. This will raise long term environmental problems like groundwater depletion, degradation of soil etc.

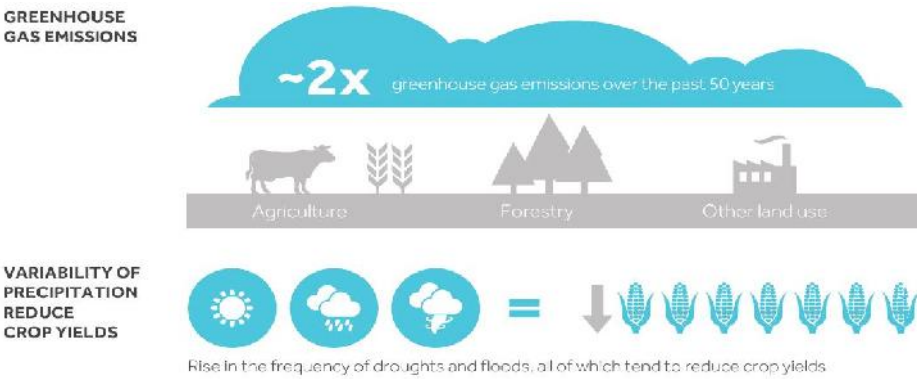

Figure 2-Climate change[3]

FOOD WASTE-

Wasting of food is one of the culprit in destroying Earth. About 33% to 50% of the food is wasted and is never eaten . This is bad for our environment as growing food requires lot of resources like water , land, soil, labor. This wasted food decomposes and produce harmful gases.[3]

III NEED OF TECHNOLOGY IN AGRICULTURE

All the above discussed issues will increase rural poverty and hunger. India is one of the biggest producers of agro products but still farm productivity in India is very low and most of the farmers are in debt. Farming sector is the main occupation for livelihood in rural region , yet this sector carries the blot of farmer's suicides , poor crop yields , low crop quality , climate threat and many more serious issues. Most of the farmers are below poverty line because of the above serious issues. Due to this farmers don't want their

future generations to involve in farming. . This is creating agro brain drain , farmers and their children are migrating towards urban areas ,this is reducing food producers and increasing food consumers day by day.
Undoubtedly rural development in India is increasingly associated with agriculture, which is considered as a central force of economic growth and development in rural areas. To retain our food producers in the rural area , new technology , new ways of additional income , modern agricultural concepts must be introduced to the farmers. . New and advanced farming technologies will help Indian agriculture in promoting the next green revolution and also provide food and nutritional security to the country. Smart agriculture can provide a way to overcome all these serious issues. It has the potential to optimize productivity , improve product quality , Conserve energy, protect environment and attaining sustainable agriculture with less inputs using the key elements information , technology and management. Emerging Smart Agriculture concept and its techniques will be the solution for increasing agricultural productivity. It is discussed in the subsequent sections.[16][17]

IV SMART AGRICULTURE

Modern science and technology touches all of us in every aspect of life and is a big boon and blessing. The use of technology has further revolutionize our life and work and make everything smart like TV , mobile , fridge , office , mall , cities , villages etc. As the agriculture and man are directly connected to each other so technological advancement has touched this field also and replaced the time consuming and inappropriate conventional techniques.
Smart Agriculture is the new hot buzzword. Smart agriculture , Precision agriculture , Smart farming are all synonyms of each other. In simple words smart agriculture can be defined as managing agricultural fields in a smart way with the use of technology. Smart agriculture is a complete farm management system that help farmer to manage field effectively and get desired outputs. Farmers get the increased yields, better crop quality , conserve energy and protect environment by using smart agriculture technologies. It is the promising solution that can balance productivity with environment. Smart agriculture is the combination of new technologies and existing farming practices that can together increase the agricultural productivity and quality of the agro products.
Any machine or system is called smart or intelligent if it can sense , monitor , take decision and can change parameters according to the need. This system can take action on its own according to the situation like an intelligent person can do. [4]

V SMART FARM

The farm where all the latest technologies are applied to increase the crop production and reduce the human labor. Technologies like smart tractors , drones , smart irrigation , autonomous robots , sensors and the Internet of Things (IoT). By using these advanced technologies production efficiency and agricultural products quality increases. Also these new techniques has improved the quality of life of farm workers by reducing heavy labor and tedious field work. [6]

Figure3 - Smart Farm[6]

V SMART AGRICULTURE ARCHITECTURE-

The three tier architecture of smart agriculture consists of smart farmer , smart consumer and smart farm. Consumer who is smart generally does online browsing , they access web applications , online stores ,

databases etc. Smart consumer can directly contact to the smart farmer at the other end. Smart farmer can directly connect with the open market without the involvement of middlemen. Any farm management system can be used to handle these outside activities. This node is then connected with the smart farm which contains all the latest technologies like RFID tags , green house , sensor nodes , pesticide detection etc. [4]

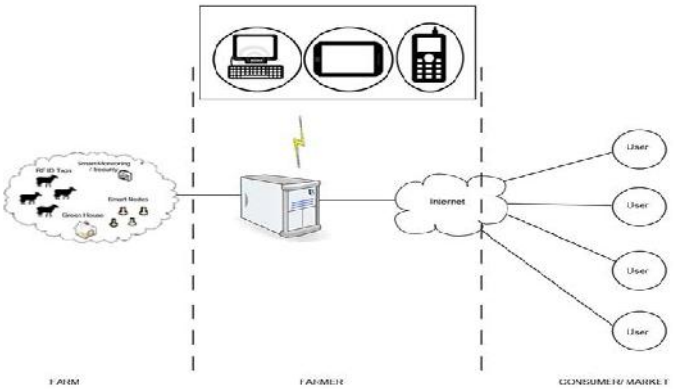

Figure4: Smart Agriculture three tier architecture[4]

