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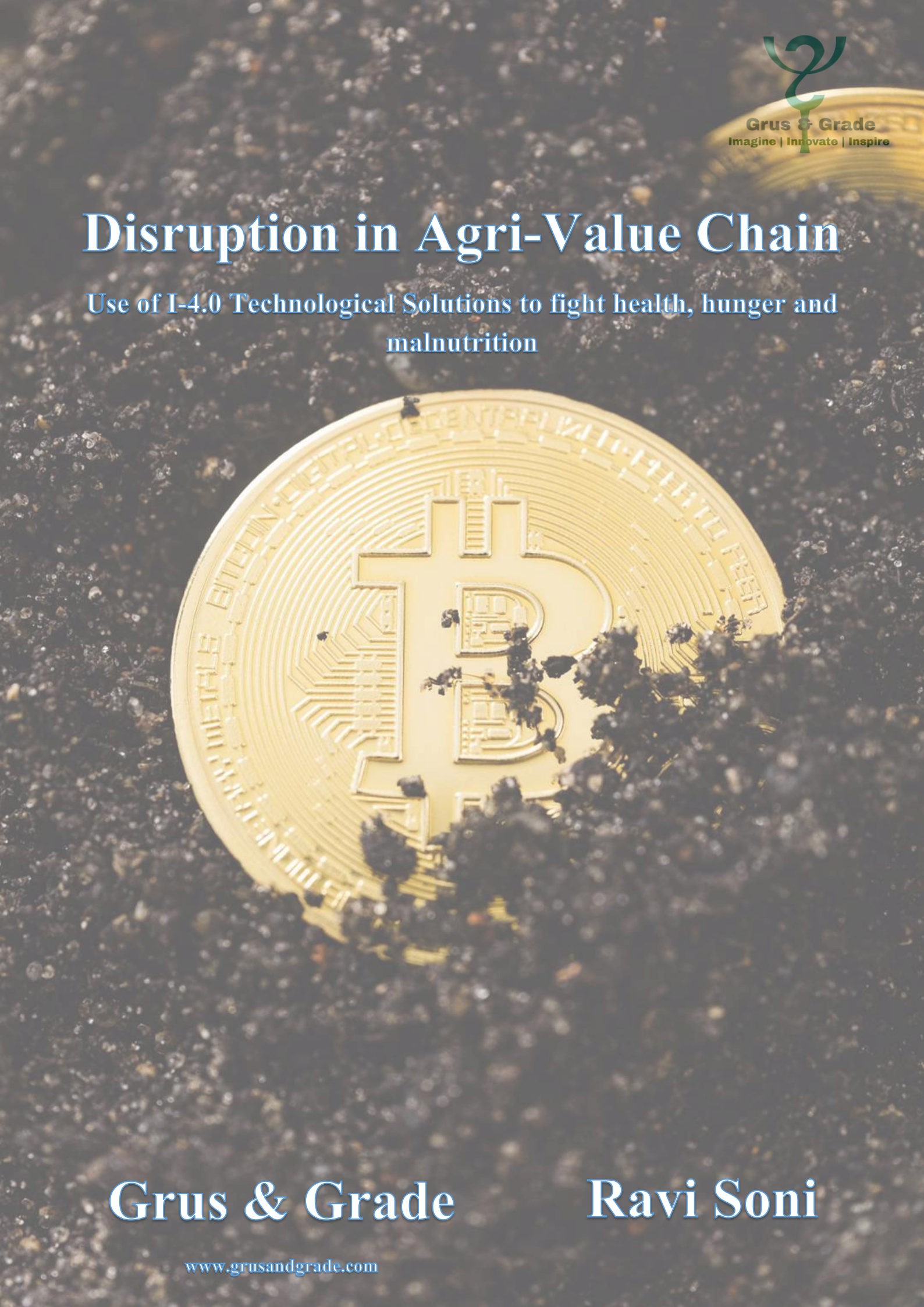
Disruption in Agri-Value Chain

Use of I-4.0 Technological Solutions to fight health, hunger and malnutrition



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Acknowledgements

This report would not have been possible without active support and help of entire Grus & Grade research team. I sincerely thank Sapna Shimikeri, Sunil Bangi, Chhavi Ankita and Shalu Saharan who helped me complete the research project. I also thank Praveen Sinha and Anadh Trivedi who are actively involved in developing and implementing I-4 technological solutions for farmers as a dedicated team for Grus & Grade. It was active help of Dr. Sunil Patil, mentor of Grus & Grade who introduced us to some of the most progressive farmers in North Karnataka. Dr. Patil has been instrumental in conceptualizing the prototypes for integration of technology in agricultural domain.

