

**A TREATISE ON NAVIGATING EXTENSION AND ADVISORY SERVICES THROUGH DIGITAL DISRUPTION**



*Digital disruption can seem like a threat, but it can truly be a game changer for Extension Advisory Services (EAS) opines Dr Shaik N Meera.*

**CONTEXT**

If you are an extension professional involved with the field demonstrations, you must have observed that extension advisory services are being disrupted, and we are at the receiving end. Apparently the disruption will be happen not only due to digital technologies (please see my blog <http://www.aesa-gfras.net/admin/kcfinder/upload/files/AESA%20Blog-68-March%202017.pdf>), but also through farmers’ centric approaches that offer retail like extension services (advisory & supply chain coordination) specifically designed to meet and exceed expectations of farmers.

Extension Advisory Services (EAS) delivery in India have limited scale, sustainability and impact. Globally, it is estimated that public extension systems’ outreach does not exceed 6.8 per cent of farmers (GFRAS, 2012). NSSO, 2014 has indicated that of the 40.60 per cent households who received extension assistance, only 11 per cent of the services came from public extension machinery most of which were advisories. Farmers expect much more than access, quality and affordability of knowledge (advisories) and services (financial inclusion, supply chain and marketing). Seldom have we dared asking ourselves what farmers want. This shows how prepared EAS systems are!



Perhaps, the current thinking process of EAS does not take into consideration (not delivered if already considered) personalised, exceptional, retail-like experience: time and mission criticalness of extension services. It is about providing these services as how, when and where it is most convenient for them, not us.

I argue that digital technologies may help us achieve this. Not digital technologies alone! As was discussed in my earlier blog (Meera, 2017), the disruptors leverage digital tools and technologies to provide enhanced experience to farmers. The disruption in EAS should be caused with commitment to provide a superior farmers experience, not by our commitment to digital technology.

Digital disruption is happening across industries (agriculture is no longer an exception!) bringing significant values to individuals and organizations. We are spotting disruptive trends in commerce, health, hotel, governance, banking industries, but have seldom tried to relate them to rural

advisories and agricultural development. What could be done to leverage the strengths of digital disruption requires a bit of analysis. This blog is about this. This is presented in the following sections.

1. Give Farmers what they want.
2. Start-up Digital disruption - where do we stand?
  - 2.1. Current avenues for digital disruption from pilots from public sector.
  - 2.2. Start-up based digital disruptions models
  - 2.3. Strategies to redesign practices public extension systems.
3. Winning the game of disruption – extension way.
4. Navigating through Digital Disruption – Conclusion.

## 1. GIVE FARMERS WHAT THEY WANT: PHILOSOPHY OF EXTENSION

Extension Systems were impactful in the past when there was an information and technological disequilibrium between farmers and service providers. Over time, as increasing numbers of farmers become aware of a specific technological thrust, the impact of such extension diminishes, until the opportunity and need for more information-intensive technologies arise. This situation warrants extension systems to focus on disequilibria shift from production technology to market linkages and information access issues. This paradigm shift poses real threat to the conventional understanding of extension philosophy (though one can find literature related to market led extension etc.). Performance of extension system is monitored in terms of budgets, staff levels, and other bureaucratic, rather than substantive indicators. Accountability to the farmers is nominal, as typically there is neither a mechanism nor incentives, to actually induce accountability to farmers (e.g., Howell 1986, Farrington et al. 2002). This is ironic, as farmers are the only ones who can relatively easily observe the quality and effectiveness of the extension service they receive. This could not be done, perhaps due to the lack of standards and inability to handle personalised data from farmers. Sooner or later, one of the indicators that an extension professional has to deal with is his/ her ability to provide information and technology that farmers want – in a time and mission critical way. (Think about the definite success indicators of a private extension professional though not similar to the public extension professional). I believe that, to be relevant - we need to define to what extent 'can EAS provide farmers what they want'.

*Mission critical is a popular term used to describe the essential services required for day-to-day operations. All indispensable farm operations absence of which may affect production, are termed mission critical.*

My team at Rice Knowledge Management Portal ([www.rkmp.co.in](http://www.rkmp.co.in)) at the ICAR-Indian Institute of Rice Research (ICAR-IIRR), Hyderabad has analysed around 11,000 queries of rice farmers from the database of Farmers' Call Centres during 2011 (Meera, 2013 and [www.rkmp.co.in](http://www.rkmp.co.in)). We found that there was a clear shift from production oriented questions to protection and postharvest market related questions. Specifically, there is and will continue to be a shift from crop diagnosis and pest/ disease management towards prediction and prevention. Can we really handle simple personalised pest management that includes pest surveillance and forecasting at individual field level, if not village level? That means to be effective an extension professional has to elevate his job role from giving knowledge advisory (bulletins / POPs) to retail like personalised predictive analytics. While diagnostics immediately should be followed up by management options (pesticides

### **Retail like Extension?**

*The retail format influences the consumer's store choice and addresses their expectations. At its most basic level, a retail experience is when a consumer shops he/ she usually looks for something specific and wants to be able to find it easily, they expect to get their personalised product delivered quickly and for free. And now retailers are literally racing to consumers' doorsteps to meet rising expectations.*

*Farmers demand a confluence of convenience, choice, and control when they seek advisories and services. If we can cater to their needs then it is a retail like experience for farmers.*

delivery and spray), predictive analytics should be followed by precision advisories. Both require huge amount of data from the farmers (if not comprehensive, at least representative). That is exactly what a data driven extension is all about. Linking the data and organizations to enable time critical supply of pesticides and other inputs is happening in the private sector, but not comprehensively (please refer to my earlier blog). Empowering farming communities in handling diagnostics and predictive analytics in a simplistic way will bring disruption in pest management. Providing farmers with the diagnostics and management options - when, where and how it is convenient to farmers (even field delivery experience of Amazon) will be the next game changer. Pest diagnostics is only a small component of a whole range of extension deliverables. Consider providing farmers personalised, exceptional, retail-like experience: time and mission criticalness of extension services related to every single enterprise (crop or allied sector) they are dealing with. It is about providing these services how, when and where it is most convenient for them, not us. Sounds challenging?

If not done by traditional extension advisory systems, the incumbent extension organizations will become vulnerable to those farmer-centric ventures that offer the same or similar services, but with a delight to the farmers. To prevail - EAS must acquire and implement digital tools for a truly modern, farmer-centric, retail-like operating model that integrates available and emerging digital technologies to meet and exceed the expectations of agriculture sectoral needs.



Sooner or later we need to answer the 10 difficult questions in effectively harnessing digital technologies in EAS (Meera, 2013). Currently the digital pilots while providing extension advisories do make use of digital technologies, but within the traditional operational models that may not provide an exceptional experience to farmers. In such cases we end up with the digital extension, but not with the digital disruption.