VI SMART AGRICULTURE TECHNOLOGIES

Smart Agriculture is comprised of many technologies. These technologies are replacing time consuming , hard-hitting and unpredictable conventional farming practices with productive, dependable and sustainable smart agriculture. Some of techniques used in smart agriculture are RFID tags for cattle monitoring , sensors networks , warehouse management and livestock applications ,E-farming , Drones for crop surveying , driverless tractors , humidity and moisture detection etc. Below is the chart for smart farming techniques- [5]

Figure5: Smart Agriculture techniques[5]

SENSING TECHNOLOGIES-

Remote sensing can be defined as a science and specialty of procuring data about the earth's surface without really interacting with it. The energy which is either reflected or emitted from earth's surface can be recorded. The data recorded is then prepared and analyzed, and the data is utilized to create a direction map that can be used in a variable rate application. This technology can be utilized to get different layers of data about soil and yield conditions. It can detect an object , series of objects or landscape without physical contact with the sensor. To sense crop vegetation and identify crop injuries satellite imaging is used.[12]

POSITIONING TECHNOLOGIES-

It is US possessed utility that furnishes users with situating, navigating and timing services. It is a satellite navigation system that determines the ground position of any object on the earth's surface. This framework comprises of three portions: the space section, the control fragment, and the client section. The space section consists of 24 satellites deployed in space above the earth's surface that transmits the one way signal and give the current location and time of object on earth surface. The control segment is responsible for maintaining the satellites in their proper orbits. The user segment consists of the GPS receiver equipment that receives the signal from GPS satellites and uses the transmitted information to calculate the three dimensional position of object on earth. By combining GPS and GIS site specific farming can be done. By using these techniques large amounts of geospatial data can be manipulated and analyzed and also accurate position information can be coupled with real time data. These techniques can be used in agriculture in farm planning, field mapping, sampling of soil, tractor regulation, crop inspection, variable rate applications, and yield mapping. GPS facilitates farmers to work during rain, dust , fog and darkness.[13][14]

ROBOTICS-

Automation is used in many industries to reduce human labor. In agriculture also robotics and automation is used to handle labor intensive tasks. Agbots or agricultural robots are used in field for planting , harvesting , sowing , sorting etc. This technology can produce more quality food with less manpower. [6]

ICT-

Right information at the right time plays a very important role in agricultural development. To overcome these challenges Information and Technology can play a big role. ICT incorporates any gadget, device, or software application that allows exchange or collection of information via interaction or transmission. ICT can be used in farmer's advisory services , women empowerment , market information , soil quality assessment and overall rural development.[18]

SMART MACHINERY-

Farm Machinery is getting advanced day by day. Some of these are driverless tractors , drones ,Agbots etc. These machines has all the latest technologies like GPS , sensors for remote monitoring and radar and LiDAR for object detection and avoidance. These machines ease the task of farmers and increase the production. [6]

DATA ANALYTICS-

Every farm can produce millions of crop data like crop production , land use , and many other statistics every data. This large amounts of data or big data can be collected and analyzed by the farmers to improve the business operations. Forecasting and operational efficiency can be improved using data analytics and this can lead to timely decision making and give better outcomes. [8]

VII SMART AGRICULTURE IN INDIAN CONTEXT-

According to a latest report by the OCED and the Indian Council for Research on International Economic Relations (ICRIER) cultivable area in India is getting reduced ,so yield must be increased. Present challenges in Indian agriculture is different from previous decade. Today there is enormous pressure on farmers to produce more food with less cultivable land and shrinking natural resources. To increase yield Indian farms desperately needs technology diffusion. Smart farming technologies can facilitate higher yields with less inputs so rapid adoption of these technologies is worthful in Indian agriculture. But there are many obstacles in adopting smart farming in India some of them are fragmentized land holdings , rural infrastructure issues , very few local technical expertise, knowledge and information gap etc. But despite of many issues and challenges , adoption of smart agriculture in India is gradually widening. Farmers must take initiative to pool in their fragmented lands to increase the farm size to get the benefits of smart farming. There are several farmers who pool in their lands to increase the farm size to at least 100-200 acres and are getting benefits of smart farming .Punjab and Haryana in India are the states that have adopted farm mechanization and smart agriculture on large scale.[7][11]

VIII CONCLUSION

In spite of several issues like rural infrastructure , fragmented lands , less technical expertise and many more, smart agriculture is gradually making its space in India. Due to rapid socio economic changes new scopes are created for smart farming adoption. For faster adoption of smart agriculture deliberate support from government and private sector is essential. Smart agriculture technologies are cost effective and can be helpful in maintaining sustainable environment. Farmers should understand the importance of using latest technology in their farm and take required initiative to get maximum benefits. Smart agriculture technology can provide solution for many agricultural issues and can enhance the overall agricultural productivity. Thus all the public ,private sector and farmers should come forward to work in smart agriculture growth that has the capability to make the green revolution as evergreen revolution in India.

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