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DIGITAL TRANSFORMATION IN AGRICULTURE SECTOR

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Abstract

Digital world-Yes we are living in digital era today. Just visualize the world we lived in just some two decades back, and the world we are living today. Everything we needed is on our fingertips now. All the information which we need is very much accessible. It is because of the big data storage and cloud computing, mathematical algorithm calculations, predictions, Artificial Intelligence etc., these are called digital technologies. Which are very familiar now a days. Even small kids use computer and access information whenever they needed. This change or transformation happened because of data collection, data storage and applying it effectively. So, we are digitizing everything we can. That means we are in the era of transformation based on technology, which we can call - digital Transformation

Keywords: *Digital Transformation, Artificial intelligence, Global Positioning System, KrishiVigyan Kendra, Information and Communication Technology*

Introduction

Digital transformation has led to lots of opportunities for innovation across various sectors. From life sciences to retails, from banking to pharma, we observe a complete reinvention of services, products and user experiences in the modern market. Digital transformation means the union of digital technology towards different areas of business, essentially changing how you perform and present value to the customers.

It is good that we are on the verge to transform everything digitally. But we should give importance to those things or basic needs of mankind which cannot be digitalized, that means the things we can't transform digitally are precious, just like Food, Love, Trust, humanity etc. So, we can say that all the values which are precious cannot be digitalized, but technology can help to increase the productivity of them.

Food is the basic need of mankind. In this article we will discuss something on digital transformation or applying technology in Agriculture sector. May be agriculture sector cannot be completely digitalized but digitalisation can help to improve the productivity on this sector for sure. Technology is spreading its wings wide, but we still don't have any software that we can drink and hardware we can digest! That is the reality. So digital transformation in agriculture, means using technology to increase the productivity of the sector, is the need of the hour.

The problems on agriculture sector is increasing. The productivity is not up to the mark because of limited agricultural land, Water levels are decreasing because of unscientific usage of water resources and digging bore-wells etc. If the situation continues, we cannot expect a green revolution in near future, which is most needed. So, we should develop technology to overcome these problems, and methods to find how to use the resources effectively. Absolutely Technology can do that. And Its very laudable that there are number of inventions are impelling on this regard, and we can see many success stories of using technology in agriculture sector. But the acceleration of Digital transformation in Agriculture needs to be increased with the involvement of government, Scientists and organizations.

Digital Transformation

The word Digital could be defined as technology used by electronic gadgets, which generates, stores, and processes data used with new physical communications media, such as satellite and other transmission methods.

Transformation means: Act of transforming, or a state of being transformed into another form without changing the value.

Digital Transformation does not mean only the technological, scientific and those complex algorithm things, but changes connected with digital technology application in all walks of life. We will define the term Digital Transformation - is the reinvention of a person or organization through the use of digital technology to advance the way he/it performs and serves for the notion/ consumers. Digital refers to the usage of technology that generates, stores and processes data and recall it whenever/ wherever it is needed.

Digital Transformation: Need of the Hour

The reason why DT matters so much is businesses are undergoing a fundamental change in the way they operate. They are rethinking the strategies through which they meet their customers' needs, and the way in which those customers engage with businesses services and offerings, it may be through mobile devices, wearable technology, or other technology-based devices. In today's world, businesses, including agriculture need to realize that they must use digital channels to engage with their customers. It is necessary to maintain relevance and drive the conversation on this regard. In their latest Digital Transformation report, World Economic Forum expressed its view and states that-"To succeed and survive in digital era, companies or sectors should strive smartly to become digital enterprises, reviewing entire attitude of their businesses/ sector.'' If any company or sector wants to survive in this digital age it should pass through the digital transformation phase effectively. If not, that will be isolated. Once again Darwin's theory "Survival of the fittest" applies here, but of course evolution has an end, but technology evolves continuously.

Importance of DT in Agriculture Sector

Over the last 10 to 20 years enormous technological development and scopes have transformed people's lives for sure. But these opportunities have not aided the agriculture sector in a significant way. American agronomist Norman Borlaug says: the first component of social justice is adequate food for all mankind. Food is the basic need of Mankind.

