

Digitization of Unorganized Indian Agribusiness

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ABSTRACT

Digital India was launched by the Prime Minister of India Narendra Modi on 1 July 2015 with an objective of connecting rural areas with high-speed Internet networks and improving digital literacy. The vision of Digital India programme is inclusive growth in areas of electronic services, products, manufacturing and job opportunities etc. and it is centered on three key areas – Digital Infrastructure as a Utility to Every Citizen, Governance & Services on Demand and Digital Empowerment of Citizens. Digital India Programme launched to create digital infrastructure for empowering rural communities, enabling digital delivery of services and promoting digital literacy. Given that 68 per cent of India's population is rural and agriculture is the main source of livelihood for 58 per cent of the population, one must consider the role of Digital Agriculture within Digital India. Digital Agriculture can be defined as ICT and data ecosystems to support the development and delivery of timely, targeted (localised) information and services to make farming profitable and sustainable (socially, economically and environmentally) while delivering safe, nutritious and affordable food for ALL. Rural connectivity will be key to providing low cost data and access to information. It would empower rural youth to realize their full potential, farmers to increase their profitability by accessing equitable markets and rural businesses to offer value added services. Unorganized Agribusiness consists of local food processing units, cold storage units, farm machinery producers and several others. India being the fertile ground of diverse raw material, sky should have been the limit for India's Agribusinesses. Instead this sector is nowhere in the race not only by the standards of industrialized countries but also in comparison with several other developing countries. This is due to the mismatch between the three main players in the value chain namely Farmers, Agribusiness organizations and the End consumers. Farmers are crucial in this value chain as they influence both the supply side and demand side as well. So, All is Well for Agribusiness only when Farmer is well.

1. Introduction

The key components to support the implementation of Digital Agriculture is Spatial (and Temporal) Data Infrastructure (SDI) and low-cost smart phones and tablets to support the bi-directional flow of data and information to rural consumers. SDI has been the key driver to support modern farming in the US, Australia and Europe as well as emerging economies of China and Brazil. Agriculture is a data-intense enterprise when one considers soil variability, moisture and nutrient levels, rainfall variability, timing of key operations like planting and harvesting, and market price volatility. Advanced agriculture industries help farmers manage these production and market risks through the application of spatial/temporal data bases that are cloud enabled and integrated through Application Programming Interfaces (APIs). This creates a rich and dynamic data ecosystem that enables advanced analytics to inform farmers of the best economic options to maximise profitability and minimise risk - the two critical variables farmers in India would also like to manage. Smart phones are the other key intervention as they are equipped with GPS to track where photos of field infestations or hail damage have taken place for technical support or insurance claims. Mobile phones also enable farmers to integrate into structured markets based on approved grades and standards that can be verified using calibrated photos and settlements made through mobile money. While India has over 960 million mobile phones, only 17 per cent of the population has a smart phone but this is

changing quickly with over 204 million smart phone users projected for 2016. This percentage is much lower for rural consumers but this too is changing as the price point for smart phones manufactured in India is dropping as are phablets (phones and tablets that support rural education and extension).

Digital technology will be key to increasing agriculture productivity by delivering tailored recommendations to farmers based on crop, planting date, variety sown, real time localised observed weather and projected market prices. These recommendations will be based on advanced big data analytics related to down-scaled daily observed weather that is now 9 km x 9 km but will soon be under 1 km x 1 km and effectively field level that feed into crop growth models to estimate yields, harvest date and potential pest and disease outbreaks to optimise pest control measures. Remote sensing is another big data resource to support the development of derived weather products (radar), improved hydrology and watershed management, soil health, crop coverage and crop health estimates among other application. This is now complimented by Unmanned Aerial Vehicles (UAVs) that can capture multispectral images to assess crop health, damage and yield far more accurately than satellites.