Special thanks to Prof. Vijaya Bhaskar Marisetty, University of Hyderabad, for conceptualizing, creating and mentoring the application of digital solutions, especially blockchain technology for solving many of the farm issues and challenges and linking the solution by integrating with the FPOs as a key enabler of technology led solutions for the farmers.

I thank Niva Jain, IPS, Pune for helping us connect with the farmers and getting their active support for on-farm data collection from Maharashtra.

Special mention of Dr. Sumit Mudh, PCS, SDM, Baba Bakala Sahib, Amritsar, Punjab who helped us gather data from various farmers, producers, distributors and mandi managers in Punjab.

At the end I would like to thank all of them whose name could not be mentioned but who have directly or indirectly helped us compile this research report.

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Foreword

The agriculture sector across the world has remained isolated for ages. Farmers across the globe have worked on remote properties in hinterlands, thus remaining in the age of digital darkness with very limited access to ideas, innovation and information.

The traditional agricultural value chain has suffered multiple challenges including information asymmetricity, high transaction costs, lack of knowledge, uncertainities of natural calamities, weather variance, quality of inputs, soil conditions, pests, etc. The upstream in the agri value chain is innundated with multipele intermediateries who eat bulk of the proft, hence keeping the farmers perpetually in poverty trap.

Apart from this these challenges, there are multiple variance in upstream supply chain, resulting in price assymetricity and uncertainity at the bottom of the pyramid. The cost of credit is quiet high, and most of the governments subsidise the farmers to make them globally competant. This attracts global trade barriers/restrictions and geopolitical tensions for respective govenrments.

Lack of information and knowledge also leads to unsustainable farm practices.

Majority of the farmers consume what they produce, thus an access to improved varieties of biofortified seeds can help us reduce hidden hunger due to deficiency in nutrition in daily diet.

Application of industry 4.0 solutions in agri-value chain in particular and across the agricultural indusry in general, can not only enable the farmers with greater power over uncertainities but also ensure the consumers with better qulaity of food that they consume.

Grus & Grade explains the benefit of using I-4.0 in agriculture and how these technologies will help us allevate poverty, ensure better health and nutrition across the globe.

Ravi Soni

CEO, Grus & Grade

Introduction

Introduction

Disruptive technology will transform agriculture from sustenance to security and happiness.

Agriculture has witnessed umpteen number of challenges since ages. The sector has seen disruptive innovations and discoveries to overcome some of the challenges. While the 20th century saw innovations in four major areas including genetics (seeds), mechanization, fertilizers and pesticides, which helped us reduce the global food crisis, the 21st century led by so called 'Fourth Industrial Revolution (I-4.0)' will foresee disruptions led by application of Internet of Things (IoT), Information Communication Technology (ICT), Artificial Intelligence /Machine Learning, Augmented Reality, Blockchain Technology etc.

The global demand and need have started shifting from food security towards nutrition security, thus fighting the global hidden hunger caused by malnutrition. COVID 19 has created a permanent impact on consumer demand for healthy and nutritious food while the entire Agri supply chain is undergoing a complete transformation. Quality assurance and traceability of entire journey of the product and services till the end use has become the need of the hour.

In India, the level of mobile penetration and access of internet services has increased manifold. As per TRAI report dated 19th November 2019[1], the total number of active wireless subscribers in India as of September 2019 was 960.88 million. The total tele density in urban areas was 160.63% while in rural India it is 57.59%. Thus, more than half of the rural India has access to real time information at a much affordable price.

> These disruptive technologies can help increase farm income by more than two times.

The changing demographics and impact of social media has been instrumental in bringing in the much-needed information world at the doorstep of every individual. These transformations bring in immense opportunities to bring in the innovation in traditional supply chain, procurement management solutions in the agriculture sector. The solution needs to be designed based on system archetype as against the conventional model of identification of local problem and solution matrix.

Grus & Grade research and innovation team has examined and explored the problem statement by adopting bottom of the pyramid approach. We have collaborated not only with the farmers but the partners in the downstream as well as upstream of the agricultural value chain. The approach has been based to diagnose the root problem through a system's thinking approach and find the right technological and disruptive solutions that would cater to the need of each of the players in the entire Agri-value chain.