Rural India is mainly based on agriculture. Agriculture is the backbone of any country. But why some of the rural farmers, the committed suicide and the statistics are still raising in India. Based on the scenario, we can assume that they maybe had no proper knowledge about their Agri land and its geography, nutrition value or effective usage of water resources, and information to get the good price for his corps, and lack of financial support from the bank,. the problems continues. To overcome this serious issue, based on some technological inventions in India and abroad we can set up a 'cloud' of information that can help each and every phase of crop development, price, loans, bank involvement, subsidies, mundi prices etc to the farmers. Around 50% of farmers now use smart phones. So, information can reach to the fingertips of farmers. Farmers and different sectors associated with the agriculture need significant volume of information to develop. Information and Communication Technologies (ICTs) are playing a vital role in knowledge and information exchange such as targeted recommendations, market integration and access to banking sector to make agriculture a profitable and enticing for upcoming generation.

How do we get significance increase in food production using information? Farmers apply water, pesticides or nutrients uniformly. With technology we can now apply only where it is needed and save water and decrease usage of pesticides and we can apply nutrients where it is needed in the farm and increase productivity. This will be helpful for better environment also.

Of course, the impact of digitalisation in Indian agriculture will be long. Even though the mobile penetration rates are emerging across our country, the smart phones usage into rural areas are still quite low. At present scenario, the smart phone usage increasing gradually in rural areas too, but we may be lagged behind from escalate the types of services related to agriculture in rural areas.

But there is a way of hope. Even if usage is low, we can find at least two or three smart phones every village. The smart phone connects to the knowledge, and then the word of mouth gets it out around the community.

Technologies that boost Digital Transformation in Agriculture

Digital Transformation is playing an important role in Agriculture sector. When we create a platform that farmers can use to get this digital knowledge on their smart phone, when they know how much they produced, how much they have sold, how much has come under cultivation—when they can see all the data in their own language on smart phone on a real-time basis, that is when the change starts taking place. That's when you start feeling, yes, it is doable. India will always have a large number of small farmers, but small farmers can bring about a big change. Farmers can be profitable, productive and progressive if all three put together. So, technology can help farmers effectively on this regard.

IT in agriculture

Agriculture sector has found its track widened only after exchange of information within it. Here Information means the data relating to market prices, demand, cultivation ideas, and seasonal changes etc. Information linked to weather is the very important, which saves the farmer from any loss due to un predictable weather conditions.

The mobile revolution helps to widen the wings of digital transformation in agriculture, but we need physical devices and related infrastructure to go along with the digital. That is where we think there's a small amount of divergence, because the basic needs in this regard are not developing in a significant way to support the digital innovations which the farmers would like to implement

Data driven farming or precision agriculture

One of the technologies used effectively in agriculture sector is Data driven farming, that means using data, may be pictures, data from drones and sensors installed on the fields, this technology has the ability to map every farm land, just like what is the soil moisture level, nutrient level etc. Studying the information every farmer can use the resources effectively. Then there will be decrease in the cost of production and obviously the productivity increases. So, scientists or techies call the technic - precision agriculture.

There is some technology called Pheno typing, which gives information to the farmers on which land which seeds should be sowed for good increased yield.

AI (Artificial Intelligence) in agriculture

One of the great inventions in digital era is AI (artificial intelligence). With the rise of Artificial Intelligence, in the agriculture space, solutions based on the technology are also coming up

Mr. Prashanth Shukla, veteran technologist expresses his thoughts through a TEDx speech. He says AI can transform the lives of rural area and farmers even in India more effectively.

What is AI? We learn technology, but surprisingly AI learns us based on information or data given to it. The AI learns us and observes us, it looks at the way we are answering questions, then taking the data point, it anticipates and predicts what will be our answers for certain situation. AI is the combination of Cloud data technology, real time data and simple to complex algorithms.

So, AI can be used in Agriculture sector. Actually in India our farmers use some apps in which they are getting real-time solutions, and answers for their problems, which is based on AI. Of course, use of AI helping the farmers to increase their productivity gradually.

In AI technology with the sensors planted in fields, the soil tells you what can grow best, using drones we can calculate the crop qualities, Soil Moisture information can be collected and analysed. Even according to the yield, we can get the expected support price, we can get parasite pics and plans to get rid of them. So, the AI absorbs all the information and give the farmer a better solution. So obviously the productivity must increase if everything goes on the right way – right channel. There are some success stories we can get from the IoT (Internet of Things).

