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Agricultural digitalization and rural development in COVID-19 response plans: A review article

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Abstract COVID-19 has led to spread economic adversity throughout the world since it effects on food security. After COVID-19 there is necessary to suggest the novel direction and combination of new input, information and telecommunication technologies for agricultural growth and development. Agricultural digitalization is able to impact rapidly to mitigate some of the negative effect of the COVID-19 pandemic. In developing countries, rural information and services are the most important of effective agricultural and development. The "Internet of Things" and electronic networks offer very promising technologies and many services and solutions including the agricultural fields. The application of digital technology is of great importance because it has the ability to provide technologies, innovations and acquired sustainability to the agricultural sector and increase productivity as an alternative and complement to agricultural extension. Mobile application have developed rapidly for enhancing telecommunication, information ,input , development , invention in service transmission and their quality. However, many stakeholders have known the need for digital agriculture. The most countries have already taken a national strategy for the agricultural sector's use of information and communication technologies. These reviews explain the possibility of agricultural digitalization for rural services and development in COVID-19 response plans.

Keywords: Mobile application, Agricultural digitalization, Rural development

Introduction

Agriculture is starting more knowledge-heavy that the farmers have to make decision on agricultural production, and the markets. In new years, rural servces and information have assorted from agricultural expansion and increased a wider area of governmental and non-governmental organizations forms, public-special co-partnership. There is major focused on which the rural producers and farmers may be engaged more successful in regional, or global supply chains including new forms of community mobilization, organization interaction and learning (Davis, 2008).

United Nations declared that the year 2020 marks the starting of the “Decade of Action” and information and communication technologies to aim and plan in the Sustainable Development Agenda 2030 (ITU and FAO, 2020).

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Most of developing countries are need to gather quality and advantage of digitally innovation in the agricultural, rural section based on using the cloud platforms and big data to avail in effective information release. Digitalization of the agriculture system ensures that everyone benefits from the information and technologies (FAO, 2018) which known as “smart farming” or “e-agriculture”. Agricultural digitalization has broadened for improving agriculture production with upgraded technologies to make support for fineness assurance and marketing of product, (Feder *et al.*, 2011 and FAO, 2017). There is a requirement to planning for development of a mobile implementation for farmers and agricultural experts with improvisation and expansion in both input, consultative and services. Digital technologies are effect on using innovations in rural areas, and mobile application helps to press digital agricultural applications which demand more advanced digital cleverness (Haggag and Fawzy, 2020). Digital technologies can improve the farmers’ life, agricultural works and communities secure their life. In an increasingly digital expert, information and communication technologies play a key to achieve Sustainable Development Goals (ITU and FAO, 2020). Digital Agriculture is based on building social and economic resilience, and services offer many matchless opportunities to make real and rapid steps (ITU and FAO, 2020). Digital technology can be utilized to achieve e-agriculture, and often called “precision agriculture” which uses a well-efficient approach that has a great benefit in ecological issues as the optimization of treatments, water use and inputs, reduced application of fertilizers and reduced the chemical pesticides. E-agriculture has effective to meet economically, environmentally and socially sustainable agriculture (Figure 1).

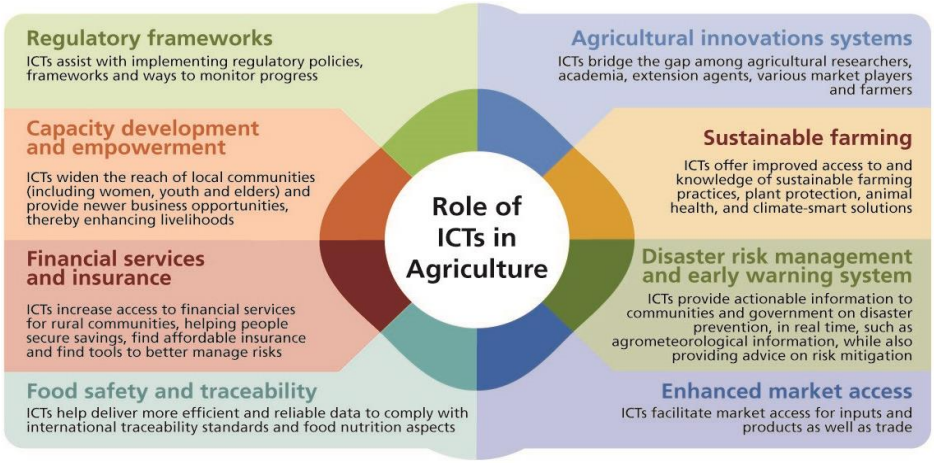

Figure 1. Role of information and communication technologies in agriculture (Sources : ITU and FAO, 2020)