## **2. START-UP DIGITAL DISRUPTION - WHERE DO WE STAND?**

A report by Derrick McCourt (2017) on digital transformation in public sector from UK indicated that nearly half of public sector organisations (41%) think that their industry will be disrupted within the next two years and there is no roadmap - only 35% of public sector senior and middle managers said their organisation has a clear digital transformation strategy.

It is difficult for the large organizations such as public sector extension systems (State Departments of Agriculture in India per se), to embrace digital strategies that would quickly bring disruptive innovations. The pressure further mounts when governments expect the organizations to work in the same way as a small digital start-up. We need to address this by analysing existing start-up digital models from the private sector, try to understand the current avenues for digital disruption, identifying the processes where disruption could be planned (?) and working out strategies for redesigning the EAS processes for improving the disruptability.

This brings us to a point where we need to analyse 2.1. What are the current avenues for digital disruption from pilots in public sector 2.2. what are the digital disruption models that are start-up based - but lack the scale 2.3. What are the strategies to redesign practices, simulate innovations and crowd source within existing public extension systems?

### 2.1. What are the current avenues for digital disruption from pilots from public sector?

In India like many other Asian countries, National e-Governance Program – Agriculture component (NeGP-A) aims to provide an integrated and seamless interface to the farmers for making informed decisions. The NeGP-A mission mode projects envisaged providing Information to farmers on seeds, fertilizers, pesticides, government schemes, fertilizer recommendations, crop management, weather, and marketing of agriculture produce. Most of these mission mode projects have either of the one - scale or comprehension, not both.

Agriculture Information Portal of Ministry of Agriculture and Farmers Welfare, Government of India (<http://agrionline.nic.in/>) features various platforms such as Farmers' Portal, mKisan Portal, State Specific Agrinet Portals, Direct Benefit Transfer- DBT, Agriculture DBT Portal,



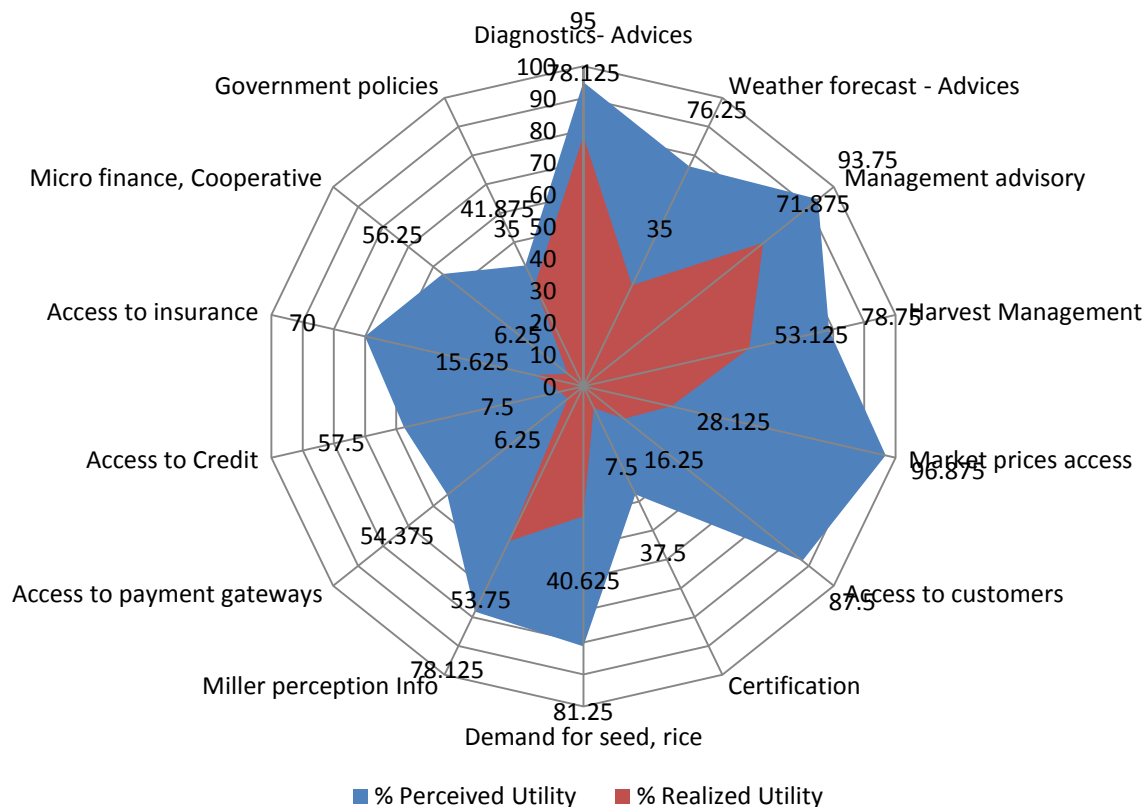
DBT-Agriclinics and Agribusiness Centers, Forecast Weather and Agromet Services Information, RKVY Management Information System, SeedNet Portal, Soil Health Card Information System, Industry Specific Projects like Plant Quarantine Information System (PQIS), Fisheries Input management System, National Agriculture Market (NAM), Agriculture Census, DBT in Agriculture Machinery, Farmer/Public Centric Projects, AGMARKNET Portal, Computerised Registration of Pesticides (CROP) and Seed Export Import System etc.

Most of these initiatives are aimed at creating platforms without much emphasis on comprehensive, up to date and real time data/ information/ knowledge sharing. They appear to have scale in terms of frameworks, but do not have substantial quantities of data that would make a difference. The Direct Benefit Transfer (DBT) platforms (please see <https://dbtdacfw.gov.in/Home.aspx>) are more like G2G kind of initiatives that aim to faster expedite fund transfers and monitoring of progress under each category.

Similarly on ICAR website one can find links to 100 mobile apps (<https://icar.org.in/mobileapp>), KVK Portal (<https://kvk.icar.gov.in/>), other knowledge initiatives such as Agricultural Education Portal, ICAR-e courses, CanelInfo, Compendiums, Consortium for e-Resources in Agriculture (CeRA), KRISHI, Knowledge Innovation Repository of Agriculture in the North East, National Innovations on Climate Resilient Agriculture (NICRA) and Rice Knowledge Management Portal. While these are comprehensive initiatives in terms of scientific and validated knowledge for different crops, the knowledge is not customised to suit a specific village/ land holding. Some of the platforms are not directed to be used by extension systems.

Even though one can find a number of digital initiatives in agriculture sector, such initiatives are not comparable with the digital disruption models experienced in other sectors. While these are all push based platforms (with few exceptions), the ability to provide customised and personalised information and services all along the value chain is questionable. For a crop based enterprise, farmers may require at least 14 different information and service assistance at multiple stages that would make a difference in informed decision making (please see fig.1).