Using technology we are not only get the information of soil and the Nutrients in it but farmer can take Right decision about their land. Mobile usage surprising increased the productivity with some agricultural related info apps by the government and some other developers. So, we can say that data science is very much helpful to empower a famer.

So by AI technology we can perform field by field specific analysis of soil constitution, weeds, pest infestation, fertilizer requirement, water requirement through GPS and probes on the farm machinery; colour based spectral analysis of the crop maturity stage, time of harvest; weather forecast based time and type of crops best to be sown; harvesting and post-harvest equipment to increase the efficiency and reduce wastage, grading of the crops etc. Even we AI can contribute on genetically modified seeds / saplings fitted to specific climate, area and even farm to increase yield and reduce failures; thus, reducing need for pesticides, saving water etc. So Digital transformation spreading its wings in the agriculture sector also.

Use of GPS technology in agriculture

In the navigation sector, global positioning system (GPS) topped the factors for easy access to places. The same impact or an equally significant impact has been made in agriculture too. Along with GPS, GIS also makes its part huge in

digital farming. The involvement of these technologies is for Site-specific farming and Precision Farming. These technologies are used in some sections of agriculture effectively.

Field mapping, Farm planning, Soil sampling, Crop scouting, Tractor guidance, Variable rate operations, Yield mapping etc. are conducted through these technologies.

GPS in agriculture will allow the farmers to perform their job even at zero visibility. Zero visibility means the struggles in viewing the farm amid environmental natures like rain, fog dust and darkness. During these unpredictable conditions, GPS interfere in to bring a break-free or interruption less farming.

Apart from these technologies, there are few more in the market which is being used in the field of agriculture. Information technology, GPS and Nanotechnology are broad classifications and the following are a bit specific in their purpose.

Drones in Agriculture sector

One of the newest and greatest assets to modern farming is the invention of Drone. No longer do farmers have to cover miles of farms and fields to see where crops are flourishing or in need of additional care. Add to this the GPS programmed units out on this field that do the neat work that was previously done by farmers. These instruments give an immediate notice of where moisture is needed and automatically divert water there and not to the whole fields as previously. Crop yields can be accessed prior to harvesting using drones. In near future drones are going to be used extensively in India to monitor farming activities. Many farmers and scientists are already working on this regard, and may be within 5-7 years it should be used vastly across the country.

Irrigation systems: Centre pivot

Irrigation must be done precisely, because of its impact on the growing crops. Better irrigation plays a key role in conserving the water resource as well as providing gad equate water for crops. This is to be considered the most needed criteria in selecting a convenient irrigation structure. On this regard center pivot ranks first in that and the costs associated with it are also relatively less. It is notable that the center pivot irrigation system is more suitable for flat terrain regions.

It is promising that some areas of agriculture in India is undergoing digital transformation process. Here are some moves in which digital technologies help in their own way for better changing agricultural practices.

Apps that Support Digital Transformation in Agriculture

Another technology that we are trying to use for the better productivity, is developing some apps to monitor activities on the farm. There are significant number of apps related to agriculture currently available on app stores, free of cost, which deals in an array of functionalities in agriculture sector.

Market place facilitation using apps: where farmers or agriculture enthusiasts or producers are able to connect directly with the consumer. Better Farming practices can be implemented using apps by farmers for higher quality and quantity yield, crop health, seasonal plantations, cost optimization, etc. Apps also keep the user updated on government policies, schemes, grants on agriculture.

Some examples of such apps used by farmers are ApniKheti, Organic Livestock Farming, Krishi Gyan, CCMobile, Hitech Kissan, Agribuz etc.

How these apps help Farmers go digital

The farmers can download the apps related to agriculture on their smart phones thereby apps bring together the farming community and helps them in selling, buying and exchanging agriculture commodities and services locally without middlemen through ad listing/posting

which they can post from their smart phones.

Apps feature several significant information to farmers, some are.

Information on Buy or Sell agriculture related products: India has one of the large agricultural markets around the world. So, it is important to have a service, which can connect the farmers across the country. This would help them in increase their productivity and profits by selling their produce at a better price locally or where farmer get better price.

