INNOVATIONS IN AGRICULTURE – A CASE OF “DIGITAL AGRIBUSINESS MODELS”

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A B S T R A C T

World population will increase at geometric rate of progression and an estimated 9.6 billion people and will require 70 percent more food than is available today. In order to increase the production efficiency, expertise in the domain of agriculture opined and developed different agribusiness models to address the above aspects. In order to conduct this research, case study method was adopted to collect the necessary data and information from the entrepreneurs performing successful ventures in digital mode of agribusiness by adopting purposive sampling method. Secondary data pertaining to different countries were collected from the websites of digital agribusiness of their respective country. Digital agripreneurs enrolled in the Agribusiness incubation society were contacted personally to collect the required data. M/s Kisangates Agro Informatics is an innovative startup with a motive to revolutionize business processes in agricultural ecosystem through strategic models and digital transformations that are synergistic with environment and business needs. Further, M/s Jeypee Biotechs, Virudhunagar developed the digital and ICT enabled field advisory system model and executes networking among farmers on a common platform for dry chillies cultivation for export purposes. Through his intervention, farmers are realizing 20 per cent extra income. A paradigm shift is taking place to transform the traditional farming system to digital mode in order to reduces the cost, minimize wastages and thus leads to realize better price in the market. To conclude this study and based on the discussion with entrepreneurs and expertise in the domain of digital agritech companies, following strategies are suggested for a better agribusiness value chain.

Keywords
Digital agriculture, Startups, Artificial Intelligence and Internet of Things (IoT)

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Introduction

Agriculture sector contributes significant share in the economic development and sustainability of developing countries in the world. Majority of the population in India depends on agriculture as their major profession and source of income. Research reports revealed that in the year 2050, world’s population will increase at geometric rate of progression and an estimated 9.6 billion people and will require 70 percent more food than is available today. In order to increase the production efficiency, expertise in the domain of agriculture opined and developed different agribusiness models to address the above aspects. Among the different models developed, intervention of “Digital
Agribusiness” Model through Artificial Intelligence (AI) and Internet of Things (IoT) could be the game changer and increases the production and marketing efficiency. “Digital Agribusiness” is nothing but an alliance of data driven advances in AI and the IoT to help and influence the agricultural organizations and use data to drive efficiency in both forward and backward linkages and reduce cost. It is easy to use, environment friendly, saves agro chemical, time and energy. It not only focuses business opportunities but also caters to the needs of farmers and creates business opportunities to startups in the domain of agriculture. In this paper, case studies of different digital platform models in the domain of Agriculture in Asia were analyzed and presented.

Need for digital agriculture

Majority of farmers adopted conventional method of agricultural practices in India. It is evident that the sales of tractors in India are increasing over the years. However, the usage of digitalization as platform for promoting agribusiness among agriculturists is minimum. There exists a vacuum and huge gap in adopting the digital usage of agriculture by agriculturists and farmers. In order to bridge the gap, Government of India (GOI) had launched “Digital India” scheme to promote digitization to enhance the efficiency and performance of public and private sectors. Further, NITI Aayog has started a pilot project on precision agriculture by using Artificial Intelligence (AI) in ten districts across seven states in India. State government of Telangana, Tamil Nadu and Maharashtra have launched an agri open data portal to promote digital technology as an important tool in agriculture. Hence, it was suggested to adopt digitization in agricultural practices viz., Good Agricultural Practices (GAP), farm mechanization, methods of irrigation, management practices, good nutrient management and proper plant protection to enhance the production efficiency.