**Fig 1: Radar chart representing Data driven services accessible through mobiles**



A study conducted in Indian rice industry (Meera, 2018) revealed avenues for digital disruption when data driven services are provided by extension functionaries. While there is a huge gap between perceived and realized utilities of various data driven services, disruption is remotely realized by the current mobile extension initiatives. Among the extension advisories, diagnostic and crop management advisories are the only available knowledge services through the public extension systems. Not to mention the personalised advisories on every single avenue for digital disruption in rice sector.

The flagship digital pilots in public sector such as farmers’ portal, mKisan portal, eParwana, AeFDS, RKMP, Krishi Portal etc., have made much dent in developing repositories of scale, but have not reached a level of digital disruption. The reasons are several - one of which is lack of comprehension and inability to provide personalised retail like experience to farmers. You name any publicly funded digital project in Indian agriculture; it has limitation to disrupt the incumbent processes. While the public sector EAS has an advantage in terms of scale, reach and data; they have limitations in terms of rigid workflows and inability to bring innovations abruptly. This necessitates analysing some alternate examples from digital start-ups and then trying to map the functionalities for deployment in public sector. Let us see what could be learnt from digital start-ups in agriculture from available models.

## 2.2. Start-up based digital disruptions models

In several sectors it is not the incumbent organizations but the new entrants and entrepreneurs who are creating new waves, meeting consumer needs in novel ways. The job charts of professionals are changing fast with strong digital skill sets. Their work styles and ways of approaching a problem are different. If we are sceptical about this for agriculture, it is probably because we have seen many digital projects before, without much 'wow' factor.

### 2.2.1. Digital Start-ups and Data Driven Extension Perspective

I prepared an analysis from Coffee book 2017 of a-IDEA (Association for Innovation Development of Entrepreneurship in Agriculture), a Technology Business Incubator(TBI) hosted by ICAR-National Academy of Agricultural Research Management (ICAR-NAARM) & Department of Science & Technology, Govt. of India (DST, GOI).

**Table 1: Digital Start-ups and Data Driven Extension Perspective**

Digital Start ups	Agriculture related information, access to agri inputs	Buying & selling of agri outputs	Predictive analytics Big data	Process automation	LBM IOT	Mobile / cloud Social media/ networking	Ai others
<b>Agrowbook</b>	Yes	Yes	No	No	No	Yes	No
<b>Scope for DEAS</b>	LD, ID	ID, ED	LD, ID, ED, AD	LD,ED	ED, AD	ID, ED	AD
<b>Agmart</b>	No	Yes	Yes	No	No	Yes	No
<b>Scope for DEAS</b>	ED	ED AD	ID, ED, AD	ED, AD	ED, AD	ID, ED	AD
<b>Bharatrohan</b>	No	No	Yes	No	Yes	Yes	No
<b>Scope for DEAS</b>	LD ED	-	LD, ID, ED, AD	LD ID ED	LD, ID, ED, AD	LD, ID, ED	LD, ID, ED, AD
<b>StampIT</b>	No	No	No	Yes	Yes	Yes	No
<b>Scope for DEAS</b>	LD, ID, ED,	LD, ED, AD	LD, ID, ED, AD	LD, ID, ED	LD, ID, ED, AD	LD, ED	ID, AD

\*DEAS Data driven extension advisories – data types (Please see the text box for details)  
(LD: Localized, ID: Imported, ED: Exported and AD: Ancillary data)

a-IDEA aims at fostering innovation and entrepreneurship in agriculture in India. Out of 12 start-ups being mentored by a-IDEA, four are digital start-ups that have potential to serve farmers in a better way.

The following analysis is not to suggest what should be done by these start-ups. Rather what could be learnt by the extension advisory systems (preferably under public sector). The analysis is carried out based on the two publications (Meera, 2018; Maru, 2018).

### Box 1: Tetragon of Extension Data

LD stands for Localised Data: Data generated and collated on the farm for use only on the farm. This is called 'localized' data. This includes soil data (soil form; soil depth; nutrient composition), seed and fertilizer use, date of sowing, production practices, water use, etc. that farmers have about their immediate location. This data can be generated and managed by the farmer or by an agent acting for the farmer. Since the data per se does not have any bearing on farmer's actions – the ability of EAS system to translate this into advisories (unlike in developed countries) becomes very important. For example soil health based fertilizer recommendation largely depends on Localised Data.

ID stands for Imported Data: Data generated and collated off the farm, for use on the farm. Examples are climatic data and market prices that have been interpreted and customized for on-farm use. This data is usually owned, managed and controlled by a third party and made available, directly or through intermediaries, to farmers. The disruption happens when there is ability of EAS to synthesise and infer from this data and translate this into effective advisories. For example weather data on 45-50 days after planting rice crop does not have any meaning until it has been inferred and gets translated into an advisory as what should be done by that farmer.

ED stands for Exported Data: Data generated and collated on the farm for use off the farm. This is usually processed, aggregated or combined with other data and information generated elsewhere and is used by various actors and stakeholders. Right from public EAS to market intermediaries, farm input and service providers including banks, insurance agencies, farm advisory services, ICAR, other farmers and farm networks can bring disruption with this data.

AD stands for Ancillary Data: Data generated and collated (on and) off the farm, mainly for use off the farm. A large proportion of 'agricultural' data such as government statistical and research data, FLD data, demand & supply analysis data, milling data, export and import (market watch) etc., across the value chain will bring next level of EAS.

The data interoperability across the databases and repositories is the name of the game (to get a feel about what is data interoperability please see an interview with Shaik N Meera at <http://aims.fao.org/community/interviews/collaboration-rice-data-interoperability-interview-shaik-n-meera>).

Adapted from Maru et al. 2018 and Meera, 2018

**Agrowbook** (<http://agrowbook.com/>) features a list of services that enable a rural farmer with agriculture related information, access to agri inputs through door delivery services for agriculture, these include *AgrowTube*, *AgriOnMobile*, Video extension service, soil testing service, farm mechanization /automation service, *Agrowbook Suite*, *Agrowlist*, and Agri Contests. The data dimensions are unclear on - how - personalised extension advisories will be achieved based on the four types of datasets.



The challenge lies in collection and micro utilization of localised data and imported data while dealing with the production management advisories. Critical to this challenge is coordination with the door delivery of inputs to the farmer's fields. Taking cue from *Agrowbook*, if public EAS wishes to bring digital disruption, they need to focus on both scale and comprehensive solutions. The limitation denial of small start-ups is understandable for not involving themselves in process automations, use of location based monitoring and use of Internet of Things. But their ability to use social networks is something worth emulating. For strengthening similar pilots/ roll outs, public EAS

need to focus on dynamics of various data types across the value chain components while using disruptive digital tools.