Digital agriculture helps the farmers to utilize mobile and different digital application technologies to bring agricultural input and information in true and stable once.

Digital agriculture in response to COVID-19

The COVID-19 pandemic in most of the developing countries have impacted food supply chains, agriculture input stocks, jobs, farmers, producer income and limited storage capacity. Farmers became hopeless to market their produce, especially perishables. COVID-19 has made us all dependent and following the digital technology extra than previously. Increasing development and growth in technologies that help the small-scale farmers to realize benefits after the COVID-19 pandemic will has passed. The COVID-19 pandemic is speed the digital revolt that has formerly started at the first of the year. Covid-19 crisis can punches a digital revolution in agricultural industry with tools and information to make the correct decision in time and improve productivity of yield. Digital technologies in agriculture sector have ability to help the international poor faster than in developing countries special in rural parts since the most of world living from agriculture sector.

How will digitalization change agriculture in the case of COVID?

Recovery of the COVID-19 is a road to convert agriculture which help the farmers to increase agricultural productivity and quality. Recently, most of farmers in the world's have utilized mobile application to reach the targeted agricultural technologies, information, new adviced and received market information via voice and text messages without utilize of Internet and wirless. This may turn and transfer the farmers' practices to the best which has empowered with digital technologies and information will excess their agricultural harvest and ouput. Moreover, remote sensors have been used and developed to assist the farmers to optimize water irrigation, appropriate seeds, fertilizer levels and chemical pesticides to protect crops from diseases and pests to reduce risks.

Digital technologies for improving the argic systems

Digital transformation and mobile application have become the potentiality to achieve significant economic, social and environmental advantage and services, the benefits of these applications according to the World Bank (2012) are shown as follows:-

Promote access to information and technology: The information must be valuable needed and time to make the quick access of the information. Leading access to agricultural extension services via expert and counsel advice for good cultivation practices support to improve the harvest yield. The information, collected data from satellite imagery and analytics are important to understand the immediate conditions of crop harvesting status and quality, water resource and quality availability, soil type which are critically important in the case of COVID for coordinating short and long-term response plans.

Mobile applications: Application of mobile would supply the price and cost information to plan production processes (Baumüller, 2015). The capability of mobile application in the transmission of rural services for agricultural are estimated as follows:-

- Methodologies used to proceed research to mobile phones and estimated the guide from these studies, then provided an schedule for future research.
- Approaches are estimated the requirements for mobile application, invention that inclusive the various, service and information requirement.
- Adoption is to understand the type of utilize of mobile application for agricultural developing countries.
- Output: the benefits of use of mobile application may be measured.
- Impact is evaluated the results and wide productivity from the mobile application for agricultural developing countries.
- Conditions are notable availability, Information and communications technology leering and programmes for digitate strategies, connectivity, further support the adoption of technologies that to use internet, mobile application and public media, digital skills and support for agri-preneurial and invention culture.

Remote sensor systems and Geographic Information System (GIS)

During and after COVID-19, remote sensor systems determinde by mesuring the parameters of temperature, humidity, water level and quilaty and moisture of soil. The data composed from these sensors are connected to the micr observer and the transformed information is confirmed with the sill values. The input surpasses the edge esteems, the LED begins to blink and send the messages to the farmers who work the area conditions by examination the produced web-page outcomes and characterization of the data in detail (Haggag *et al.,* 2017). A blind hyperspectral unmixing in IoT environment was introduced to elevate several applications, especially precision framing and smart agriculture (Elkholy *et al.*, 2020).