In case of information technology domain, Expert Support System (ESS), Decision Support System (DSS), Management Information systems (MIS), Enterprise Resource Planning (ERP) and Internet of Things (IOT)) serves as a platform and provides solutions for different agricultural operations in a smart way. Developed countries are adopting various digital agribusiness strategies viz., smart agriculture 4.0, IoT, AI and machine learning for enhancing their farm production and marketing efficiency (Table 1). Further, forecast from the International organizations revealed that digital technologies will transform and increase productivity of food and agriculture over the next decade (Nikola M. et al., 2019). Different components of the digitization in agri food sector are precision agriculture and remote sensing technologies (IoT, GNSS, RTK, VRT, PLF, UAV and satellite imagery), Big Data, cloud, analytics and Cyber security integration and coordination (block chain, ERP, financing and insurance systems), Intelligent systems (Deep Learning, Machine Learning and Artificial Intelligence and robotics and autonomous systems), Mobile devices and social media. It is in support with the report of Daniel Newman (2019) explored that Google is working in AI with respect to image recognition of 5000 species of plants and animals and recognizes pests, diseases and extent of crop damages.

Advantages of the digitization are Increase farming efficiency and productivity, establish the sustainable agriculture value chains, address the market and price volatility, implement novel and sustainable agri business models, engage with the different stakeholders in agribusiness networks, practicing smart and precision agriculture.
A recent global health crisis (i.e) pandemic disease “COVID-19” created lot of challenges in health care and agriculture sector. Researchers predicted that the possibility of food shortage crisis may arise in near future (FAO, 2020). The usage of IoT tools and robotics can reduce the virus spread among human and improves the sanitization of the eco system. Hence, there is an urgent need to adopt “Digital Agribusiness” to enhance the efficiency of agriculture value chain. Thus, it will bridge the gap and will be a game changer for providing the solution of food shortage. In this paper, different models of digital platform in the domain of Agribusiness in Asia are discussed.

**Methodology**

A suitable formulation of research methodology is important to facilitate the systematic research study. The case study method of research was adopted to collect the necessary data and information from the entrepreneurs performing successful ventures in digital mode of agribusiness by adopting purposive sampling method. Secondary data pertaining to different countries were collected from the websites of digital agribusiness of their respective country. Digital agripreneurs enrolled in the Agribusiness incubation society were contacted personally to collect the required data.

**Farm Decision Support System (FDSS)**

Digitization facilitates farming operations and agribusiness firms to achieve higher productivity, optimum use of inputs, reduces cost and protects the environment. In India, about hundreds of agritech startups viz., StampIT, AGNEXT, AGROV, Kisangates, MyCrop, Flybird Innovation, Cropin, Agrostar, EM-3, Farm Taaza, Crofarm, Aarav, Bharat Rohan, Albono, Gold farm, Ninja Cart, Waycool, Intello Labs, Farm Links, Gramco Infratech and Tessol are dealing with digital agribusiness. Out of these, a case study on M/s Kisangates Agro Informatics was done and the results are presented as follows.

M/s Kisangates Agro Informatics is an innovative startup with a motive to revolutionize business processes in agricultural ecosystem through strategic models and digital transformations that are synergistic with environment and business needs. It was started in the year 2014. This company provides solution and solves need based problems faced by different clients in the domain of agriculture. The following figure 1 depicts the journey of the company and its achievements.

In order to achieve the excellence in the domain of agribusiness, the company adopts Farm Decision Support System (FDSS) model and its digital transformation components are digitizing field records, digitizing process, data analytics and decision system. It focuses on commercial agro sector viz., seed production, value addition of fruits and vegetables, vet bio security, millet value chain, value chain of different crops and poultry.

Uniqueness about this company is that services are offered by agribusiness experts (50 more years of experience), PANDO platform is used for dashboard insights for the performance. Further, it adopts Amazon Web services (cloud architecture) for data storage, scale up and securities, products are carefully designed for field force to capture the important data without any error. Product works seamlessly in offline mode also.