The present paper tries to identify some of the major challenges and constraints in Agri-supply chain, procurement management solutions and post-harvest activities and recommend breakthrough solutions by use of disruptive technological solutions.

[1] PR_No.118of2019.pdf (trai.gov.in)

What is legacy model of Agri-value chain?

In the conventional or legacy model of Agri value chain, the intermediaries play a pivotal role. The system is designed with a liner communication structure which creates information asymmetricity and hence opportunities for arbitrage. Thus, the intermediaries benefit the most in the legacy model.

Design of the legacy model

The legacy model of agri-value chain can be broadly classified into five different categories viz. Input, Production, Quality Control/Storage, Processing, Distribution & Marketing. The entire value chain along with list of activities in each of these five domains has been explained in Figure-1

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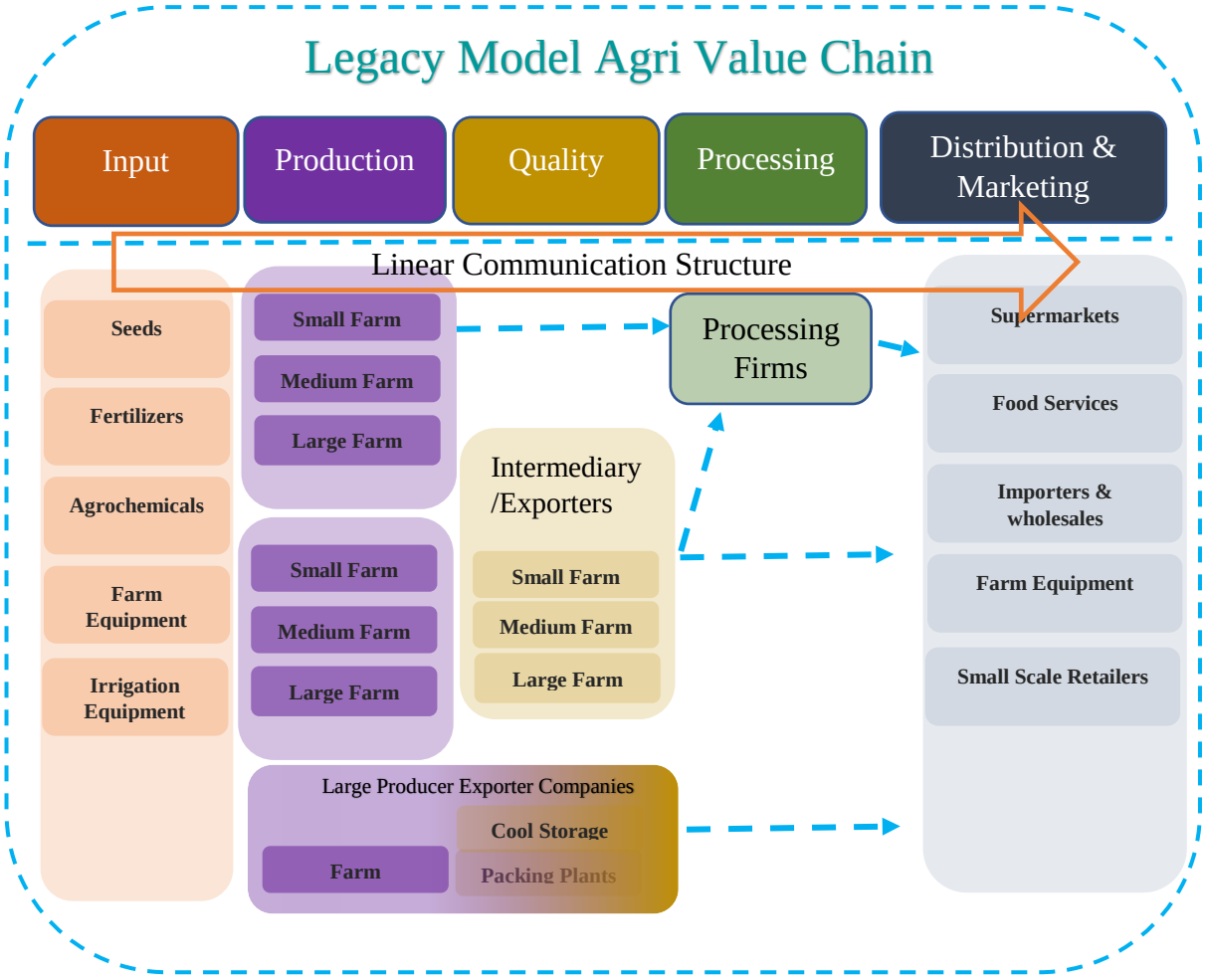

Figure 1: Legacy Model Agri-Value Chain

The entire value chain in the legacy model is fraught with multiple challenges. The input side constraint includes unavailability of quality and quantity of seeds across all the geographical location, differential pricing and variance, germinating capacity, seed adulteration, etc.

