## Digital Transformation for Indian Agriculture: A fertile Ground

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Agriculture is the most ancient organized activity of humankind. Indian Agricultural practices have unbroken tradition going back millennia and are interwoven into the cultural landscape of the subcontinent. Even today Agriculture plays a vital role in the Indian economy. Over 70 per cent of the rural households depend on agriculture. Agriculture is an important sector of Indian economy as it contributes about 17% to the total GDP and provides employment to over 60% of the population. Agriculture is the largest enterprise in the country. An enterprise can survive only if it can grow consistently and generate positive net returns from the enterprise. The net returns determine the level of income of an entrepreneur, farmer in this case.

Agriculture is also the most complex of human activities which is characterized by:

Volatility, Uncertainty, Complexity, Ambiguity (VUCA). VUCA is a popular term usually used to denote the environment around a business enterprise. Agriculture as an activity has each of these elements in much larger a proportion than a typical business enterprise and has much less resilience to withstand the effect of these. It is therefore important to consider Agriculture as a business with extremely high risk and uncertainty.

Therefore, concerns in making Agriculture "entrepreneurial" are:

- Recognizing agriculture as a business
- Sustainability of production
- Monetization of farmers' produce

The relevance of appropriate Digital technologies to address the aspects of **VUCA** is particularly important to run the "enterprise" profitably. It is ironical that given the importance of Agriculture to our economy the fruits of digitization have not benefited this sector as much as it has done in all other areas of business and social activity. Mechanization has happened to a large extent but not digitization much less transformation.

Before we examine the digital transformation in Agriculture, we need to keep it in mind that Agriculture activity at its core is a botanical and biological production activity and therefore subject to specific dynamics which are vastly different from a typical business enterprise. More importantly it serves a necessity of human existence and sustenance which is food. The digital Transformation of Agriculture and therefore at the farm level requires to be understood in terms of what Digital technology can do in real terms.

There are three broad areas where digital technology can be deployed:

- 1. As a Decision Support System Real time Information availability
- 2. Providing Market Linkages: Farm to Fork

3. As a departure from Traditional Farming or Crop Growing Practices to "Smart Agriculture" or IoT based farming Practices

It is necessary to look at the information needs of the farmer at each stage of the Agriculture cycle from Seed to Crop. It can then be examined where and how digital technologies can help in the above-mentioned focus areas.

The table below gives the information needs of the farmer at different stages of the Agriculture Cycle.

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Pre-Planting	Seeding	Preparing and	Growing	Harvesting,	Marketing
		Planting		Postproduction	
				Packing and	
				Storage	
1.Which crops to	1.Which seed	1.How to sow the	1.Diagnosing	1.How to harvest	1.Whether to
grow for which	to purchase?	seed? (example:	pest attack (if	the Produce?	sell the
target market?	2.Where to	seed rate, sowing	any) and	2. Where to store	produce or
2.How much land	purchase?	time, depth at	which	the Produce?	consume it
to allocate to	3.How to	which seed should	pesticide to	3.How to cure the	at home?
each crop?	prepare the	be sown; using	apply?	crop and options	2.Where and
3.Whether to	land for the	seeds vs.	2.How to apply	available for	when to
purchase seed	specific crop	seedlings)?	the various	value addition?	sell the
or use own	/ produce?	2.How much quantity	inputs		produce?
seed?		of water, fertilizers,	including		
		manure, herbicides,	water, and		
		micro-nutrients,	judicious use		
		and pesticides to	of inputs?		
		be applied?	3.From where		
		3.Which fertilizer,	to purchase		
		manure, herbicides,	the inputs?		
		micro-nutrients to			
		apply?			