Kisangates offered problem solving solutions and services to clients ranging from agribusiness firms to government
organizations and are listed as follows (i.e)
Field force management (Enhances the
efficiency of field force last mile operations,
offering Daily Planner, campaign Activity,
grower record module and channel sales
module, real time visibility on field
operations, market and season insights,
optimizing resources and enhancing customer
experience), Farm decision support system
(supporting the management of seed farms,
offering grower record module, IOT sensor
integration, providing data analytics and
forecasting and real time visibility on Crop
stage, understanding field level deviations and
Field Quality Standards, well integrated IPM,
INM and Agronomy recommendations for
Management and Growers) and Product
market solutions (enhancing technology
product and outreach, market and farm data
module, multi lingual, geo and user specific
outreach).

Major clients of this company are Advanta
(analyze, review and drive sales of their
products during peak season), Syngenta
(digitize the seed production operation,
integrating weather, soil, crop data for
providing decision alerts), SEED Works
(Digitizing commercial sales and marketing
operations, Walmart (market linkages,
demand and ensuring supply parameters for
farmers) and Government of Tamil Nadu
sponsored Tamil Nadu State Agricultural
Marketing Board (TNSAMB) (Digital
platform for linking farmers, aggregators and
primary processors with markets). Thus, it
benefits all the stakeholders in the
agribusiness supply chain and especially the
gass root level farmers and last mile
agripreneurs.

Government of Indonesia also initiated the
digitization of database related farm land and
irrigation through Geographical Information
System (GIS). Some of the private enterprises
in Indonesia also played a crucial role and
provided the agri value chain solutions to
enhance the efficiency of agribusiness.
Agritech companies such as Vasham,
Agradaya, Agri socio, Javara and Big tree
farms are providing both backward and
forward linkage solutions. However, business
firms viz., Kakao, East Bali Cashews
exclusively provides market linked solutions
such as processing, warehouse, transportation,
branding and sales channel. Tailor made
specialized and technology based solutions
are provided by Burgreen, CI agriculture,
Pandawa agri, Sentinel Indonesia, Eragano
and igrow.

In case of Germany, startup firm M/s Infarm,
Berlin provides digital platform solutions and
builds IoT powered indoor hydroponic
vertical farms. It was started in the year 2013
and establishes vertical farm models for retail
spaces, restaurants and distribution
warehouses to grow herbs and vegetables.
The sensors installed collects and record farm
data and allow the end users to remotely
monitor plant growth from mobile phones.
Major food retailers Edeka, Metro, Migros,
Casino, Intermarche, Auchan, Selgros and
Amazon availed the service from this
company for the installation of Modular farm
design.

Farm activity, documentation and
traceability
M/s Jeypee Biotechs, Virudhunagar
developed the digital and ICT enabled field
advisory system model and executes
networking among farmers on a common
platform for Dry chillies cultivation for export
purposes. Through his intervention, farmers
are realizing 20 per cent extra income.
Following figure 2 depicts the cloud based
mobile application “Cropin” was successfully
developed and operated for monitoring the
crop production activities of 400 farmers
(Fig.2). A module exclusively for chilli crop
was developed to monitor the implementation of field activity plan for Chilli crop in a real time. This system helped to capture field activities and helps in area of planning, managing the farm inputs, implementing best practices, providing advisory to farmer, helping to find cost involved in each operation, weather alert, bringing traceability and generate reports.

Farmers are networked under the common digital platform and different farm advisory services were provided viz., farm direct procurement, post Harvest Loss minimization, knowledge creation and sharing of information (Chillies cultivation @Food Safety and GAP) and IPM usage. Following figure 3 depicts how the mobile app captures the details of farmer data form filled and uploaded real time in web.

It provides timely supply of need based inputs and helps the farmer to increase the overall yield from 6 Qtl/ acre to 10 Qtl/ acre. Farmers are cultivating chillies with zero pesticide residues in a sustainable manner. Farmers are able to sell their produce directly to the processor at farm gate and thereby getting full share of their produce price. Based on this intervention, they gained extra 15% value of their produce.

The farmers are assured of 5% price premium for taking care of food safety aspects in field. The net financial gain by the farmer who grows the IPM chilli and sells directly at farm gate is more than 20%. Other than this, farmers are getting direct grant support from Spices Board in the form of inputs and drying (tarpaulin) which costs about Rs 3000/- per acre of chilli cultivation.