**AgMart** (<http://agmart.in/>) is a classified portal for buying & selling of Agri outputs, including Niche commodities like medicinal, tuber crops etc. It is an ICT platform enabling transactions of farm Produce and other value added agri products by registering the crop details of the farmers and facilitating buyer linkages. It is a classified ICT portal and mobile App connecting farmers with buyers like traders, processors, retail chains & wholesalers. *AgMart* is also involved in statistical analysis of gathered data to generate timely reports on future arrivals, crop mapping, agri input demand prediction etc.



This start-up essentially focuses on buying and selling along with predictive analytics. This combination can really bring disruption. The advantage - this kind of initiatives currently have (especially when we have operational e-National Agricultural Market) is their ability to bring the complementor stakeholders and aggregation ability of niche commodities. Surely they have scale problem.

Public EAS may like to focus on developing similar strategies with eNAM and start piloting using their exported data and ancillary data from a cluster of villages. Clubbing these efforts with social network analysis and location based monitoring would bring better market realization to farmers.

**BharatRohan** (<https://bharatrohan.in/>) is an exciting start-up that empowers farmers with precise information about the status of crop and land through applications of Unmanned Aerial Vehicles (UAVs). It is a platform that provides actionable information to apply fertilizers and chemicals only where they are actually needed and prevent crop losses even at the onset of pest and disease outbreaks. *BharatRohan* has a capability to survey more than 10,000 acres of area in a single day using fixed wing UAVs. The technology enables them to identify biological changes that occur in the plants once a pest starts to affect the crop which otherwise are only identifiable when their effects become visible to human eyes.



Providing highly personalised advisories and linking it to supply of inputs can never be as exciting as it is in the case of this start up. Predictive analytics, Big data, Process automation, LBM, Mobile / cloud, Social media / networking can easily be harnessed with exported , imported and ancillary data. If public EAS has constraints to experiment with the use of UAVs on their own, then public private partnership models can be explored. uberization (like *Uber Eats*, you can have *Uber Inputs*) on a real time basis will bring unimaginable benefits to the farmers. The time series data of two to three seasons from each landholding will bring predictive analytics into the forefront of EAS.

**StampIT** is a start-up (<http://www.stampit.biz/>) that enables business process automation for farms especially plantation crops. They focus on niche business process automation solutions for industries such as agriculture, seed, retail, and marketing services. *Crop Terrain* is a full module, online/offline, mobile and browser based application that provides a streamlined information flow between field level activities and management vision. *CropPro 360* is a trendy offline/online information system designed to run on Android based Mobile Tab devices to collect real-time farmer and plot details



from the field. Application facilitates agri companies to collect details of associated farmers, which include farmer socio-economic details, bank details, plot details; GPS based automatic area measurement, water,



power, irrigation, crop, inter-crop details, harvesting, transportation details and picture of the farmer and crop. *Falog* is a self-service comprehensive field agent/ sales force management solution designed for sales & marketing teams of industries such as retail, real estate, agriculture, seed, manufacturing, banking & financial services. The application's main functionality is to track sales people on the field based GPS co-ordinates with no clue to the sales person.

With support from various stakeholders and public EAS, this can be a good model to showcase the impact of data driven extension. The digitised localised data (that's incorporated into the same field after processing), imported data, exported data and ancillary data will flow/ flows freely when this start-up moves with the public EAS that has rich sources of much of this data. A strong scientific back up with different tools - Agriculture related information, access to inputs, market access, predictive analytics, big data,, social network analysis, LBM, virtual aggregation may help public EAS to a great extent.

### 2.3. Strategies to redesign practices simulate innovations and crowd source within existing public extension systems?

Some of the creative, innovative and entrepreneurial-inclined extension professionals who joined the public sector in the past, found that these qualities were not valued enough. Of late, many public sector organisations now form partnerships with digital and social enterprises blurring the lines between entrepreneurial spirit and public service (aIDEA of NAARM/ Agrinnovate of ICAR). But how effectively this convergence gets integrated into the public extension systems is something that is worth watching in future.

To realise the digital disruption in public EAS we need to create avenues for redesigning the extension processes (work on the frameworks not on the guidelines), stimulate new thinking (capturing innovations and start-ups within the system) and include crowd sourced extension innovations (allowing partnerships and local redesigning to certain extent).

For redesigning the extension processes, the EAS may draw lessons from these digital start-ups under four categories. They are EAS for Precision agriculture, EAS for Financial inclusion, EAS for Data-driven agriculture and EAS for Digital knowledge sharing / delivery. Prime Minister Narendra Modi has called for doubling of farmers' income by 2022, India's 75th year of Independence. Government of India initiated several moves some of which are Startup Agri India scheme, Digi Gaon (Digital Village) initiative, and Bharat Net project which can all work together towards making this a reality. Initiatives like agri-hackathons can also bring together aspiring entrepreneurs from diverse sectors.

**Table 2: Indicative strategies for redesigning EAS Processes – Current DAC Activities**

Activities	Redesign Process – Digital Strategies
<b>Powering extension systems with disruptive innovations: Medium term plans</b>	Building capacities and initiating schemes with cloud, mobile computing, big data analytics, IOT, Block chain technologies etc., Digital Start up Platform – Linking them to Digital India Initiatives (like T- Hub)
<b>Building capacities of extension systems</b>	Developing support systems for NeGP-A 2.0, Farmers’ Portal, mKisan Portal, eNAM, KCC, etc.,
<b>Role of Value Chains – Doubling Farmers Income</b>	Mobile Apps – Cross Learning for Financial inclusion, Value chains, market access, insurance, production management. Social experiments, Convergence Models
<b>Training of Trainers Field Extension Skill Development</b>	Brining best of the class global experiences to local extension units. Next generation MOOCs, leveraging strengths of 3D printing in extension
<b>Out of Box – Opportunities for Collaborations for EAS</b>	Uberization, Traceability Models for Government & Private Sector Digital support for Crop Colonies of Government of Telangana Amazonize with aggregation – Complementors Ecosystem for eNAM
<b>Knowledge Management strategies</b>	Facilitating development of Integrated Farmers’ Portal by synergizing different web, mobile sites for input supply, financial inclusion. Capacity building in Knowledge Management strategies in extension systems
<b>Policy advocacy</b>	Advocacy for bringing next generation extension that is responsive to emerging challenges

### 3. WINNING THE GAME OF DISRUPTION – EXTENSION WAY

Digital disruption can seem like a threat, but it can truly be a game changer for EAS. It throws open innumerable opportunities to rethink the way we handle extension. Across industries, the perception that disruption is imminent has many executives scrambling to launch digital side projects in the form of programs, products, and services that can stand on their own. Organizations like ICAR and SAUs tend to think about development of digital products in a linear way. In recent past, more than 100 mobile apps were developed in India that were mostly standalone apps. Moreover a careful analysis reveals that the offline CDs developed during the 1990s and the expert systems developed after the year 2000, transformed themselves into mobile apps adding nothing but ate in to the cloud space on google play store. I am yet to see a smart phone user who has installed more than 100 apps for regular use and we expect farmers to do so. What we need is a single interface like BHIM (Bharat Interface for Money) or a wallet that pulls money like PayTM.