Post Ad/Listing: using apps farmers can post anything about Agriculture within minutes. Take a snap or upload a photo of the field or products, just provide the details of product and submit Advertisement and instantly their post will be displayed.

Chat, e-mail or Call service: Seller or buyer can chat, details can be shared by e-mail and then discuss about deal on phone.

Sell anything related to agriculture: Farmers can connect with each other to deal with agriculture related products.

Information on seeds: Apps provides info on Vegetables, Flower, Fruit seeds, Seed Production, Processing, Drying, storage and Packing etc.,

Information about planting material: Apps provide info on Fruit and Vegetable crop, Flowers crop seedlings, Tissue culture plants, Ornamental plants, Landscape plants and Spice crop plants. Info about Agriculture Chemicals such as Insecticides, Fungicides, Herbicides, Rodenticides, Pest control service and Lab chemicals available through apps.

Apps provide Info on Straight, Complex, Soil enrichers, Soil Amendments, All in one, Special, Water soluble, Micronutrients and Bio-Fertilizers etc.

Info on Hi-tech or Modern Agriculture or Smart Agriculture: We get real-time info on Precision farming, Poly-House, Net-House, Mulching, Hydroponics, Nursery Portrays, Drip Irrigation, Sprinkler Irrigation, Growing Media, Helicopter or drone crop spraying, Hiring service and Field contractual service.

Info on Machineries and tools(Farm, Harvesting Post harvest machineries and farm tool Farm Implements): Apps provide info on traditional and modern Hand operated, Bullock drown, Tractor drawn implements, Field equipment's and Lab equipment's.

Agriculture Market Information: Apps also provide info on Millets, Cereals, Pulses, Oil seeds, Vegetables, Fruits, spices and fiber, Ready-made products and Ready to eat products.

Organic Agriculture Market Information through apps: Organic farming, Organic Inputs, Organic fertilizers, Organic Insecticides, Organic Fungicides, Other organic Pesticides, Organic sprays, and other Organic Products information can be accessed through apps

Info on domestic animals, pets and farm Land: Cows, Bullocks, Poultry, Fishery, sericulture, Sheep, Goats, Dogs and Land development, Layout or land for lease and sale.

Agriculture Consultancy and services such as Field visit, Phone consultation as well Service on phone call and Hiring service are made available through apps.

Knowledge on Agriculture Communities and events: Information on Agro-connect, Social, Commercial, Agriculture Forums, Agriculture Events, Trainings, Field days, Agriculture-expo, Seminars, Conference, Agriculture-Trade fairs, Krishimelas, Kissan melas and Discussion.

Agriculture Education and jobs: We can get Information agriculture education for students, Diploma, Graduation, and Post-graduation courses. Conducting Quiz based on Agriculture, Jobs in Trading, Service companies, Agriculture Officer and Agriculture business.

We can say, modernism is not in agriculture alone but in the lives and levels of farmers too, which makes use of technology. Development of new apps significantly ease the workload of a farmer is definitely a good sign in the Agriculture sector.

All is well, but why a common farmer cannot get these technological benefits to increase productivity is another big question. Because the cost of the technologies. It is not affordable for small common holder farmer. Thus, it is very essential that government and organizations tie up together to help the backbone of the mankind, i.e., farmers.

Organizational Support on Digital Transformation in Agriculture-Sector

In India there are number of organizations that empower farmers to adopt modern techniques in Agriculture. KVK(Krishi Vigyan Kendra) is one of the Organization which guides the farmers on this regard. The KVKis financed by Indian government and the KVKs are sanctioned to Agriculture Varsities, ICAR institutes, related Departments and NGOs working on Agriculture development.

Krishi Vigyan Kendra, is an integral section of the National Agricultural Research System (NARS). It aims at determination of location specific technology segment in agriculture and related sectors, through technology appraisal, refinement and demonstrations. KVKs functioning as Information and Resource venture of agricultural technology. It supports the actions of public, private and voluntary sector to empower the agricultural economy and linking the NARS with extension system and farmers of the respected district.

Technology assessment and demonstration of its application and scope development is the mandate of KVK. Some activities are assigned for each KVK to implement the commission effectively.

1. Under various farming systems conducting on-farm testing to assess the location specificity of agricultural technologies.

