GAP GYAN
A GLOBAL JOURNAL OF SOCIAL SCIENCES
( ISSN – 2581-5830 )
Impact Factor – SJIF – 4.998, IIFS - 4.375
Globally peer-reviewed and open access journal.

# INNOVATIONS IN AGRI VALUE CHAIN WITH NEW GENERATION STARTUPS IN INDIA

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***Abstract***

*New generation start-ups have been emerging in the country since the last few years in various sectors of the economy including agriculture. These are entirely different from earlier waves of start-ups in the country, as they are driven primarily by information and communication revolution, globalisation and private initiatives. There are no structured studies on the nature and impacts of these start-ups on farming as well as the ecosystem needed to scale them up. The present study focuses on the Agri value chain intending to trace their interconnection with innovative business models and related impacts.*

***Key words:*** *Innovations, Agri value chain, challenges, startups, review*

## INTRODUCTION

The value chain refers to the multiple actors engaged in various production and consumption activities, and their continuous relationships for value generation and market linkages. (Kilelu et al., 2017). In line with this agro-food value chains (AVCs) comprises "all activities required to bring farm products to consumers, including agricultural production, processing, storage, marketing, distribution and consumption" (Rao et al., 2017). Agricultural innovation is usually the result of a dynamic interaction between the various actors involved in the production, processing, packaging, distribution, and consumption of agro products (World Bank, 2012).

**Why Agri value chain framework in India needs transformation?**

As stated by Kola (2018) India's yield per hectare is really poor at 2.3 tonnes, much lower than the Asia average of 4 tonnes. Kola further pointed out that approximately, US$14 billion worth of food production is wasted in India due to supply chain inefficiencies.

**Table 1: Yield gap major crops – comparison India Vs world.**

| Crop | India Yield kg/hectare | World Highest Yield kg/hectare |
|---|---|---|
| Paddy | 3848 | China -6917 |
| Wheat | 3219 | China - 5481 |
| Maize | 3115 | USA - 11084 |
| Sugarcane | 69735 | Brazil 74482 |
| Ground nut | 1732 | China 3709 |
| Tobbbaco | 1711 | China 2212 |

Source: FAOSTAT (08.01.2020), GOI, (2019)

**Table 2: Productivity gaps in Fruits & vegetables (Figures are in Yield kg/ hectare)**

| **Fruits** | **India** | **World Highest** | **Vegetables** | **India** | **World Highest** |
|---|---|---|---|---|---|
| Banana | 35.9 | Indonesia (59.3) | Brinjal | 17.5 | Egypt 49.2 |
| Grapes | 11.1 | USA (16.3) | Cabbage | 21.5 | Japan(66.1) |
| Mango | 7.1 | Braazil (15.8) | Potato | 22.7 | USA (44) |
| Papaya | 39.6 | Indonesia (85.8) | Onion | 14.2 | Turkey (30.3) |
| All fruits | 11.7 | Indonesia(22.4) | Tomato | 19.5 | USA (81) |

**Source**: Srivastava & Srivastava, (2018)

Table 1 and Table 2 shows substantial yield gaps in agricultural productivity of various food crops compared to its global counterpart. The factors responsible for this deficiency are in areas ranging from farm inputs and equipment to farming techniques and retail connections. Other issues include several intermediaries, inadequate refrigeration during transportation, limited farm sizes, and a lack of financial stakeholder equity.

**Table 3: Comparison level of processing and amount of loss in value chain of various crops in India**

| Item | Levelof processing (% of production) | Amount of Loss in Value Chain |
|---|---|---|

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| | | (% of production) |
|---|---|---|
| Fruits& vegetables | 1.7 | 16.0 |
| Milk | 37.0 | 0.9 |
| Meat | 21.0 | 3.0 |
| Poultry | 6.0 | 7.0 |
| Marine fish | 8.0 | 10.0 |
| Shrimps | 1.4 | - |
| Cereals | 90.0 | 6.0 |
| Pulses | 90.0 | 6.0 |

*Note*: '-', denotes missing data
*Source*: MOFPI Report (2014), CIPHET (2015)

It is visible from table 3 that the amount of loss is maximum in perishable products like fruits and vegetables (18%), while the level of processing is minimum (2%). In the case of meat, the annual loss is 3 percent which is comparatively less and the level of processing is 21 percent. Since fruits and vegetables and milk are highly perishable, they need cold chain infrastructure. Considering this background, Central and state government is promoting startups in the agro and food sectors to transform the Agri value chain through schemes like Ease Of Doing Business (EODB), E- Nam, Mega food park schemes, Sampada Yojna, 100 % FDI approval, etc. (MOFPI, 2020).