A critical review of 32 digital start-ups (Table A in Annexure) has been carried out to understand the functional core areas of digital services. The core areas are broadly classified into Precision Agriculture, Financial Inclusion, Data Driven Agriculture and Knowledge Sharing & Delivery. A qualitative Disruptability Index has been worked out on a specific extension function based on Performance, Efficiency, Innovation, Defences (barriers to adapt). These start-ups are judged qualitatively for indicative results, not empirically. Finally, based on the desk study, current status of public EAS is given (1 for presence of similar initiative 0 for absence).

Out of 32 digital start-ups, 11 have focused on precision agriculture tools, 3 focused on Financial Inclusion, 23 on Data Driven Agriculture and 12 on Knowledge Sharing & Delivery of inputs (multiple core areas).

Seamless integration and exponential thinking is required for bringing digital disruption in EAS. Basic lack of connection between digital start-ups and structural and functional frameworks of EAS is evident across the country. When you are facing disruption, or launching a disruptive effort, recognize the leverage that comes from finding unidentified gaps in the current service provision. A disruptive move will tend to undermine regulations and governance structures that have been built over time, wherein people internalize the behaviour and turn it into a norm. The real challenge for disruption in EAS is not only about capacity building and digital skill development but of attitude too (doing the right thing is wrong).

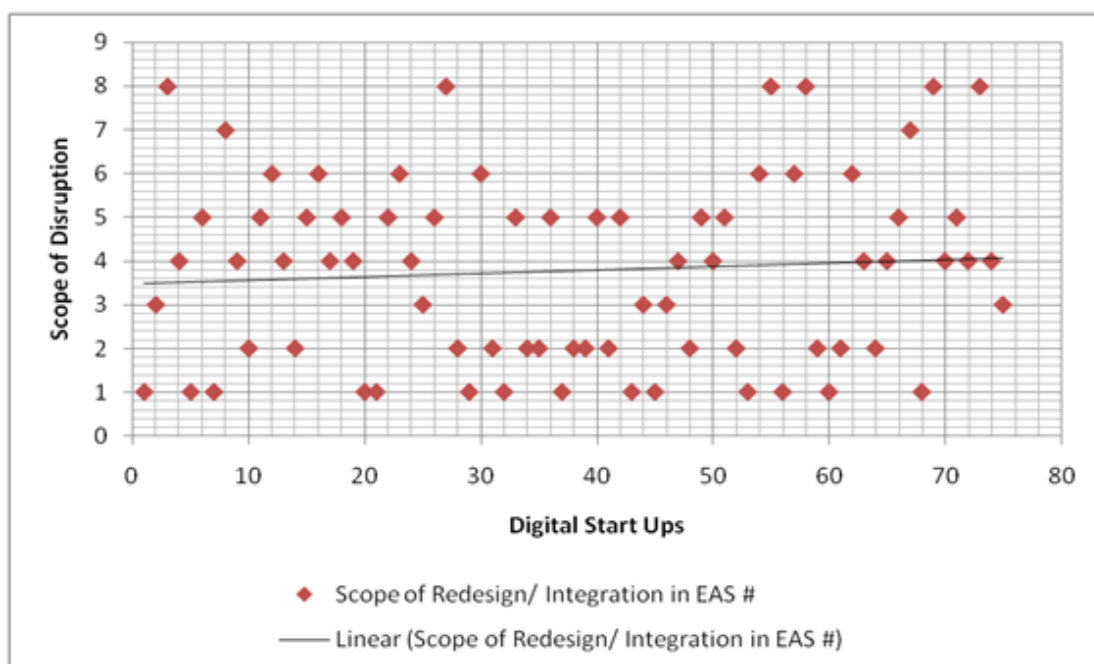
The basic principles to realize digital disruption in EAS remain;

- 1) Engaging farmers and providing them with retail like experience.
- 2) Empowering extension professionals to take up the challenges. Encouraging them to enjoy flexibility in terms of tasks and making them aware that they are judged by the outcomes/ impacts.
- 3) Optimising the extension systems with available digital start-ups, collaborations and partnerships. Recognizing the role of plurality in digital strategies and their complementarity is essential.
- 4) Transforming EAS in the digital era with structural and functional adjustments along with focus on collective action. The conventional job chart of extension professionals will undergo rapid changes.

We need to comply with both essential and sufficient conditions for disruption to happen. The disruptions in each of the EAS services will take place when a complementors ecosystem is evolved. For a better understanding I would like to give an example of eNAM and how disruption like Amazon could be possible with (or within) an ecosystem. Amazon= eNAM+ Complementors (aggregators + retailers+ courier+ payment gateway). While eNAM per se cannot be a disruptive force in EAS, a combination of complementary organizations will help bring n disruption in the way agricultural marketing has seen in recent past. These kind of expanding opportunities could be captured when organizations are flexible and role of other agencies are valued.

From the analysis carried out from the Table in Annexure 1, a qualitative assessment of various disruption dimensions in EAS have been worked out. The Fig 2 indicates disruption ideas from digital start-ups on x axis and the scope for redesign of EAS process on y-axis.

**Fig 2 : Scope of redesign/ Integration in EAS from Start ups**



**Legend PA=1, Mkt=2, KT=3, Acc=4, Agg=5, FI=6, SN=7, Aes=8**

If we need to incorporate digital start-up ideas in EAS in knowledge sharing, data driven agriculture, financial inclusion and precision agriculture, Fig 2 will give an idea as which start-up would give best suited strategy to readily embrace.

Big data and **predictive analytics (PA)** at EAS level (not at farmers level) can help farmers to access and apply crop choice, market recommendations, pest modelling, soil test value, and crop yield predictions, as well as nutrient management — all across varying field conditions. The advantage that public EAS have over private start-ups is availability of huge quantity of data. But absence of action would lead to experiences of likes between Skymet and Indian Meteorological Department.

Better **market price realization (Mkt)** is difficult to achieve by simply establishing eNAM kind of online platforms. We require real disruption in the way farmers market their produce. The complementors that were discussed in my earlier blog (<http://www.aesa-gfras.net/admin/kcfinder/upload/files/AESA%20Blog-68-March%202017.pdf>) will help realise the benefits. Many digital start-ups are approaching this issue with different models (direct marketing apps are increasingly seen now a days). The EAS can consider this as a low hanging fruit for bringing about digital disruption.