2. To Establish production potential of technologies by frontline demonstrations on fields.

3. To update knowledge and skills of farmers and extension workers on innovative agricultural technologies.

4. To support initiatives of public, private and voluntary sector in developing the agricultural economy, KVK work as knowledge and resource center.

5. Through ICT and other media means KVK provide farm advisories on varied subjects of interest to farmers

KVKs also provide quality agriculture and technological products like, seed, planting devises, bio-agents, live-stock etc.KVK make these innovations available to farmers, conducts extension activities, identifying and documentation of farm innovations and to converge them with schemes and programs within the authority of KVK.

Some organizations developed real-time Mobile Apps that will be very helpful for the Farmers. These technologies and Apps must made available to all farmers to empower the sector.

The Intelligent Agricultural Systems Advisory Tool (ISAT): ISAT gives concise farm advisories to our farmers on their smart phones. ISAT is emerged by a collaboration of the IT giant Microsoft, Indian Meteorological Dept. (IMD), Acharya NG Ranga Agri University (ANGRAU)and ICRISAT. These advisory or messages are generated after study of local and global climate history data as well current and predicted weather conditions, soil-related information and crop systems. The application employs a decision-tree approach to generate SMSs, which then sent to farmers who asked for the service. By guiding planting decisions, the tool helped farmers increase the crop yield across several areas.

Sowing App: The Sowing App, developed for farmers of Andhra Pradesh utilizes artificial intelligence technology to

interface with weather-forecasting models (provided by USA-based a Where Inc.) and extensive data which Combined with Village Advisory Dashboard which is Personalized.

Rainfall data over the last 4 decades and 10-year data of groundnut sowing process in Kurnool district and data about crops and fields are collected and uploaded to a cloud-based computer and is used to provide important insights about soil health, fertilizer recommendations, sowing date suggestions including weather forecasts for a week.

The Sowing App is developed with the partnership between ICRISAT, Microsoft and the Govt. of Andhra Pradesh. The App has helped farmers achieve excellent harvests by giving information through SMS on the perfect time to sow. The Farmers of the region got 30% increased yield with timely advisories from the App.

Plantix App: Plantix mobile app developed by German company PEAT Gmbh's is customized to mandate crops of ICRISAT. The app help farmers to identify diseases and pests on their smart phones. Farmers click pictures of the crop affected and upload them instantly. The images are analyzed by AI (artificial intelligence) algorithms, and results immediately returned to the farmer. Using the app farmers get analytical information on symptoms and triggers, chemicals and even biological treatments of crop diseases on time, preventing greater loss of crop and productivity.

The Measure M&E Platform: Monitoring and Evaluation of Agri-Science Uptake in Research and Extension (MEASURE) is a mobile and web-based application designed to collect real-time, geo-tagged info about farmers and their farmland, livestock, as well other on-field interventions and other important measures of agriculture research and extension. Originally created as a field data-collection instrument, MEASURE has now transformed into a full-fledged M&E platform to trace activities, manage beneficiaries and supply real-time insights through visually enabled dashboards to the project teams. The MEASURE platform gathers info on geo-tagged data of farmers and farmland and crops in it, capacity building activities in real-time. It provides a multi-layered web-based dashboard to see the collected info from all sources. It keeps track of the progress of the project implementation and provides proper distribution of the project intervention sites. As well it schedules and manage field level activities carried out by the partners/staff on the grass root. In two years of the particular launch, MEASURE has about 560,000 records from 20 different projects within and out of doors ICRISAT.

Technological impact on Agriculture

Delivering appropriate knowledge for better and sustainable farming and livelihoods Impact - Having the proper information and knowledge can lift poor smallholder farmers out of poverty and food insecurity, be more resilient to drought and other shocks. Access to plug price information means better bargaining power and incomes and this will successively influence the selection of crop cultivation accordingly. Applying knowledge about new farming practices like no-tilling conservation agriculture could improve soil fertility and double yields.

Right information at the proper time – within the dry lands, public-funded agricultural extension to place research into practice is usually poorly equipped to reply to smallholder farmers' real-time agricultural advice needs. E.g. "A pest is destroying my chickpea crop what should I do." Science produces large amounts of data, but how can farmers dig out the key piece of data to answer a selected question at the time they have it? Agro pedia, a web collaborative knowledge repository on Indian agriculture, aims at cataloguing scientific information for easier access, providing localized content to extension

workers and farmers consistent with key agricultural entry points like by crop.