Challenges in the Legacy Model of Agri Value Chain

Excessive use of chemical fertilizers has affected soil fertility, microbial growth as well as cost burden for the farmers. Precision irrigation technologies has not been adopted by the entire farming community. This is mainly because lack of knowledge, resource as well as availability of input materials. The irrigation is either rainfed or dependent on ground water. The uncertainties of rainfall cause depletion surface water due to legacy model of irrigation system.

The inefficiencies in the input side (pre-harvest activities) are some of the main reasons for high cost of yield per farmer. As per GOI report dated Feb, 2007[2] the average cost of paddy cultivation per hectare of land in the State of Andhra Pradesh increased from Rs.21022 in year 1996-97 to Rs.28571 in year 2003-04. Thus, there was an increase of more than 35.96% increase in cost of cultivation for a single crop.

With the growth in population, the average land holding size has been constantly on decline in India since independence with 1.1 hectare being the present average land holding size. Thus, the bargaining power of the farmers has reduced substantially which is one of the major reasons of the poverty trap of the farmers.

The changing demographics has completely changed consumer need and demand. With an increasing income level, the demand for nutritious as well as quality food product has increased dramatically. Global pandemic caused by COVID-19 has further increased the consumer consciousness across the globe for healthier farm products. Need for biofortified food in the Agri-value chain has increased to fight global hidden hunger. Most of the exporters in the global supply chain need a traceability solution to reduce any risk caused by food adulterations.

Processors, distributors, and various other marketing channel in the upstream of the value chain require symmetricity of information, stability in pricing as well as a tool that can forecast demand to match supply.

These are some of the major challenges of the entire Agri-value chain. The disruptive technological solutions led by predictive analytics, artificial intelligence, and blockchain can ideally solve most of these challenges in a short span of time. The present century will witness a stream of disruptive technological solutions in the agricultural domain. Grus & Grade has been actively involved in collecting data from the filed as well as other sources to implement these technological solutions in the farming domain. Our mission is to reduce global hidden poverty by adopting sustainable farming practices led by technological solutions.

"Innovation is not a process but a state of mind. Therefore, it can't be learned but felt." – Ivonne Kinser

[2] 2737ag(P).p65 (dacnet.nic.in)

How disruptive technologies will help overcome the challenges?

"Technology, through automation and artificial intelligence, is definitely one of the most disruptive sources." **- Alain Dehaze**

Agronomics and Digital Economics

The agricultural economy is in the age of transformation from physical to 'digiphycal' (Digital + Physical). Some of the growth drivers for the transformation include the penetration of mobile and internet in the hinterland. While these are the key enablers, the application of blockchain and artificial intelligence in the agricultural value chain has immense opportunities and potential to create a sustainable business practices in agriculture.

These breakthrough technologies have matured with immense capabilities to scale up. The new business model applies multiple use of hyperconnectivity, supercomputing, cloud computing and the internet. Grus & Grade research team conducted a detailed survey of various value chain players in the agriculture sector. Our research shows that there is a latent need as well as acceptability of digital technology by the farmers. The positive bias of the farming community to accept and adopt digital solution supplemented by enabling environment created by various government initiatives such as amendment in APMC laws, Essential Commodities Act, etc has further necessitated the need for disruptive innovations in agriculture.

Another key enabler for successful adoption of technology is the thrust through policy initiatives to make the Farmers Producers Organizations (FPO) a success. The success and growth of FPOs in India shifts the bargaining power from users to producers. A professionally run FPO gives the farmers not only the access to market, better price to their produce but also transforms the sector from sustenance model to commercial model with abilities to invest in cutting age technological tools.

Digital innovation provides a circular two-way communication pattern for each layer in the Agri value chain, thus reduce the role of the intermediators. The shift in communication from a liner model to a multivariate model is the talisman for success of agronomics.

The digital technology along with changes in policy initiatives such as formation of FPOs and burgeoning digital marketplaces (e-NAM, Dehaat, Ninjakar, Merakisan, etc) have empowered the farmers with real time access to information, better pricing, storage as well as access to market.