The greatest impact Digital Agriculture will have is on democratisation of market pricing and compressing transaction costs so that farmers capture a higher portion of the produce's

marketable value. Agricultural value chains are complex with several actors along the chain but information asymmetry between the farmer and aggregator or intermediaries results in farmers having to sell into saturated, weak markets that are not based on standards. Powerful business models have emerged from Africa, Brazil and China that use big data and mobile phones to increase value chain efficiency for upstream access to appropriate inputs and credit. It also helps in targeted recommendations for improving productivity through market integration based on agreed grades, standards and prices. It is not uncommon for farm incomes to double in the case of grain crops and to quadruple in the case of perishable produce. India is well positioned to realise the same opportunities for its farmers by providing the basic spatial data infrastructure to enable coordination along the value chain.

With the Direct Benefit Transfers system and the unique identification number, Aadhaar, to support transfer of government subsidies to citizens, India is uniquely positioned to leverage these platforms to support the earlier interventions around soil health, Prime Minister Krishi Sinchayee Yojana, national markets and weather indexed insurance. When combined with spatial/temporal data infrastructure, subsidies can be validated (for example, application of fertiliser on a specific field under a targeted fertiliser subsidy programme) and targeted (e.g. digital soil map and crop to be cultivated and rainfall anticipated) to increase farm profitability and manage production and market risks that in turn give farmers confidence to invest in their farms to further increase productivity.

Digital Agriculture will also leverage social media platforms to build human capacity. One of the best examples originating from India is Digital Green. It uses participatory videos that have farmers explain best management practices to other farmers. This approach is ten times more cost effective than traditional extension services as farmers trust other farmers more given they can better relate to someone like them who are building a livelihood under similar circumstances.

Mobile money is the last key intervention that has unlocked tremendous opportunities for rural consumers in Africa and will do the same for India. Paper money is expensive and risky to rural consumers but mobile money is safer, especially for women, and costs less to transfer. Mobile money also allows rural consumers to bypass poor infrastructure to support savings and access credit. While Digital Agriculture is most advanced in the US, the concepts are scale neutral and are being successfully applied to smallholder farmers around the globe. We need to move with a sense of urgency to apply these new tools to accelerate the pace of agriculture development to not only realize the vision of the Prime Minister of a Digital India but to facilitate the achievement of Sustainable Development Goals before 2030. Digital agriculture will also help achieve the objectives of the National Food Security Act in the most efficient, effective and equitable manner to ensure ALL have access to safe, nutritious and affordable food.

2. Digitization of Unorganized Indian Agribusiness

Unorganized Agribusiness consists of local food processing units, cold storage units, farm machinery producers and several others. India being the fertile ground of diverse raw

material, sky should have been the limit for India's Agribusinesses. Instead this sector is nowhere in the race not only by the standards of industrialized countries but also in comparison with several other developing countries. This is due to the mismatch between the three main players in the value chain namely *Farmers, Agribusiness organizations and the End consumers*. Farmers are crucial in this value chain as they influence both the supply side and demand side as well. *So, all is Well for Agribusiness only when Farmer is well.*

- We have been witnessing one revolution after other like *Green revolution* for increasing the productivity of rice and other grains. *White revolution* for increasing milk production. *Yellow revolution* for achieving self-sufficiency in oilseeds *GM revolution* for engineering crops at genetic level like Bt cotton etc. to withstand hostile climates and pests and finally now *Digital revolution* for complete digitalization of Agriculture and Agribusiness.

3. State of Indian farmer

Small and fragmented land holding, poor returns, inefficient extension and lab to land activity, price fluctuation, weather uncertainty, atrocities of money lenders and commission agents made farmers languish in extreme poverty. Wastage of fruits and vegetables amount up to 18% due to insufficient cold storage facilities. The estimated post-harvest losses are at Rs 44,000 crores per year, valued at whole sale prices

4. Latest Digital trends in Agribusinesses:

Agribusinesses should proactively take the challenge and adapt to the changing scenario.