## OBJECTIVES OF THE STUDY

1. To study the Agri value chain in India
2. To study the contribution of innovative startups in transforming the Agri value chain in India.
3. To identify the challenges faced by the startups and suggest overcoming strategies.

## AGRI VALUE CHAIN AND OPPORTUNITY FOR STARTUPS

| Inputs | Production | Procurement & Storage | Processing | Retailing |
|---|---|---|---|---|
| Key activities | Seed, fertilizers and farm equipments | Farmers, cooperative and private companies | warehouse, cold storage and silos | Grading, sorting, milking and packing | Retail shops, malls, cash and carry |
| International Major layers | NSDL, Cargil and Advantage India Ltd. | Farmers, Amul, ITC, Pepsi, HUL | Food Corporation of India, NCMSL, Arshiya International | ITC Ltd, Cargil, Adani enterprises, Olam | General Merchant Stores, Bharti Walmart, Future Retail, Aditya Birla Ltd. |

**Source:** ( ASSOCHAM 2017)

Value chain in food processing provides opportunity for startups at each stage:

1. The first stage of the value chain provides an opportunity for the startups in the supply of seeds, agrochemicals, fertilizers, etc. to farmers.
2. The second stage includes the production of a crop and insurance of crop against any sort of natural or man-made calamity. The stage also involves procurement of agro-produce for value addition. This stage provides an opportunity for startups in primary food processing.
3. The third involves storage and trading of produce. There is a strong need of high-tech entrepreneurs who can develop modern and sustainable cold chain infrastructure.
4. The fourth stage includes the processing part which provides an opportunity for startups in primary, secondary and tertiary processing.
5. The final stage provides an opportunity for entrepreneurship in food retail and food services utilizing hotels, restaurants, eat-outs, retail stores and food delivery businesses. Startups like Zomato, Swiggy and Food Panda have got remarkable success in the online food delivery business. Online food supermarkets have been started in India and it has good potential e.g. Big basket.

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**Table: 4 Innovative startups in food and agri value chain in india**

| Input/ Output based | Start up | Innovation | Source |
|---|---|---|---|
| Input | Flybird Agri Innovations | Developed sensor to detect moisture content in soil to cotrol irrigation. It claims 25-30 percent savings of water and improvement of crop yield by 10-15 percent. | (YS, 2018) |
| Input | Fasal | 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. | (Bhatia, 2018) |
| Input | Vise Organic | Offers MyLab, an innovative product that allows low-cost production of bio-fertilisers and bio-pesticides by farmers. | (Reddy, 2018) |
| Both | Onganic | Works with small farmers to boost their organic produce. Based on contract farming, it 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. | (YS, 2018) |
| Input | Gold Farm | Helps farmers book farm equipment such as solar-powered pumps . Beneficiaries are more than 25,000 farmers, who tap the services of 250 booking agents and over 500 tractor owners connected via mobile app. The equipment is also tracked with IoT devices, resulting in rich data sets for analysis and forecasting. | (YS, 2018) |
| Input | Distinct Horizons | It has developed a machine that helps in reducing excess use of fertilisers by 30-40 percent based on Urea Deep Placement (UDP) technique. | (Reddy, 2018) |
| Input | Satsure | Developed satellite image processing that will help farmers with the decisions on what to sow, when to irrigate or add fertilizers, or prepare for harvest. | (Bhatia, 2018) |
| Input | Impeccable Innovation | Uses a "nano nutrient" to enhance the efficiency of photosynthesis and boost crop production. comprises 12 nutrients and is applied to leaves to boost the photosynthesis process | (Reddy, 2018) |
| Input | Vasumitra | Develops agriculture inputs suitable for organic agriculture. With the help of its 28 products across four categories, including Carbon-Rich Fertilisers, Physiological Triggers, crop Protection, and Ionic Fertilisers. | (Reddy, 2018) |