Some the areas where disruptive technology has wide application has been explained in Figure 2 below:

Figure 2: Some of the matured technology leading disruption in Agricultural value chain

Grus & Grade is working in these technological domains to create an entire ecosystem for end-to-end solutions to the farmers. Our model is to collaborate with the farmers through FPOs and provide cutting edge digital solutions that would be effective in the following areas:

1. Create a sustainable and scalable model of agricultural practices in line with the sustainable development goals to fight global health hunger and nutrition.
2. Create the objectives of circular economy by reducing the utilization of fresh water through precision irrigation, lower power consumption through real time information, robotics and BOT, fuel efficiency through cloud technology and GPS tracking etc.
3. Enhance soil health though robotics, AI tools. Collaborate with seed companies for selective breeding and naturally improved crop varieties with higher nutritional content (biofortification technology)
4. Ensuring the quality to end consumers by using Hyperledger technologies.
5. Reduce cost of credit by applying smart contracts tools and enhancing the data integrity and security by information symmetricity in all nodes on real time basis. This also helps the lending institution to

track their cash flow, monitor the assets financed by them and improve the recovery rate (reduce sub-standard assets on the books).

6. Application of GPS technology helps reduce the lead time, transportation challenges, route mapping and tracking as well as optimization. The overall efficiency reduces transportation & logistics cost, warehousing cost as well as reduces the wastage of the agricultural crop (both perishable and non-perishable).

