

WORKING PAPER NO: 686

An Exploratory Field Study of Select AgTech Start-ups

V. Ravi Anshuman

*Finance & Accounting Area
Indian Institute of Management Bangalore
Bannerghatta Road, Bangalore – 560 076
anshuman@iimb.ac.in*

Venkatesh Akella

*Department of Electrical & Computer Engineering
University of California
akella@ucdavis.edu*

Sahajdeep Kaur

*Research Associate
Indian Institute of Management Bangalore
Bannerghatta Road, Bangalore – 560 076
sahajdeepk@iimb.ac.in*

Year of Publication – August 2023

The authors thank NSRCEL and NITI AAYOG for providing a research grant to conduct this study

An Exploratory Field Study of Select AgTech Start-ups

Abstract

This study presents a set of field studies of Indian Agtech startups that use digital technology: Jivabhumi, Adi Naturals, Milk Mantra, TraceX, and Stellapps. In addition, we study a few startups that rely on blockchain technology, e.g., Curry and Company and Intel Connected Logistics Platform, Trabppca Coffee, Blue Korintji Coffee, and Slay Coffee. We also discuss the integrated organic farming model proposed by Mr. Ramesh Chandra Dagar. The finding of these caselets suggest that digitisation of both upstream and downstream activities are critical for achieving scale.

Keywords: Agtech, Startups, blockchain, dairy, agriculture, coffee, traceability

Table of Contents

List of Content	Page No.
Jivabhumi	2-4
Adi Naturals	5-7
Contrast Between Jivabhumi and Adi Naturals	8-9
Milk Mantra	10-12
Contrast between Jivabhumi, Adi Naturals and Milk Mantra	13-14
TraceX	15
Stellapps	16-17
Integrated Organic Farming	18-20
Other Case Studies	21-24

Jivabhumi

Idea

With the increasing concerns over the use of chemicals in farm produce and adulteration in the products, the idea of building a platform that connected local farmers and consumers emerged— Jivabhumi. The business model focuses on bridging the gap between farmers, who have been practising the principles of sustainable farming for years, the consumers, who are conscious about their health and environment.

Jivabhumi ensures trust and traceability between the farmers and consumers. Initially, the founders of Jivabhumi started with the promotion of rooftop gardening and encouraged people to become self-reliant and grow their own food. The motivation to build a digital platform evolved when small farmers started gathering together and forming small communities to produce naturally grown food products. A network of farmers was built during the 'Food from your garden' initiative by the founders. This initiative aimed to teach people about growing their own food from scratch in the cities. The team would invite farmers from different areas to teach people. The challenge, here, was to keep the communities connected. As the farmers were usually from remote areas, away from the urban consumption points, it was difficult to keep the farmers and consumers connected.

The connection was possible with a technology-driven platform so that the gap between local farmers and consumers is filled. Before the online platform was built, the founders gathered some farmers from different communities to sell their products offline. A successful response to that led to building the online platform for a better reach.

Business Model

The website of Jivabhumi lists the farmers who are willing to sell their products. The focus is on building trust between farmers and consumers. The main idea behind setting up such a platform is to build a supply chain which that is fully transparent and that can be trusted.

USP

The company creatively uses their 'Seal of Trust' on each product that provides explicit information about the product, its geographical location and farmers' returns on that particular products. The whole process of how the product is produced is mentioned for each product. 'Seal of Trust' is a design that is practical. It easily captures the ground reality and challenges that the farmers face on a daily basis. In contrast, a mere certificate could not possibly capture that. Also, an open and transparent brand holds a stronger position in the market. As long as the products can get traced to their original source, the consumers are more likely to make a purchase.

Jivabhumi places its trust in the farmers and maintains records of the whole process for growing the produce. It deals with farmers who are certified as well as those farmers who have been producing the food products naturally without using any chemicals but do not feel compelled to get certified. Moreover, in India, since majority of the farmers have small holdings of land, the certification becomes an expensive affair.

The organic certification process is designed to ensure that the products are authentic and organic but it is just one of the many aspects. Jivabhumi aims to bring that authenticity through their community connection and build a long-term trust between local farmers and consumers.