Source: Adapted from (Mittal, Gandhi, & Tripathi, 2010), (Aker, 2011) and (Meitie & Devi, 2009)

Stage	How will digital Intervention help the information need?	What are the specific Digital Tools?
1	Previous Season Information of the Farm and of the region if collated could be analyzed in conjunction to find out the Probable yield and the market Price and to work out the Profitability for a crop mix which will give maximum Profitability.	A farm data Analytics can be created for the specific farm and also for the region to help in supporting the decision and also do a what if analysis as a decision support system (DSS)
2	Previous years or Seasons information about seeds including the source can be a good indicator of the quality based on historical	A suitably designed software tool could help in comparing different Varieties of types of seeds and their growth, yield, cost and any other specific requirement and

	trends. In addition, access to UptoDate Information about various seeds could be accessed online through KVKs and other Reliable Sources.	gain help as a DSS instead of gut feel or even traditional practice
3 and 4	Optimize all Agri inputs in terms of quantity and therefore cost. Optimize them in terms of multiple variables like Crop type, Soil nutrients and type, moisture, temp etc etc. Practically all parameters which are essential to monitor and control. This could also include monitoring healthy growth and pre- empting Pest infestation	The entire gamut of measuring continuously Agri inputs, growth parameters and soil conditions is facilitated by what is called "Smart Agriculture. This is facilitated by an integrated set of digital technologies which use sensors, videos and corresponding analytical software to operate as an integrated whole based on data and not subjective information
5	Postproduction and warehousing management including appropriate storage requirements is important for reducing wastage and having an accurate picture of Inventory. It would help also in Tracking of produce to a specific plot of farm especially important for Organic farming.	Warehouse management system including tagging of produce. Managing the environment in the warehouse for wastage free storage can be helped again by elements from the Smart Farm toll sets as explained above.
6	Ability to access the market on a Pan India basis and facilitate price discovery to get the best possible returns for the produce in addition to open the possibility of "farm to fork".	Using or creating an e market portal to connect to the Indian market for concluding the entire sale process online. The supply chain including local logistics is an important issue which can be also enabled by digital technologies (explained in detail)

As an example, we will examine stage 6 from what digital transformation can do. This stage is one of the weakest currently in most of the states in India. The reason is Information asymmetry about market information and poor access in terms Logistics for transporting farm produce as well as access to bigger consumption centers. Government of India has recently amended certain Laws to facilitate the concept of one "Country one Market" for Agricultural produce. There is e-NAM as a platform for selling or accessing buyers. What will work for the farmers is to collectivize their efforts in the direction of getting direct access to large end buyers or even directly to end consumers. An example would be to enable FPOs, farmer Cooperatives or Self-help groups to digitize their operations so that they can directly get connected to the wider world through Internet. The transition from the mindset of only looking to sell in the nearby market needs to change at looking beyond to India or even abroad as potential target market. This change will be not only on one part be of the mind set but is also much more than digitization of getting a portal in place. There are important pieces which needs to be integrated together through the digitization process for this stage to really be useful. The portal would of course be supported by a payment gateway. This would be the easier part. However, a greater challenge is the local or rural logistics piece. This challenge can only be met by digitization of this piece as explained here.

The important stage is creating a local logistics ecosystem consisting of transportation providers (local entrepreneurs) a hub and spoke system. The spoke takes care of collection, aggregation and transportation link which can provide the link to the nearest hub within a radius of 200 to 250 Kilometres or more. The hub could be the mainstream Logistics national providers. The local spokes could be organized on the "Uber" model wherein the farmer connects into the "Uber" portal to schedule a pickup and receive information about delivery and returns (in case appropriate). Such a model will depend on an end to end digitization of the local Logistics supply chain by a set of local transporters as entrepreneurs. A similar process can also be used for custom hiring of farm equipment.

The stages 3 and 4 of the Agri cycle are areas which are very appropriate for adoption of "smart farming" framework. This is an evolving area and presently it is not scalable in terms of returns on investment as opposed to traditional methods. This framework is also yet to be tried on a large scale to establish robustness to withstand the environmental conditions in the rural conditions. The need for a higher level of technical support and the need to customize the solution framework is an issue which requires to be factored in as well. The way forward is to establish the Proof of concept by having experimental demonstration farm at the state level to establish credibility amongst the farmers.

In terms of impact on the farming enterprise there is a clear feasibility of bringing digital transformation in all spheres of activities in stage 6 of the Agriculture cycle immediately. The rest of the stages especially stage 3 and 4 will have to await the transition of the Technology from the bench to the farm. A more detailed article covering the "smart Agriculture" aspect will be part of the next blog.

It can be said the time has come for the age of digital transformation to dawn on the Agricultural ecosystem in a way which can transform the sector from a high VUCA environment to one which is more remunerative and also less risky.

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