Post-Disruption prototype of Agri-Value Chain

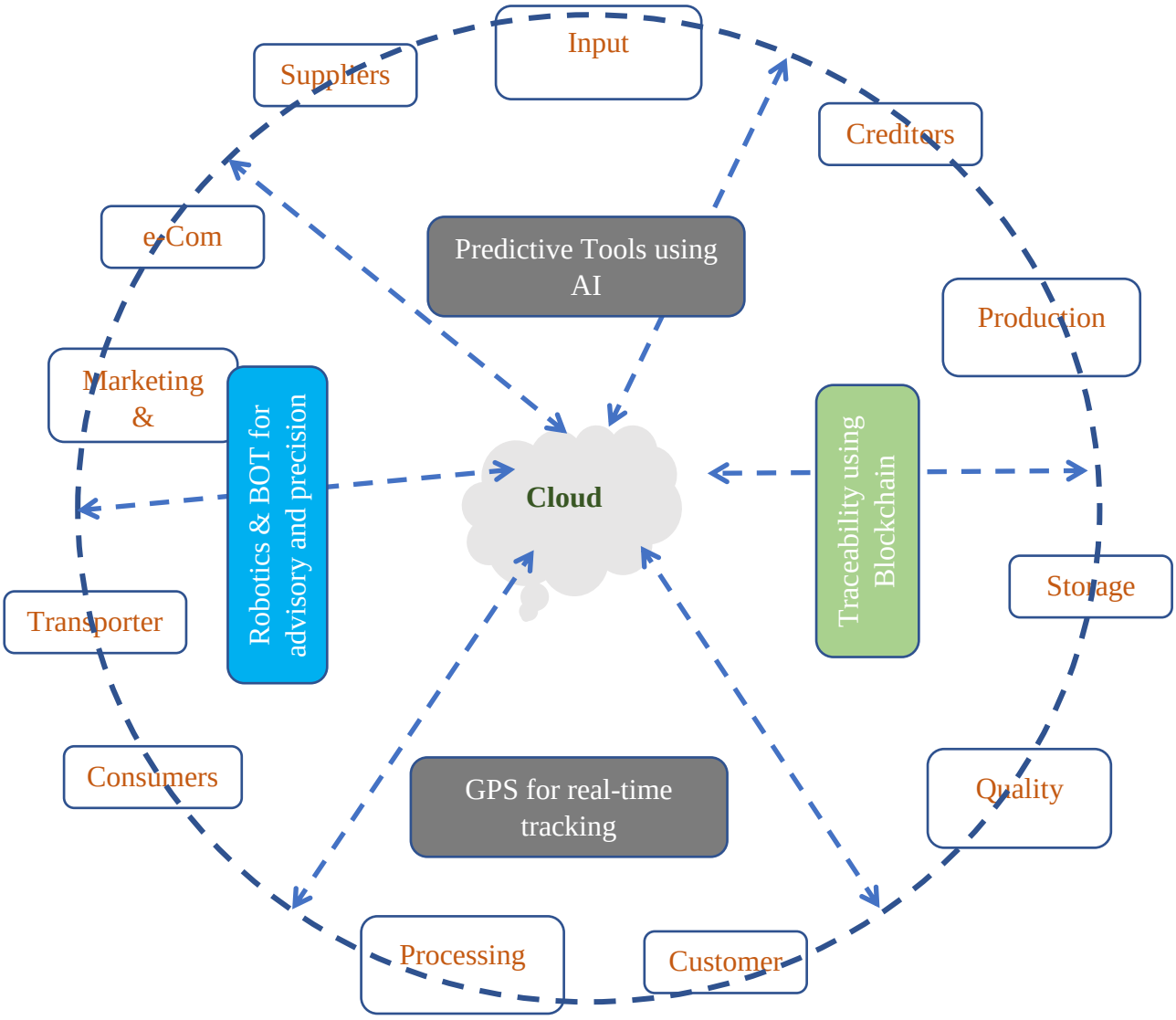

Figure 3: Interconnected Disruptive Value Chain

Risk and mitigation strategy to adopt industry 4.0 solutions in agriculture

"Businesspeople need to understand the psychology of risk more than the mathematics of risk" – Paul Gibbons

The adoption and implementation of cutting-edge technological solutions in the agri-value chain is fraught with multi-layer challenges. A brief analysis of the major challenges has been discussed hereunder:

Political: Though the adoption of technology will empower the farmers, the immediate political agitations can sabotage the actual intent of the disruption.

Mitigation: Developing a pilot project to demonstrate the benefit to the key beneficiary, especially the farmers and communicating the same to all the stakeholders to develop a consensus.

Cultural: Farmers have been used to traditional model of production and distribution. Adapting technology for end to end services involves a cultural shift, which will witness a lot of resistance from various stakeholders.

Mitigation: Engage at least one young member of the farmer's family as part of the social change. Demonstration of the end use and application usage with UI/UX farmer friendly can create interest in the farming community. We consulted farmers in six states in India and majority of them were ready to adopt technology that would increase their income level. A proper communication strategy is a must.

Financial: Technology adoption is costly initially, before it brings in economies of scale, scope, and knowledge. Farmers and other stakeholders lack capital for initial investment.

Mitigation: Adopt technology through FPO route who have better managerial capability, capital raising capability as well as bargaining power and access to market.

Technological: Some of these technological are in early stage of their maturity. Thus, the risk of failure is high. Moreover, the end users, i.e. the farmers should be able to use and adopt these solutions.

Mitigation: Start with a base model with definite learning curve and model for reenforcing loop and feedback cycle. The UI/UX should be as simple as possible with integration of image processing tools and NLPs. This is to ensure that the farmers can adopt and accept easy to use tech enabled solutions.

Conclusion

These are only the broad classification of some the risks involved for adoption of disruptive technology in agricultural value chain. However, a collective approach by Government agencies, civil society, corporate world as well as farmers and other stakeholders can have a definite solution for complete transformation of the agri-value chain.

Way Forward

"The next industrial revolution is the revolution by the commons, to the commons and for the commons." – Grus & Grade

To make productivity, viability, and transparency in Agri-Value chain, an agreeable acceptance of the technological solutions by all the stakeholders is a must. The current agricultural value-chain includes liner relationship between product-flow, process-flow, information-flow, and dataflow. This needs to be restructured so that the liner flow of information is transformed to a multi-dimensional information flow with continuous and reliable data points.

Cutting edge innovation and advancement in data science, image processing capabilities, neural mapping, security, and integrity of data etc. can bring in complete robotic process automation in each node of the agri value chain. The so called 'Fourth Industrial Revolution' (Industry 4.0) is seeing 'breakthrough' innovations in the field of Artificial Intelligence, Blockchain, Internet-of-things, Augmented Realty, and so forth.

The integration of digital solutions will provide the last-mile availability, convenient connectivity and accessibility of data and market opportunities, quality assurances, reliability, and transparency. As per a report of the World Bank[3], 70% of the poorest 20% in developing countries have access to mobile phone. Apart from this more than 40% of the global population has internet access and there are major initiatives to connect rural areas in developing countries.

Thus, there is enough opportunity and enabling environment created by value drivers for integration of I-4.0 in agricultural value chain. A consolidated effort by government agencies, political organizations, civil societies, corporate world as well as various other stakeholders can help us leverage the technology to fight the global hunger, malnutrition and health and create a more sustainable world.

[3] World Bank report (2016)