Farmers and Consumers

From a consumer's perspective, it is as simple as placing an order online and getting the product delivered. Most farmers belong to far-off, remote areas and majority of the consumers reside in the urban areas. The farmers' main focus is on their produce. Farmers are not particularly looking out for the consumer expectations. Farmers put their expertise in growing the food and sell it for instant benefits. So, Jivabhumi assumes the role of a mediator between the farmers' and consumers' expectations. It is difficult for farmers to reach the consumers, especially the marginal farmers who do not have the infrastructure to clean, process and supply the produce for the consumers. Hence, Jivabhumi has filled that gap seamlessly by providing these services. Thereby, facilitating the connection between farmers in the rural areas and consumers in the nearest cities.

The farmers do not have to worry about the sale as the firm facilitates the sale through its online platform. The main responsibilities of procurement, processing, packaging and distribution etc. lies with Jivabhumi. It ensures that the food products reach the consumers as per their expectation. Nowadays, consumers are becoming more aware about the organic certification. Also, regulations are more stringent than before to be able to sell the products as 'organic'. Certification is becoming a necessity for selling organic products. Hence, the firm has been helping its farmer communities to obtain certifications. Consumers are becoming more concerned about the original source, ingredients, packaging etc., and Jiva Bhumi has built its name by openly mentioning all the information about these factors. Eventually, as the consumers start trusting the brand, the brand name serves as a proxy answer for all these questions of consumers. A brand name that has positioned itself on the basis of trust and traceability is more likely to win the consumers. Interestingly, new sign-ups for Jivabhumi services happen primarily through referrals and awareness campaigns.

Quality Verification

In the nearby areas, as the supply chain is small, the firm relies on self-verification and regularly monitors the farmers' communities that are directly connected with Jivabhumi. However, when the firm deals with different farmer organisation from far-off areas then the supply chain becomes longer, the verification process becomes tedious. The firm, then, relies on certification provided by different organisations and agencies to check the quality of the products.

Adi Naturals

Idea

With the inspiration to supply authentic, eco-friendly and chemical-free food products, Adi naturals built a multi-vendor platform that connects big companies, bulk buyers as well as retail buyers to the farmers. The idea was to set up a platform so that the middlemen are eliminated and the farmers are encouraged to adopt a variety of farming rather than the conventional method of farming.

The founders conducted a survey to find out if the farmers were interested to change their conventional method of farming and adopt a more sustainable method. The keen interest of farmers in the idea of organic farming encouraged the founder to set-up the digital platform to help the farmers reach more buyers. The farmers were willing to follow the principles of organic farming to become more profitable. Moreover, to compensate for the losses incurred during the conversion from conventional to organic methods of farming, the government provides subsidy to farmers. So, the farmers are encouraged to adopt sustainable methods of farming and Adi Naturals is helping farmers make such transition and fetch them better prices for their produce.

Business Model

In this farmer to buyer (F2B) business model, the company takes the role of a processor that facilitates the connection between farmers/farmer producer organizations (FPOs) and the buyers. Majority of buyers consist of firms/companies that are buying the produce as their raw materials to convert it into other products or re-brand it for the end users. Adi naturals mainly focuses on digitizing such bulk transactions. Spread across India and exporting to the US, the company is setting high quality standards. They facilitate the interaction between buyers and growers that can reduce the role of middlemen and make organic food more affordable. A thorough check is performed by the firm before connecting with the organic farmers. The firm also relies on the certifying agencies to ensure that the farmers are following the principles of organic farming. Moreover, some random checks are also performed by the firm. The firm identifies the certifying agencies and farmer organization that are trustworthy and deals with those vendors only.

Along with the certification of organic food products from both national and international agencies, the company provides a transaction certificate on request to vouch for the quality of the product. A transaction certificate is issued by the government authorities to certify that the products in each consignment are certified organic products. A product will be allowed to be exported as “Organic Product” only when accompanied by a Transaction Certificate issued by a Certification Body accredited by National Accreditation Body (NAB) for Organic Products under the National Programme for Organic Production (NPOP) of the Department of Commerce, India. As the organic food market becomes more regulated and stringent about the rules and regulations, this unique feature provides the firm with an edge over its competitors.

Product Quality

When dealing with the organic food products, the supply chain has a pivotal role. Since the produce is grown organically, it has to be processed, refined and stored exclusively, as it cannot be mixed with the conventional food at any stage of the supply chain. Each step in the supply chain has to be separated from the non-organic products. Adi Naturals has been building exclusive supply chains so that the authenticity of the organic produce is maintained and high standards of quality are assured for the buyers. With a Quality Assurance System in place, the buyers can also request for a quality report of the products which will help them in making an informed decision.