- **Cultured farming:** Can you imagine that one day Digitalized Agribusinesses will produce meat without animals, eggs without hens and milk without cows? It is possible with the help of Cultured farming where animal proteins are grown in the lab and there is no need to grow the whole animal. So no issue of Animal rights Group or non vegetarian problem.
- **Nutraceuticals :** We can see number of workaholics who skip lunch or grab some unhealthy fast food keeping their eyes fixed on the computer screen. For such dedicated employees, nutraceuticals from bioengineered algae like Solent and Spirulina are the most balanced drinks with all the essential nutrients is a boon. Algae culture is an emerging and promising Agribusiness venture.
- **3D food printing:** Such Agribusinesses help deliver highly personalized diets by enriching food with various nutrients and medicines as per the consumer's requirements.
- **Supply chain innovation:** Improvised sacks, refrigerators, trucks etc will reduce the losses while transporting to the remote areas and there is great demand for Agribusinesses which are into agri-logistics.
- **Urban vertical farms:** These are gaining popularity which make use of digitally controlled and manipulated indoor lighting systems, irrigation and nutrient media to grow seasonal crops throughout the year without any

environmental impact. Continued supply of raw material at the Agribusiness location itself is a boon.

- **Technologically savvy Agribusinesses:** Several Digital monitoring Apps in local language and with simple GUI are highly beneficial. They make farmers life easy like
- **NextField DataR** analyses the soil type, climatic factors etc and determines the suitable crop and optimum time to sow seeds.
- **GEOSYS's** satellite-based remote sensing combines the historical records with the real-time observations and helps in predicting problems even before the real symptoms appear.
- **Drones** which are fitted with sensors that take images of crops and based on the requirement he can apply fertilizers or pesticides just to the plants that require treatment known as Precision agriculture.
- **Geo-tagging** is the technique which helps us to trace the farm produce which means we can know the place from where the raw materials are bought and now a days several customers are keen to know the details of the raw materials used in the final product.
- **Radio-frequency identification (RFID)** tracks batches of cereal crops and Live stock management. Thus with several techniques, we can merge field data with crop / weather / soil data which are extremely useful both to the farmers and Agribusinesses as well.
- **Agricultural equipment Manufacturers:** Such Agribusinesses are capital-intensive but promising if we can update regularly. *Sensors fitted Irrigation delivery equipments* deliver water after analyzing the soil moisture, crop and weather conditions. *Agrivi* app helps in planning, monitoring and tracking the input status, expenses, weather, extent of pest attacking risk. *Module Map* provides a simple and efficient management of all types of Agri digital maps.
- **Mobile Platforms:** Digital mobile apps are very useful and Connected Farmer system is very successful. *Connected Farmer system* is a public-private partnership between Vodafone, USAID and the non profit techno Serve. It is a mobile product started in East Africa to help farmers work with agribusinesses and better manage their own crops and finances and has proved to be successful. Thousands of farmers across hundreds of kilometres can be connected in a single mobile by Virtual aggregation.

On this mobile platform, Agribusinesses can register farmers, manage contracts, provide extension services, make payments, extend farmer loans and provide SMS receipts. This is of great help to Agribusinesses to identify patterns, efficiencies and best practices.

5. Tasks to be done on priority basis by Agribusinesses

- Consolidation by going for alliances, joint ventures etc to withstand competition.
- Cost cutting without any compromise on quality.
- Optimize vertical integration by upstream and downstream upgradation.

- Upstream Upgradation includes measures to strengthen R&D and develop new products as per the consumers' taste. The design and shelf life of the product is equally important and should fit well into their life style. For example the products that are targeted to elderly should have easy to open seals as many of them may suffer from arthritis and other ailments.
- Downstream upgradation includes measures to digitalize Agriculture and improve infrastructure so as to supply the raw materials uninterruptedly with the required quality specifications.
- Search for new markets internationally and expand the reach in the present markets by increasing the efficiency of sales channels.