#### **Box 2: Stages of Digital Disruption in EAS**

If we need to incorporate digital start-up ideas in EAS in Knowledge sharing, data driven agriculture, financial inclusion and precision agriculture, we need to understand where from the next best idea is coming from! To take advantage of disruption, executives need to deploy a tailored strategy, underpinned by a combination of four actions (Omar Abbosh, 2018). I tried to adapt this to suit different industries/ organizations. Since I have dealt with the processes, all the four stages may not happen in sequence. Certain extension functionalities may fall into viability period, whereas others in either durability, vulnerability or volatility stages.

Researchers recently proposed two important qualifications to disruption theory that could be relevant to rural advisory services. First, higher-performing products and services result in higher profitability (so they have an economic motivation) and second, using “extendable core” that could be used to do more and more sophisticated things at a lower cost than incumbents (Wessel and Christensen, 2012).

Steps in driving Digital Disruption in EAS organizations:

1. In the Viability period, it is time to focus on expanding the core activities by offering new products / solutions using innovations, or increasing the reach exponentially without compromising on the quality of EAS.
2. In the Durability period, the emphasis needs to be on transforming the core extension activities, while experimenting massively with new disruptive processes taken from start-up ideas.
3. In the Vulnerability period, where public EAS organizations benefit from the continued presence of high barriers for entry by other agencies, it is time to scale up new opportunities. The public data that till now is in the hands of public EAS organizations make them custodians of certain actions and they apparently discourage other organizations to undertake similar activities./create hindrance for other organisations undertaking similar activities.
4. In the Volatility period, where there are pressing issues in the core extension processes to address, focus should be placed on retaining only the relevant parts of the core extension, while increasingly redirecting efforts to new directions of extension.

Prima facie the words reforms and redesign sound threatening to many extension professionals. But if we look around in every sphere, several departments are re-aligning the way they carry out their activities. State Departments of Agriculture (SDA) are requested to redesign few activities as pre-requisites for eNAM. In order to facilitate unification of market and online trading, it is necessary for

the states to undertake reforms such as a single license to be valid across the state, a single point levy of market fee, and provision for electronic auction as a model for price discovery. Only those States/UTs that have complied will be eligible for assistance under the scheme.

**Knowledge Transfer (KT)** through personalised advisory and multiple delivery channels have been tried out by digital start-ups. This is another strong area for public EAS. All we need is to sit together and understand what structural and functional changes are required.

It is important to link up advisories with the inputs and other services. eFresh pvt Ltd., is trying to develop a model in Telangana where door delivery of inputs/ services based on personalized needs are worked out. Public EAS can work out a series of collaborations and partnerships to realize this.

**Aggregation model** all along the value chain (**Agg**) brings together small farmers for accessing numerous services (mechanization, bulking, input buying, markets etc.). A careful analysis of several start-ups reveals ways and means achieving this using digital technology.

**Financial Inclusion (FI)** of small and marginal farmers includes credit and insurance. Quite a few models are available across Asia and Africa on this front. Digital financial services (DFS) are fundamentally about saving money, accessing credit and insurance, and performing transactions via digital channels like eNAM.

**Social Networks (SN)** and Media analysis in EAS has to move forward from mere perception studies. The ability to synthesise the results of network graph theories and social network behaviour would bring customised services to the door steps of farmers

**Aadhar enabled Services (AeS)- Unique Identification Numbers enabled Services** - is proven to be quite successful in public distribution systems and many other public sector endeavours. Aadhar Enabled Fertilizer Distribution System (AeFDS) is being executed in Krishna district since March, 2016 with an objective to effectively monitor the distribution of fertilizers across the value chain from manufacturers till farmers to ensure timely and correct distribution of fertilizers based on biometric authentication of farmers. The AeFDS is a change management initiative that has the potential to streamline subsidies to actual beneficiaries and also facilitate in releasing subsidies to fertilizer companies based on the actual sales made. There are umpteen avenues for public EAS in Indian agriculture awaiting disruption.

#### **4. NAVIGATING THROUGH DIGITAL DISRUPTION - CONCLUSION**

Powering Extension and Advisory Services (EAS) with disruptive technologies such as mobile/cloud computing, Internet of things, location-based social networks etc. is a new game changer. Use of digital technologies in rural advisories has been documented well in the past two decades. While most of the digital pilots reported success, the empirical evidences of such digital extension strategies on farmers' income and in adding value to the extension advisory systems have not been sufficiently deliberated upon.

As discussed in the blog, disruption does not happen only because of digital technologies, but through farmers centric approaches that offer retail like extension services (advisory & supply chain coordination) specifically designed to meet and exceed expectations of farmers. This lengthy blog aims at presenting a perspective in a single go, so that the future EAS will be empowered to give farmers what they want.

Because, the large organizations such as public sector extension systems (State Departments of Agriculture in India per se), find it difficult to embrace digital strategies that would quickly bring

disruptive innovations, there is a need to analyse existing start-up digital models from private sector. Based on this blog, the policy makers should try to understand the current avenues for digital disruption, identifying the processes and working out strategies for redesigning the EAS processes for improving disruptability.

In terms of digital disruption, public sector is uniquely positioned in terms of scale, reach and data, if only proper strategies are adopted. To realise digital disruption in public EAS we need to create avenues for redesigning the extension processes (work on the frameworks not on the guidelines), stimulate new thinking (capturing innovations and start-ups within the system) and include crowd sourced extension innovations (allowing partnerships and local redesigning to certain extent).

Digital disruption follows an understandable pattern. The starting point for the leaders in agriculture is to understand where in this pattern their organization is positioned and why that is the case. A public extension professional today may be happy serving farmers with the linear flow of knowledge and services (mostly it is because of their position in hierarchy, rather than the quality of services they provide), sooner or later new players will disrupt the linear flow of services and will try to provide retail like experiences.

## EPILOGUE

A case study of Kodak's response to digital technology (Lucas and Goh 2009) revealed that inability of Kodak's rigid, bureaucratic structure and middle managers prevented them responding fast to emerging technology which dramatically changed the process of capturing and sharing images. By the way, the first prototype of a digital camera was created in 1975 by Steve Sasson, an engineer working for Kodak. Unfortunately it could not capture the new opportunities (Lucas and Goh 2009). We have missed out many opportunities in agriculture / EAS as well in past. Remember hybrid rice development in China as a disruptive force! Way back in 1954, two scientists from Central Rice Research Institute (CRRI), Cuttack, India - S. Sampath and HK Mohanty were the first to draw attention to the possibility of developing hybrids in self-pollinated crops like rice. But it was China that surged ahead, we followed suit.