Functionality

According to the founders, the organic farmers are more educated, knowledgeable and aware about the market conditions. Hence, the farmers themselves quotes their price and the firm buys at that price. As the farmers are looking for instant payments, Adi naturals buys the produce and stores it in their own warehouses. Through this, they are ensuring that farmers get the fair value for their produce and consumers get the quality of products that they are looking for. Companies and bulk buyers are looking for organic products that are genuine and show transparency. The assurance of quality is the key to winning the trust of the customers. The firm takes extra steps for the quality assurance by providing transparency in the supply chain. This focus on quality helped Adi Naturals build a reputation in the market. Hence, the firm’s branding and customer acquisition costs have been minimal.

Customers' Expectations

From the founders' experience, it is possible that the big companies are not concerned about the traceability as they place that responsibility on the processors firms like Adi Naturals. They rely on their own thorough checks and quality tests to examine the quality of the produce. The end consumers are concerned with the traceability only for the initial purchases. Once the firm has established itself in the market by openly telling its business values and the consumers find confidence in the quality of the products, then the brand name and final packaging become the crucial factors of consideration. A consumer will not check the source/ingredients every time a purchase is made.

Role of Technology

The firm is attempting to build a program that will facilitate a match between the quality expectation of the buyers and the availability on the supply-side using machine learning and artificial intelligence. The quality parameters measured at the farm-level using machine learning will add to the database wherein buyers can simply quote their expectations and an optimal match will be provided with the help of artificial intelligence. The firm has placed its intermediaries at the farm level called the "Raythu Sahayk". These people (Sahayks) are farmers and volunteers who collect pre-harvest and post-harvest data at the farm level from farmers who are connected with Adi Naturals. This data will facilitate in bringing transparency into the supply chain and a farm-level quality report can be generated. It will help to monitor farmers closely so that they adhere to the principles of organic farming. A connection is formed between the buyers and sellers when the buyer's quality expectations are met.

Encapsulating the overall objective, Adi Naturals emphasizes on the authenticity and quality of the products to win the trust of its customers and also ensures that those factors can be verified at any stage of the supply chain with supporting evidence.

Contrast between Jivabhumi and Adi Naturals

The idea of natural and organic farming emerged from the irresponsible use of chemical fertilisers and pesticides in the food. Both, Jivabhumi and Adi Naturals, bring forward the idea of 'farm to plate' and focus on providing a variety of chemical-free food to the end consumer. The approach to reach this goal is different as Jivabhumi emphasises on building a community of farmers that is trustworthy and follows the principles of sustainable farming. The products are sold as naturally grown products. On the other hand, Adi Naturals deals with those farmer organisation that have their lands certified as 'Organic' and sells its products as organically produced products. It also helps the farmers in the conversion process from non-organic to organic produce. It ensures the quality of the produce based on the certification provided by recognised agencies to ensure the authenticity of the produce.

As a proof of authenticity, along with the certification of organic food products from both national and international agencies, Adi Naturals provides a transaction certificate on request to vouch for the quality of the product. A transaction certificate is issued by the government authorities to certify that the products in each consignment are certified organic products. A product is allowed to be exported as "Organic Product" only when accompanied by a Transaction Certificate issued by a Certification Body accredited by National Accreditation Body (NAB) for Organic Products under the National Programme for Organic Production (NPOP) of the Department of Commerce, India. Jivabhumi is more focused on building smaller communities and bringing ease for local farmers to sell. The products may not be certified but the 'seal of trust' established by the firm for each product provides detailed information about the source of product. Not all products are certified as the firm relies mostly on self-verification with the farmers. The seal/brand name vouches for the authenticity of the produce.

Jivabhumi has gained trust of consumers based on their brand name. The 'seal of trust' provides information about the original source, producer/farmer name and the return given to the farmer for each product. The quality assurance system and reports, certifications and transparency in the supply chain has led to the success of Adi Naturals in the market.