Internet of Things (IoT) is applied in agriculture become a precision agriculture (PA) which use for direction, of systems through plantation and fertilization, pesticides application leading to reduce working hours and save the cost .

Artificial intelligence technology (AI) is changed the agricultural sector and helped the farmers to monitor every stage of production cycle and scanned their fields through COVID-19 periods. Also, it is depended on the data from satellite and supported early resolution making through predictive models and improved a resource use (Kumar and Karthikeyan, 2019).

Precision farming would be the most important end-user industry in the digital agricultural market after the COVID-19 spread, and made it possible to monitor the stage of the crops and minimizing the need to contact peoples during these times. These exercises can save time and costs of fertilization and chemical application, reduce pollution, and to help in monitoring the soil and plant physiochemical conditions via sensors, so that the optimal conditions required for plant growth can be achieved. These agents help to obtain a major crop production in this pandemic situation with the lack of labor and would help in a regular supply of food to achieve food security. With the advantage of smart phones in the past years, the providers have seen a vast potential to promote applications and Microsoft platforms of the mobile agriculture educational application and their features (Payne *et al.,* 2011) as seen in Table 1.

Conclusions and future remarks

The agricultural industry faces many challenges for the less potential and effective irrigation systems, pesticides, fertilizers, harvesting, weeding, plant monitoring, extreme weather conditions and others (Abouziena and Haggag, 2016). At the same time, one of the great challenges in this digital revolution is the limited internet access of farmers. After COVID-19 response plans, the use of agricultural digitalization will led a significant transformation in farming and production of safe and quality food over the coming years. Data collection will push the use of mobile applications, artificial intelligence technology and Internet of things new techniques and models will requirement to be advanced to create the data helpful to transform small-holder farming into viable, and sustainable digital work (Kumar and Karthikeyan, 2019).

Table 1. Classification of mobile applications in agriculture according to push and pull factors

Category	Frequency	Usability / Applicability
Service	Push: timely/ frequency set by feed providers / can be made immediate as well Pull: On need basis	1. Weather broadcast 2. Rainfall broadcast 3. Need based articles 4. Government updates / mandates 5. Calculators on soil quality, waterfall, 6. moisture etc., which help in effective planning and decision making Information broadcast on events like instruments, training either public which are government supported or company specific.
Interactive Markets	Push : Immediate Pull: On need basis for market data	1. Market updates on falling / rising prices Trading platforms
Support	Push : timely / frequency set by feed providers / can be made immediate as well Pull: On need basis	1. Accounting systems of Sale and Purchase 2. Logistics like Goods tracking and Inventory 3. Management Payments, Claims and Renewals
Repository	Push : on occurrence	1. Surveys / Electoral data 2. Policy changes / deadlines broadcast
Education	Push : On availability Pull: Request for more info via suggestion boards in the application	1. Information on Insects, diseases, pesticides 2. Information on machinery, usage of 3. machinery, comparison of different make and prices Information on soil, seeds, moisture, regional based rainfall predictions 4. Case studies or real experiences with facility to add one of your own

i. (Source: Brugger, 2011; Woodill and Udell, 2012)

Nowadays, a joining knowledgeable innovation is critical to solve the agricultural sector's information and technology gaps which become a key operator for innovation and development. Much action is necessary in the zone of digitalization of the agricultural rural development in COVID-19 response plans which are increased for interesting in data-enabled cultivation and regarding information, services after industrial technology and start-ups European Parliament in 2015 and Fakhoury in 2018. There are some specific advantage for future plan i.e. facilitating the data aggregate about digital technologies in rural country for modulation, of small-scale farmers in the digital agriculture conversion process. The mobile applications could support, via government policies, information to different stakeholders concerning agriculture, rural development and livelihood. The mobile implementation must be programmed to support the operative systems and made ready via all platforms active in both off line and online modes. The future of agriculture and farms would depends on the application of technologies as mobile application and others. Application of new mobile phone may become as user friendly, advantageous and pertinent in various agricultural stakeholders. With the use of these systems examined, quick response would occur with the upside of adjustable and useful activity on-request for information and locative goals.

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