| | | | |
|---|---|---|---|
| Input | Stellapps | Developed automated dairy solutions to reduce input costs using advanced cloud based analytics and activity meters | (Shankar, 2018) |
| Input | EcoZen | Developed solar-powered irrigation solution and cold storages and offers a quarterly lease | (Stine, 2019) |
| Input | Agribolo | It is a farming services platform spanning activities such as information dissemination, quality input procurement, market linkages, irrigation facilities and farming equipment. It uses the aggregator model to connect farmers to experts, development institutions, financial services, and training institutes. | (YS, 2018) |
| Output | Occipital Tech | Offers an AI-based vision system to grade and sort fruits and vegetables based on size, colour, shape and surface quality. The accuracy of technology is 98 percent and it takes one-fifth of the time required in the manual process used now. | (Reddy, 2018) |
| Input | Farm again | has 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. | (YS, 2018) |
| Output | Crofarm | It buys fresh fruits and vegetables directly from farmers and supplies them to online and offline retailers through its multiple distribution centres and claims wastage of less than 5% in its supply chain as compared to average wastage of 50% in fruits and vegetables supply chain in the country. | ( YS, 2018) |
| Input | Harvesting | Offers smart farming solutions based on analytics and AI. It also uses farmer profiles to build creditworthiness profiles for financial organisations. The idea is to provide both increased farm productivity and better financial services. | (YS, 2018) |

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|---|---|---|---|
| Both | Organik Thelawal | It is s assisting 13,000 farmers to switch to organic farming, thereby, creating a positive impact on bio-diversity, soil contamination, water, and air pollution. Further, by providing free thelas (pushcart), the team promotes micro-entrepreneurship among pushcart vendors and farmers. | (YS, 2018) |
| Input | Farmizen | offers agricultural equipment on rent using a '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. | (YS, 2018) |
| Input | Oxenic farm solution | offers agricultural equipment on rent using a '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. | (YS, 2018) |
| Input | CropIn | Uses cloud platform and get details of farms and inputs applied to make every crop traceable for meeting global best practices. Used two applications Smart Farm and Smart Risk | (Bhatia,2018) |
| Input | Farms to Folk | Provides water monitoring solutions that ensure better productivity by reducing water wastage. 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. | (YS, 2018) |
| Output | Earthfood | Based in Pune, provides chemical-free produce at market price. It has collaborated with Reliance Fresh and Nature Fresh. It uses a healthy mix of traditional methods and innovation to keep pollution and wastage to a minimum, thereby benefitting both consumers and the environment. | (YS, 2018) |
| Input | Jayalaxmi agrotech | founded by alumni of IIMB and VEC helps farmers minimise crop loss and improve productivity via its many crop-specific mobile applications in local languages that provide timely information on agriculture and animal husbandry. | (YS, 2018) |

| | | | |
|---|---|---|---|
| both | gramophone | It is a platform that combines both advisory and sale of inputs under a single roof. Farmers can access mentors for help with everything from crop selection to land productivity and more. | (YS, 2018) |
| both | Triton food works | It 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. | (YS, 2018) |
| Input | Vdrone | 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. | (YS, 2018) |
| Output | Ninjacart | Enables retailers and merchants to source fruits and vegetables directly from farmers. It connects 2,500 farmers and handles 14,000 tons of fruits and vegetables, accounting for revenue of around Rs 4 crore every month. | (YS, 2018) |
| Input | Bighat | It is an 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. The footprint spans 50,000 farmers across 20 states. | (YS, 2018) |
| Input | Ravgo | It is an agri-equipment rental marketplace based on the model of the sharing economy. It is solving the farm mechanisation problem among India farmers who cannot afford to buy the farm machinery. | (YS, 2018) |
| Output | Sabziwala | Procures directly from farmers and supplies fruits and vegetables in pre-weighted and pre-priced packs | (Fernandes, 2016) |
| Output | kisanmade | It is an e-commerce platform empower farmers by eliminating the intermediary between the farmer and the consumer. It also aims to increase the farmer's income and decrease the kitchen's expense by 10-15 percent. | (YS, 2018) |