Organizations often see the disruptive forces affecting their industry. They frequently divert sufficient resources to showcase their presence. Their failure is usually an inability to truly embrace the new business models / processes that the disruptive change opens up. Kodak created a digital camera, invested in the technology, and even understood that photos would be shared online. Where they failed was in realizing that online photo sharing was the new business, not just a way to expand the printing business.

The response to digital revolution is not many pilot projects and large scale investments in digital extension projects. Rather, a systematic approach to bring new learnings and incorporate them to next generation EAS. As per Registrar General of India & Census report 2011 the total farmers or cultivators population of India is 118.7 million (2011) & 144.3 million agricultural workers/labourers which consists 31.55 of total rural population. More than 20 million farmers must have taken birth after 1990s. They are all digital natives and this number is increasing exponentially. We need to remember, among many others, EAS will have to cater to these farmers.

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## Annexure

**Table A: Disruptability Index from Digital Start ups – Implications to Redesigning of EAS**

No.	Digital Start Up	Description	Precision Agriculture	Financial Inclusion	Data Driven Agriculture	Knowledge Sharing & Delivery	Disruptability Index*	Current Status of Public EAS	Scope of Redesign/ Integration in EAS #
1.	Aarav Unmanned Systems	Agricultural decisions are made precisely when every detail of the farm and farmer is captured. The startup's drones provide high-value engineering solutions to enterprises across GIS (geographic information system) surveying/mapping, industrial inspection and precision agriculture. There is a potential to use 3D representations of the terrain surface, it for informed decision making to optimise irrigation, fertilisation, pesticide distribution and early failure warnings. There is a huge requirement for public sector R&D support.	1	0	1	1	3	0	PA KT AeS
2.	Gold Farm	Operating in Karnataka and Tamil Nadu, this start up helps to give Uber like services for farm equipment such as solar-powered pumps. Beneficiaries have included over 25,000 farmers on ground, who tap the services of 250 booking agents and over 500 tractor owners connected via a mobile app. The equipment is also tracked with IoT devices, resulting in rich data sets for analysis and forecasting. The Public R&D and EAS can leverage the strength of such initiative by knowledge based services and data processing.	0	0	1	1	3	0	Acc PA Agg
3.	Farms2Fork	Water management has never been the focus of EAS in the past. But now there is a solution. It offers water monitoring solutions for better productivity by using less water. The solution includes IoT wireless soil sensors, AI support, and real-time analytics. While earlier agri-tech solutions were based on batch processing of data, Farms2Fork operates on real-time data. For outreach and services, farmers are contacted via farmer associations and networks.	1	0	1	1	2	1	PA SN
4.	Agribolo	Information dissemination, quality input procurement, market linkages, irrigation facilities and farming equipment through a franchise network. Operational in Rajasthan, the model uses the	0	0	0	1	4	1	Acc Mkt Agg

		aggregator model to connect farmers to experts, development institutions, financial services, and training institutes.							FI
5.	eFresh Pvt Ltd	A farming services platform in Telangana and Andhra Pradesh - spanning activities such as information dissemination, quality input procurement, market linkages, irrigation facilities and farming equipment. It also uses the aggregator model to connect farmers to experts, development institutions, financial services, and training institutes.	0	0	0	1	4	1	Acc Mkt Agg FI
6.	Agrostar	To transform Agri-business "Direct to farmer" m-commerce platform is developed. Here farmers can acquire agri-inputs at their doorstep by just giving a missed call on 1800 number and the executive will return the call and take care of the rest. The agri-inputs include seed, crop nutrition, crop protection and hardware. It focuses primarily to provide Quality, Convenience, Availability, Price, Ease of Use and Service to the farmers.	0	1	0	0	2	1	Acc Agg
7.	TQ Pump starters Kisan Raja	GSM-based Mobile Motor Controller which is controlled by the farmers even from their homes through mobile phones or landlines. Earlier farmers used to get up at odd hours to switch off the motors. This agri tech social enterprise resolved this problem. Its key features are Convenience, Protection and Comprehension.	1	0	0	1	2	0	Acc PA
8.	Skymet	To forecast accurate weather condition to prepare the farmers to act accordingly and avoid crop damages. Farmers are provided with the options on Crop Insurance, Weather Forecast, Media and Risk Management. It is likely to enhance the yield as it prepares the farmers for drought and heavy rainfall, and consecutively prepares farmers to take preventive measures for the same.	1	0	1	1	3	0	PA Agg FI
9.	EM3 Agri Services	A sequential advisory system along with input services is the key focus of this initiative. Farm mechanisation services company EM3 Agri provides pay-per-use farm services for every step of the cultivation process, including land development, land preparation, seeding, sowing, planting, crop care, harvesting and post-harvest field management. Access is provided through mobile app and a local fulfilment centre or "Samadhan Kendra."	0	0	1	1	4	0	Acc KT Agg AeS
10.	Reuters Market Light	It helps in linking farmers, traders and agribusiness companies. It has benefited over 2 million people from 13 Indian states. It offers	0	0	1	0	3	0	Mkt PA

	(RML)	Agri Decision Support Solution to farmers through cutting-edge technology. RML makes sure that farmers are selling their produce at an appropriate rate.							FI
11.	AgroWave	A perfect blend of research, analytics, and technology that optimises agriculture supply chain. Demand and supply analytics connect farmers in Panipat, Sonipat, Harpur, and Rajasthan to caterers, retail shops, restaurants, and canteens. This is a step ahead of not only serving farmers , but also to the consumers.	0	0	1	1	3	0	Mkt PA Agg
12.	Earthy Tales	Appears as if it is a back end production management activity, this initiative helps farmers indirectly by providing them with the good agricultural practices and other services. Founded in 2016, works with farmers across 11 states to provide chemical-free fruits, vegetables, groceries, and dairy products. These include snacks, jams, preserves, and pickles, provided direct to consumers.	0	0	1	0	1	0	Mkt
13.	Truce	A B2B web and mobile platform that directly connects farmers and suppliers to wholesalers and retailers. The app is available in Hindi, English, Marathi and Gujarati, and enables tracking quotes and orders.	0	0	1	0	2	1	Mkt Agg
14.	Farm Again	Converted 2,500 acres of land into organic farms, along with tech tools to trace the product's origin, when sold in outlets such as Reliance Retail, Big Bazaar and More. IoT devices are used to monitor and record moisture content and soil conditions, with pipes for water and fertiliser inputs.	1	0	0	0	2	0	PA Mkt
15.	ShanMukha Innovations	Quality standards do affect the farmers' income. Incubated at IISc, this is a portable solution for detecting contaminants in milk. The palm-sized box uses microfluidic nanotechnology to identify contaminants such as melamine. The device reportedly costs less than Rs 2,500, and each test costs less than Rs 2. A series of such initiatives with EAS can transform the traceability standards in Indian agriculture.	0	0	1	0	2	1	Mkt Agg
16.	Crofarm	Direct marketing and contract farming was not the focus of public EAS due to its inherent organizational problems. Digital tools give them new opportunities. For example an agri-supply chain startup founded in 2016, buys fresh produce directly from farmers and supplies them to online and offline retailers. It is estimated that nearly 8-10 tonnes of fruits and vegetables is supplied and connects	0	0	1	0	2	0	Mkt Agg