In terms of the variety of products, Adi Naturals has a large supply chain and delivers its products all over India and also exports to the US. It deals with a relatively large number of

products and varieties— fruits, vegetable, groceries, seeds, dry fruits and more. The firm maintains its own warehouses in order to secure the organic nature of the products. For example, wheat is bought from the farmers and stored in a warehouse where it is cleaned, processed, tested and packed for the buyers/companies for further process. Firms/companies buy the produce as their raw materials to convert it into other products or re-brand it for the end users. These facilities are maintained solely to protect the organic state of the product as the organic products cannot be kept with the non-organic products. Jivabhumi deals with relatively small quantities of produce and has 80+ products that include groceries and staples, fruits and vegetables. The functions of procurement, packaging and distribution etc. lies with Jivabhumi thereby, it assumes the role of a facilitator. Jivabhumi does not have its own storage facilities so, it deals with limited variety of products. Based on the availability of the produce in the nearest areas, it supplies the natural products into the city centres.

Jivabhumi and Adi Naturals have been working on building a system based on blockchain technology and machine learning. Adi Naturals is building a system to create database of the quality parameters measured at the farm-level using machine learning. With that, buyers can quote their quality expectations and an optimal match will be provided with the help of artificial intelligence. Moreover, Adi Naturals has volunteers working with the farmers who record timely data of the crops.

To sum up, Adi Naturals emphasizes on the authenticity and quality of the products to win the trust of its customers and also ensures that those factors can be verified at any stage of the supply chain with supporting evidence. Jivabhumi firm positions itself as a platform that is building a transparent supply chain and promotes sustainable farming. The small supply chain and brand name of the company form the basis of trust between farmers and consumers.

Milk Mantra

Idea

The idea of setting up a digital supply chain for dairy products emerged from lack of integration in the dairy business. The value chains in the industry are fragmented and the market is highly unorganized. When the middlemen are involved, the farmer/producer are left out of the supply chain and the consumers remain unsure of quality of the product. Milk Mantra solves this problem by establishing a direct link between farmers and consumers. Milk Mantra eliminates the middlemen and has set up its own milk collection centers in various collection points. It aims to digitize the chain starting from source till the product reaches the end consumer. With digitization, it gains the trust of consumers as well as the farmers.

Each milk packet of Milk Mantra has a QR code that contains information about the journey of the product. This data is collected at various points in the chain and updated on the digital ledger to provide authentic and credible information to the end consumers in order to win their trust. Moreover, the simplified supply chain helps the farmers to get timely payment which was not possible in the conventional business setting.

Business Model

In this capital intensive business model, Milk Mantra has set up processing plants to process and pack the milk obtained from the farmers. First, the milk is collected at various collection points. Here, the details of the farmers and milk are recorded and uploaded on the cloud with the help of Stellapps' software. With the help of Stellapps, the data collection on the cloud was made possible, earlier the data collection was done manually. After collection, the milk goes to the processing plant and its boiled and packaged. The product is processed in such a way that the consumers can consume the milk directly from the pack without boiling it.

For superior quality, Milk Mantra re-engineered the packaging to extend the shelf life of milk. Milk gets spoiled due to temperature and light exposure. So, Milk Mantra solved this problem by designing superior packaging that symbolizes pure and good quality product. The packaging has three layers that protect the milk from getting spoiled quickly.

The firm's earnings are dependent on mass premium on the product. They are doing so by targeting a large set of population rather than have a niche market for its products. Currently the business operates in the areas of Odisha and Kolkata and eventually plans to establish distribution across India.

USP

Along with the traceability feature, Milk Mantra has positioned its product based on the quality of the milk and its longer shelf life as compared to the other available products in the market. The consumers can have the milk straight from the pack which symbolizes quality. Moreover, it is signaling quality through innovative packaging. As the consumer touches the milk packet, the difference can be easily felt. Once all the companies have the traceability and other technology-driven feature, the distinguishing feature about product quality will be reflected by the packaging.

Farmers and Customers

Through its ethical milk sourcing program, Milk Mantra is targeting conscious consumers who show their concern towards farmers. In this program, in addition to the basic service, the company is helping the farmers grow their business. It provides direct and timely payment to the farmers. The elimination of middleman has led to better income for the farmers. There is transparency in the whole process. The farmers are aware of the market price and the basis of their payment. The consumers are able to get all the information about the origins of the product simply by scanning the QR code on the packets.

Milk Mantra also provides some additional training and services to the farmers for clean milk production. For example, it helps farmers secure finance from bank if the farmers want to expand their business and facilitates the whole process by linking up the loan instalments with the farmer's earnings from Milk Mantra.

Customers' Expectations

From the founders' experience, it is possible that the big companies are not concerned about the traceability as it places them in a tough spot. Milk Mantra has focused on transparency since its inception. Consumers find confidence in the quality of the products with this feature although the consumers are not yet willing to pay premium on the product for traceability.