| | | | |
|---|---|---|---|
| Input | Flybird innovation | 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.D5 | (YS, 2018) |
| Input | Kamal kisan | Reduces labour costs with innovative agri-equipment, with reported savings of up to 50 percent. Tools include sugarcane planters, versatile mulch layers, bed makers, vegetable handy planters, and power weeders. | (YS, 2018) |
| Input | Far mart | Connects farmers who own machinery with those who need it but don't have access to it. 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. | (YS, 2018) |
| Output | MICC Michelman Innovation Center for Coatings | New coating solution, which eliminates the plastic lining used in conventional paper cups to ease the recycling and repulping process. This solution is suitable for frozen foods, hot and cold beverages, fried snacks etc. | (Nema, 2019) |
| Output | Intello labs | developed computer vision based solutions that use images as key data and give quality parameters based on the input data. | (Bhatia, 2018) |

## DISCUSSION AND FINDINGS

Table 3 shows innovative startups that emerged in the last five years in the agro-food sector. The comparison of the different innovative models shows that they differ in the type of values they deliver to farmers, customers, organizations and collaborators. Broadly they have been classified as innovative business models in inputs services ( Pre-harvest stage 1, 2 ) and output service models ( post-harvest stage 3, 4, 5 ). The input-based startups have connected farmers with input suppliers for seeds, fertilizers, pesticides, soil testing, satellite imagery analysis, farm machinery, etc. Startups like Fasal and Satsure have come up with satellite image processing for predicting the weather. Startups like organic thelawala have educated around 13000 farmers about organic farming. A considerable number of startups are providing innovative types of equipment and supply chain solutions. Business models like Intello, Ecozen, Ninjacart, Crofarm, Farmizen, etc. are output-based startups providing B2C and B2B marketplaces for farm produce thereby eliminating middlemen They help in improving farmer's income by quality assessment, grading of produce, reduction in wastage and price transparency. It is worth noting that there is only one start-up named Harvesting which provides financial services to farmers.
The undertaken review identified following challenges faced by majority of the startups

## INTERNAL CHALLENGES

- High fixed costs of developing new infrastructures.

- Uncertainty about the prospect and success of innovation
- Traditional mind set of entrepreneurs and lack of knowledge on sustainable issues
- Increased development and production cost
- Inadequate competencies in Research and development.

## EXTERNAL CHALLENGES

- Inadequate government action and commitment towards innovations.
- Inadequate funding for early investment, which is often perceived as too risky or a lack of understanding among stakeholders about the potential economic returns of investment.
- Regulatory barriers like frequent changes in governing laws and regulations.
- Lack of consumer readiness in adopting innovations.

## CONCLUSION AND SUGGESTIONS

The Agro and food processing industry is flourishing in India and offers vast opportunities for entrepreneurs. Government's initiatives like doubling farmer's income by 2022, making India Global Food Factory and Global Food Market brings immense opportunities for startups in this sector. The startups have adopted innovation in the expectation of improvement in a firm's operational efficiency, productivity, and profitability. However, the adoption of innovation does not ensure its successful implementation. Efficient execution of innovative projects requires active support and involvement of regional or local government and municipalities. The study reveals that there is a strong need for startups to provide a solution for innovative financial services at each stage of the value chain. Startups offering healthy snacks, organic ingredient based food products, nutraceuticals, cold chain infrastructure, AI-based deep tech solutions for inspection and grading of agricultural produce, supply chain logistics and online food delivery business will have a bright future. Fragmented and lengthy supply chain, inadequate infrastructure, skill gap in human resources, low adherence to quality standards, capital intensive nature of the industry and taxation issues are the major challenges faced by the startups. To overcome these challenges policymakers need to provide infrastructural, financial, technical and institutional support to startups. Further research is needed to see that to what extent these startups have benefitted all the stakeholders in the value chain especially farmers.

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