		100 retailers to more than 5,000 farmers.							
17.	Aibono	While public EAS is questioned about the use of big data and AI applications in Indian agriculture, this start up wanted to prove it empirically. Envisages improving farm yields by using AI on a cluster of parameters like weather and soil condition. Testing and measurement services indicate parameters such as crop stress, along with recommendations on the right fertiliser mix to be used based on the soil condition.	1	0	0	1	2	1	PA KT
18.	Fasal	Microclimate forecasts are tailored to each farm location and are performed at a point scale, not at a kilometer-wide spatial scale. It collects more data; the AI-based microclimate forecasting algorithm incorporates real in-field information and relates it to publicly available weather forecasts, so that farmers can benefit from real-time, actionable information relevant to day-to-day operations at the farm. The KVK system can do wonders with the collaborations with this kind of initiative.	1	0	0	0	2	1	PA KT
19.	ONganic Foods	A combination of Traceability, organic farming and direct marketing tools will be one of the killer applications for improving the profitability of small farmers. Based on contract farming, this start ups identifies higher-priced grains and spices and gives quality inputs to farmers to increase their yield. It connects farmers to various government schemes as well as e-commerce platforms such as Amazon and Spencer's Retail.	0	0	1	0	3	0	Acc Mkt Agg
20.	Oxen Farm Solutions	Several entrepreneurs starting working on 'Farming as a Service' (FaaS) model. The platform connects farmers, farm equipment manufacturers, and government schemes. Access to such machinery can boost farm productivity in an affordable manner. The company operates in Punjab, Madhya Pradesh, Uttar Pradesh, Chhattisgarh, and Odisha, and connects to corporates such as PepsiCo and Yes Bank.	0	0	1	1	2	0	Acc Agg
21.	Farmizen	Real time dash boards will have far reaching positive consequences in EAS in future. Among the numerous opportunities thrown open by real time dash boards, Farmzen tried a small service using a mobile-based platform that lets users grow vegetables and fruits on mini-farms, and monitor the process of growing food on a real-time basis. Located in the outskirts of Bengaluru, users get pictures and	0	0	1	0	1	0	Mkt

		live videos of their farm plots. The startup also provides recommendations based on real-time inputs from the field as well as pre-defined schedules for over 50 different types of crops.							
22.	Harvesting	Financial inclusion based on the harvest indicators will offer win-win situation to farmers and financial organizations. Offers smart farming solutions based on analytics and AI. It also uses farmer profiles to build creditworthiness profiles for financial organisations.	0	1	1	0	3	0	PA FI AeS
23.	SatSure	In spite of being a private venture, SatSure uses IoT and Big Data effectively to provide financial security to farmers, via its 15-year database of satellite images. It makes recommendations clustering techniques for farmers to get an estimate of the total agriculture production, and provides this data to agri-insurance companies as well. KVK system and ICAR's extension wing can showcase the worthy of this approach.	1	1	0	0	3	0	PA FI AeS
24.	Triton Foodworks	This start up should inspire public EAS as how to think out of box not limiting themselves to the conventional definitions of extension as a service. Based in Delhi, Triton is a hydroponics startup growing fruits and vegetables. It has reportedly set up more than 2 lakh sq ft of hydroponic farms across three locations in India, and produces more than 700 tons of fruits and vegetables each year.	1	0	1	0	1	0	Mkt
25.	vDrone	The Ministry of Civil Aviation has approved regulations on the commercial use of drones or the Remotely Piloted Aircraft System (RPAS) wef December 2018. Uses drones and thermal imaging to increase yield. It analyses areas of the farm that need attention, and helps the farmer cater to these needs. Parameters include soil, cropping pattern, and use of fertilisers.	1	0	1	0	1	0	PA
26.	Ninjacart,	Demand side of crop production can be the focus in near future/ Ninjacart enables retailers and merchants to source fruits and vegetables directly from farmers without resorting to middlemen. It connects 2,500 farmers.	0	0	1	0	2	0	Mkt FI
27.	BigHaat	Amazonization is tried by many start ups and this one adds to their vision of serving farmers. Online agro e-store for farmers that lets them buy seeds, crop protection nutrients and solutions, and agro instruments. Last-mile connectivity is enabled via logistics partners like India Post and Ship Rocket.	0	0	1	1	2	0	Acc Mkt

28.	Ravgo	Uber in the success story of digital sharing economy. Uberization is tried by this initiative. It is solving the farm mechanisation problem among India farmers who cannot afford to buy the farm machinery. The target market is currently small farmers based in Punjab.	0	0	1	0	3	1	Acc Agg SN
29.	FlyBird Innovations	Sensors use in start ups is found only in terms of water management and fertilizer management. This is yet another start up that uses sensors in the soil to detect moisture content and control irrigation in farms across South India. The information is used to optimise irrigation practices, improve crop yield, and save water, time, and labour.	1	0	0	0	2	1	PA AeS
30.	farMart	Uberization with agri-machinery is tried by this. Large farmers put underutilised agri-machinery up for rent on the farMart platform, and are connected to farmers who need such machinery; they can then book it via app or call centre. The database includes 300 villages and 1,500 farmers.	0	0	1	0	2	0	Acc Agg
31.	AgroStar	Pune-based m-commerce startup, sells agricultural inputs directly to farmers. The platform can be accessed online or giving the company's 1800 number a missed call. Products are sourced from national and multinational brands, and include seeds and nutrients.	0	0	1	0	2	1	Acc AeS
32.	CropIn	Leverages GIS and data science to deliver a range of services apps to farmers and other players in the agri chain. It feeds real-time data and advice on practices related to a range of crops.	0	0	1	0	2	1	Acc KT

### Index for Table A

\* Disruptors -1 Performance -1 Efficiency – 1 Innovation -1 Defences - 0 (judged qualitatively for indicative results)

# Acc- Access to inputs, supply chain

Mkt – Access to markets

PA – Predictive analytics, Process automation, Personalisation, Forewarning advisories

Agg – Aggregated services - Uberisation

SN – Social Networks – Local sharing

FI - Financial inclusion credit insurance

AeS – Aadhar enabled Services like AeFDS