In case of Taiwan, Intelligent agriculture 4.0 project (year 2017-2020) sponsored by public sector promotes key intelligent agricultural production technologies development and service support system through smart farmers’ alliance. Further, National Ilan University, Taiwan developed Internet of Things (IoT) systems in digitization of poultry farm products for marketing and traceability (Chiu.Y.C, 2018). The application of digitization technology, robotics and Enterprise Resource Planning (ERO) are implemented in dairy, piggery and poultry (Fig. 4).

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<th>Table 1 Global observation of digital agribusiness platforms and strategies</th>
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<td><strong>Country</strong></td>
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**Fig. 1** Digital transformation components installed at M/s Kisangates Agroinformatics

**Fig. 2** Software tool “Cropin” developed by M/s Jeypee Biotech

**Fig. 3** Functioning of the data capturing process of mobile app
Further, University of Florida experimented the drone sprayers in the initial years and later it has been used exclusively since 2014 in the Citrus Research and Education Centre (CREC) for Citrus Under Protective Screen (CUPS) (Schumann et al., 2017). Trimble’s Green seeker, a handheld cum portable crop sensor device estimate the nutrient needs of different crops in order to make better nutrient management decisions and it reduces the cost. Field IQ control system facilitates productive and efficient functionality for the planting, nutrient and pest management operations. Other devices invented by them supports different activities such as crop planning, soil sampling, water management, traceability, yield monitoring, nutrient and pest management.

In conclusion the almost all cases, digital platform enhance the efficiency of agricultural value chain. A paradigm shift is taking place to transform the traditional farming system to digital mode in order to reduces the cost, minimize wastages and thus leads to realize better price in the market. Based on the discussion with entrepreneurs and expertise in the domain of digital agritech companies, following strategies are suggested for a better agribusiness value chain.

Following strategies are suggested to develop digitalization in agribusiness viz., adopting big data analytics method and collection of market data. Imparting digital agricultural technology among different stakeholders, exclusive training funds allocated for the adoption of ICT and digital technology. Establish favorable policies and programmes
suitable for adoption of digital technology and marketing including administrative and financial support for all stakeholders in the agribusiness industry. Purchase of advanced digital equipments for building smart farms, IoT infrastructure, demand-supply analysis/prediction of database system. Skill assistance to establish “demonstration unit” for adopting advanced digital control system. Organize a digital farmer alliance and forums for each specific agri-industry comprising the members belonging from farmers, equipment makers, ministry of agriculture, scholars and researchers to cooperate together.

Further, it was emphasized to establish traceability platform and system across the agrifood supply chain from farm to fork, active research and consideration for using block chain technology for transparency, decentralization and better food security. It was suggested to integrate the WSN (Wireless Sensor Network), IoT (Internet of things), mobile phone, APP software, and cloud management system to collect and analyze data to improve production and efficiency of farm management. Adopt LoRa (Long Range wireless network with low power consumption) in the farming for monitoring/control the crop/ livestock growth activities. Develop a general micro-climate station to monitor and record the environmental parameters, including temperature, solar radiation, etc to help farmers understand the status of agricultural products.

In case of marketing, it was suggested to establish funds/ grants exclusively for development and use of digital marketing platforms to encourage active participation from both developers and farmers. Promote use of integrated digital marketing and multi-channels of marketing such as SEO (Search Engine Optimization), SMM (Social Media Marketing), video marketing, influencers marketing, contents marketing etc., Develop Crowd funding platform to help farmers and agribusinesses to raise funds for development of products, by pre-selling the products before they are even manufactured and grown. It was advised to arrange capacity building programmes to different stakeholders viz., farmers, traders and marketing team of agribusinesses on the skills for adopting digital marketing. Integration of O2O (online to offline) marketing strategy, linking up online marketing, mobile APP marketing and physical retail shopping) were also suggested for the implementation of better digital agribusiness.

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