Right format through the proper channel- Many players deliver information to farmers, from extension workers to media, private companies and farmers themselves. Social networks play a robust role in circulating information among the farming community and therefore the way knowledge is assimilated by each individual. the primary source of data for smallholder farmer is usually a loved one or a neighbor. Farmers may imitate adoption behavior of progressive/successful farmers. Bhoochetana project in Karnataka uses progressive farmers (farm facilitators) within the targeted community to vary soil fertility and other farming practices.

Providing farmer-friendly information, e.g. during a tailored, local language, jargon free format is vital for effective learning and adoption. Demonstration plots beside agro-dealer shops, striga management training videos, aflatox in awareness, theatre plays screened on television in Mali, seed fairs and other visual information is effective back-up to agricultural extension.

Radio may be a major information means for farmers in developing countries. ICRISAT works with partners like Farm Radio International to enhance the standard of data in agriculture broadcasting programs.

Some impactful ICT innovations

ICRISAT has developed and supported many information systems linking research, extension and markets, just like the Virtual Academy of Semi-Arid Tropics (VASAT). Internet equipped village knowledge Centre are fed with up-to-date knowledge on best farming practices. E.g. climate adaptation methods, crop rotation, diversification and pest management for smallholder crops like millet or sorghum.

Mobile phone technology addresses many of the walk. Effective productivity lagged because connectivity problems with earlier web-based ICT platforms like infrastructure, connectivity, training needs and literacy issues. Mobile tech can increase outreach and efficiency of extension services. A pilot mobile-mediated knowledge system helps Krishi Vigan Kendra's (Farmer Knowledge Centre) to succeed in reaching 20,000 farmers in South India who are regularly receiving useful and timely crop advisories.

Advantages and disadvantages of DT on this sector

One of the main advantages of the utilization of DT in agriculture is that farmers can now farm more acres in one season than ever before. this is often important because it means less people need to be farmers, though it does present a definite disadvantage to small-scale farmers who struggle to compete with landlords who farm hundreds or thousands of acres of agricultural land.

Another important advantage of tech is that the increased efficiency of farming. Each acre of land gets precisely the correct quantity of seeds, rows are spaced precisely the correct quantity apart for optimal yield, and fertilizer are often applied without waste. All of this leads to lower operating costs for the farmer, which successively makes the utilization of this technology feasible for farmers.

Finally, the utilization of technology in agriculture helped to enhance the health of the environment. For example, a replacement edge-of-field monitoring system, the system monitors phosphorus levels in runoff from fields and updates the farmer when levels are too high and would be harmful if in major waterways. this is cool. So, we can expect a positive shift in agricultural consideration for the health of the encompassing environment.

As we speak about advantages of technology, Modern machines can control the efforts of farmers and hey reduce the time also. Used to supply water to the crops. While Machines are useful in sowing the seeds and also used in

transportation. Proper irrigation, Application of synthetic fertilizers, Chemical pest control can be done effectively to increase productivity.

Disadvantages of technology include lack of practical knowledge the farmers cannot handle the machines like tractors properly. While the cost of maintenance is very high. The overuse of machines may lead to environmental damage. It is efficient but has many side effects and drawbacks. Furthermore, a Driverless agriculture machine is a liability to access technology.

Conclusion

Transformation is an inevitable event of any living being, any person or organization/sector. That could be any form of change, may be a noticeable one. Just like a caterpillar transforms itself into a beautiful Butterfly.

The world we are living now is called digital era, because changes happen in a drastic pace. Inventions takes place back to back in our day-to-day life. We are in a situation to adopt the changes and should transform ourselves to survive and increase productivity in the digital world. Agriculture is not foreign to it, as we have seen elaborately in this article.

Digital transformation in agriculture sector is an enormous undertaking, especially a radical thinking by using the technology to meet the need of the people through new development for a sustainable and a flourishing society. When executed right, it will result in a promising business sector that is more aligned with customer demands and expectations in this digital age and robust in the fast-moving digital future.

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