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ICTs in agricultural education

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Abstract
Digital tools provide immediate benefits to people so that they can more easily communicate and access new forms and sources of information. The modern large-scale agriculture will not be viable in future without mobiles, GPS, satellite and drone monitoring and instantly available weather and climate information. Mobile phones and internet have the potential to increase the production and productivity in agriculture. To raise on-farm productivity, timely and precise information on input use is essential. Further the increasing population in the advent of climate change scenario necessitates the importance of ICT's in agricultural education.

Keywords: agriculture, digitisation, education

1. Introduction
Information and communication costs play a major role in agricultural production in the developing world. Farmers follow a range of potential production technologies and practices to choose from, each of which may have different risk profiles and different suitability for their own plots. To make those decisions, farmers must be acquinted with latest technology exists (Bardhan and Mookherjee, 2011) [1]. Digital agriculture is nothing but the use of new and advanced technologies which are integrated into one system, to enable farmers and other stakeholders in the agriculture value chain to improve food production. Digital tools have thus enabled the revival of agricultural extension and advisory services to some extent.

2. ICTs and Agriculture Development
Agriculture is the backbone of the economy of the developing countries and it has been shown that more than half 60% of the population in Asian Pacific countries live in rural areas and depend on agriculture. Developing countries are facing many problems such as poverty, education, health and farmers have no or inadequate information about the proper use of the pesticides as well as fertilizer to their crop. In today's world, information and communication technologies have brought close the communities and empower the sources to poor farmers of different regions and increased their knowledge and information about agricultural technologies and provide information about market. In rural areas, mobile phones play an important role in enhancing the capacity of rural people, especially farmers and contribute their production of agriculture on national level. It could provide access in rural areas for the development of agriculture and poverty thus can be reduced in rural areas of developing countries.
Also using the communication technologies and methods in government services to the farmers can save the time, energy and money. Similarly, they can connect buyers for selling their product good and service. The mobile phone is one of the best ways of communication directly with market buyers and producers and could get information about weather, market use of pesticides and other agricultural related information from expert. Mobile phones and wireless technologies could be used for dissemination of the information at crucial time and can provide information regarding Tsunami as well as any crisis that could happen in rural areas. Now there is a need to introduce new policies to make empowerment of farmers and to reduce the gap among farmers and research officers. Similarly, there is also need to make the linkages between farmers and market. The e-services can play important role in education trainings and adoption of these new technologies can increase education system in rural development.
Most of the developing countries are using different technologies and resources for the development of agriculture and economic development (Adhiguru and Devi, 2012) [2]. In this context, ICT's have played a major role in agriculture and rural development. ICT's have reduced the cost of transport, the barrier among countries and communities, and increased the trade and business all over the world. These technologies have also improved the living standard of the millions of people (FAO, 2017)[3]. The mobile phones and internet have played a vital role in bridging and connecting the communities and also provided a choice at the national and international level for rural development (Sing, 2006) [4].
Digital technologies have important impacts in linking farmers to markets and key stages of the value chain. A recent study of farmers conducted in Bangladesh, China, India, and Vietnam found that 80 percent of farmers in these countries owned a mobile phone and used them to connect with agents and traders to estimate market demand and the selling price (Reardon *et al*., 2012) [5]. Cole and Fernando (2012) [6] showed that in rural India, information provided via mobile phones to farmers increased their knowledge of available options for inputs such as seeds and fertilizers as well as choices of different crops leading to changes in their investment decisions and eventually to planting more profitable crops.
The rise of digital agriculture could be highly transformative, because digital agriculture not only will change their farms, but also will transform every part of the agri food value chain. Digital technologies were classified

as follows in the agrifood sector.

a. Mobile devices and social media
b. Precision agriculture and remote sensing technologies
c. Big Data, cloud, analytics and Cyber security
d. Integration and coordination (block chain, financing and insurance systems)
e. Intelligent systems (Deep Learning, Machine Learning and Artificial Intelligence and robotics and autonomous systems).

Even though more than 87 percent of the world's population are now within the range of a mobile signal, with 45 percent of the world's population living in rural areas and about 20 percent of those in remote areas (UN DESA, 2018)[7], extending mobile-broadband coverage to connect these 3.4 billion people will be extremely difficult.

3. Digital Agriculture in India

Digital agriculture is playing an important role in technology transfer among the farming communities of our nation. Digital tools can be applied to irrigation systems such as pumps that can be automated and controlled via mobile phones, such as the Nano Ganesh system in Pune, India where the farmers are able to save water, energy, and time by remotely controlling their irrigation pumps (Tulsian and Saini, 2014) [8].

The use of satellite imaginaries, remote sensing tools, robotic sensors and artificial intelligence has resulted in the collection of vast amount of data for use by the scientific and farming communities. Huge sets of data (Big Data) needs to be stored, processed and used for our present and future needs. Hence there is a need to evolve suitable system and process for effectively using it for achieving our development goals. This new technological and research development programmes coupled with extension interventions are going to change the face of our farm sector in the near future.

4. Technology for transformation

The use of digital technology offers more scope for growth and development in many sectors. From the crop breeding programmes of today, they are needed to improve our production, productivity and marketability of farm produce across the global value chain. Creation of farm produce suitable to the needs of value added industries, crop modelling for different farming systems for our different regions and states are required. So the need of the hour is use of high tech digital technologies like drone technology, machine learning, remote sensing tools, artificial intelligence to collect data, and use it for our research and development programmes.

Market forecasts suggest that digital technologies will transform agriculture and the food sector over the next decade. These technologies will have their own place and impact within the agrifood value chain. Various field studies have shown that in many places, digital technologies are quietly transforming how rural logistics function (World Bank, 2011) [9].

Digital agriculture has the advantages of potential to make agriculture more productive, more consistent and to use time and resources more efficiently, which brings critical advantages to the farmers and wider social benefits around the world. Even though Digital agriculture has also many advantages that the approach is very new, costs are high and the details of the long term benefits are rarely available.

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