6. How Will Digitization Effectively Transform Agriculture?

That old adage is more true today than ever before. It's expected that by 2050 our world population will approach 10 billion. That's double what it was only thirty years ago in 1987. Increased land, water, and resource use for the growing population competes directly with farming needs to feed that population. It's fortunate that digitization is helping to connect agricultural concerns around the world. But what will the future of farming look like?

7. How will digitalization effectively transform agriculture?

Though robotic farming may seem far-fetched, it's here today. Much like yesteryear's use of satellites for precision agriculture, the additional data provided through the Internet of Things (IoT) allows us to grow more food with fewer resources on less land. With analytics, a farmer in Kenya uses a drone to release beneficial insects in a problem patch. A Kansas wheat farmer helps keep the water table pure by only fertilizing areas in need. Yields are boosted without waste through very specific irrigation management. Total corn production savings can reach 4.5% with yield mapping, 2.4% with GPS soil mapping and 2.7% with guidance systems. Here are some recent innovations we've helped bring to life.

8. What does palm oil's future look like?

Planting a palm oil plantation requires strong long-term planning. But what does the future hold for this important crop? As palm oil's popularity has grown, so have the industries it services. Bio fuels, cosmetics, and other industries are all impacted by palm oil production in addition to its traditional uses in food. Fortunately, there's a strong push to improve sustainability in the palm oil industry.

Most palm oil production in the past has been based on overall yields. But tomorrow's plantation can determine production by every plant. IoT technology allows tracking the exact growing conditions of the palm tree. This means its exact needs are met to maximize yield and minimize waste. But how does this happen?

Aerial photos play a vital role in this process. Drones, planes, and satellites provide imagery to help producers make smart decisions in oil palm plantation management. Sensors

provide climate, soil condition, and other data. This collection of data and strong analytics options let the producer manage stressed areas while boosting production in other parts of the plantation.

This process is being moved forward through collaboration across multiple sectors. Research, genetics, machinery, inputs, and the farmer all work hand-in-hand to provide more palm oil with less waste and a more sustainable environmental impact.

9. The future is sweet with sugarcane production

Though it's still one of the world's top sweeteners, sugarcane has also branched out recently into the bio fuel and electrical production sectors. A single ton of sugarcane produces 120 kilograms of sugar, 85 liters of ethanol and 25 kilowatt-hours of electricity. But the tropical origin of the plant means it's always been planted in developing countries with plenty of land and labor. That made it a cheap crop to grow.

Today's population growth is limiting sugarcane production. This means more care must be taken in crop techniques and inputs to provide maximum results on minimal land. To complicate matters even further, the land it is raised on is often very different. This requires different approaches to achieve these results.

Different climates require the use of different techniques and methods. Ratoon planting allows the crop to be grown from the prior year's plant stubble. But the number of years can vary

greatly. Production-leading Brazil replants new cane every 5 or 6 years. As second-highest producer, India's climate demands planting new cane every two or three years.

Hand harvesting uses manpower and a sharp hand-tool while providing 500 kg per hour, with rising labor rates making this practice less profitable than in the past. Mechanizing the process allows manual labor to be focused in different area as a single harvester will handle 100 tons of sugarcane per hour. Except for on steep slopes, mechanical harvesting provides a more ecologically sound approach. Satellite-based tractor navigation uses permanent wheel tracks to maximize production while minimizing wasted time and fuel.

Combining sustainable farming practices with economical technological advancement allows us to grow as a people and as a planet. Smarter crop rotation, precision pesticide and fertilizer application, yield mapping and weed sensors are only a few of the advancements farmers will see in the years to come. IoT technology is expected to see a 20% annual compounded growth from 2015 to 2020. New agricultural business models are expected to see a 15%–25% growth in revenue above the industry average.

Farms that add IoT capabilities, Big Data analytics, and similar connected agriculture tools are making strong strides. Imagine yields 10%–20% higher than in the past. They're also seeing an average increase in profits of 18%. Some farms have seen profit increases of up to 76%.

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