Larger part of the market is not ready to spend extra but this feature is expected to be there on the product as a value-added service. Also, the final packaging has become a crucial factor of consideration before making a purchase.

Quality Verification

Regular checks are performed at the collection centers and the milk is tested at various stages of the supply chain. As the focus is not on organic milk, there are no field-level checks. However, the firm aims to source milk from high quality cows.

Role of Technology

Milk Mantra identified the need of technology from the beginning. It has invested heavily in technology for data collection, transparency and traceability in the supply chain. With the help of TraceX, the firm provides a QR code which shows the entire journey of milk. This is a blockchain-backed platform which has all the data stored.

This feature may not be a specific requirement for the consumers yet but it can become a competitive advantage in the long run. Moreover, strong guidelines and regulations from government can change the market if these features are made mandatory for the products. It will put them first in the market.

Difficulties

Dairy markets are highly price sensitive. Majority of the consumers are willing to pay only a certain amount of premium for quality products. If the products are priced slightly too high then the target consumers' proportion falls drastically. On top of that, the consumers expect extremely superior quality but are willing to pay only little amount of premium on a basic necessity product. Therefore, there is no incentive for the producer to provide extra features for the product.

Unlike developed countries, the entire supply chain infrastructure needs to be developed from the scratch. Starting from the farm-level till it reaches the retail stores, the company has to have its own facilities for any change that they are trying to build in the system. For instance, the work is not restricted to the milk processing plants that they have set up. The firm has to keep check on the farmers, have proper logistics in place for supply of the product.

Jiva Bhumi v/s Adi Naturals v/s Milk Mantra

Points of Comparison	Jiva Bhumi	Adi Naturals	Milk Mantra
Idea	Natural and traditional farming, deals with both certified organic and non-organic but reliable products which are produced by following the principles of sustainable farming.	Organic farming, deals with only organic products and the products are certified by at least one of the recognized certifying agencies in the country	Digital supply chain for dairy products. Deals with good quality non-organic milk products.
Products	80+ products, Groceries and Staples, Fruits and Vegetable	Deals with a relatively large number of products and varieties– Fruits, Vegetable, Groceries, Seeds, Dry fruits etc.	Regional supply based in Odisha and Kolkata
Deals	Mostly retail deals	Retail as well as bulk deals	Retail Deals
Operation	Operates in Karnataka	Operates all over India and also exports to the US	Operates in Eastern India
Supply Chain	Relatively small community	Large community of farmers and FPOs (Farmer Producer Organizations)	Large community of small scale farmers. Has set up its own milk processing plants
Kind of customers	Direct consumers	Firms/companies buy the produce as their raw materials to convert it into other products or re-brand it for the end users	Direct Consumers
Organic Storage Facilities	No storage, facilitates direct sale from the farmers	Has its own warehouses and provides initial support to farmers for conversion into organic farming	Deals with non-organic product
Transaction Certificate	Not known	Transaction certificate provided on request to vouch for the quality of the product	Not applicable
Quality Assurance System	Not known	Quality report of the products	Regular checks are performed at several milk collection centers and milk is tested at its processing plants before milk reaches the consumers.
Use of Technology	Not known (TraceX has the technology but it is not known as to how Jiva Bhumi uses that technology)	Creating database of the quality parameters measured at the farm-level using machine learning. With that, buyers can quote their quality expectations and an optimal match will be provided with the help of artificial intelligence.	Uses blockchain to have a digital record of all the farmers that are connected in the supply chain and provides the feature of traceability to the consumers to know the journey of the product.

Role	Procurement, packaging and distribution etc. lies with Jiva Bhumi thereby, assumes the role of a facilitator	Assumes the role of a processor by procuring the produce from farmers then processing and storing it for the end users to reach quality standards	Procurement, timely payments to farmers and quality product for the consumers.
Certification	Not all products are certified, relies mostly on self-verification with the farmers	All the products are certified and inspections are performed occasionally	No certification. Reflects quality through superior packaging
USP	Has gained trust of consumers based on their brand name. Developed a unique concept of 'seal of trust' which provides information about the original source, producer/farmer name and the return given to the farmer for each product.	Places utmost importance on quality. Purely based on organic methods of farming, transparent supply chain	Signaling quality through innovative packaging and longer shelf of the products. Their milk can be consumed directly from the pack. Consumers do not necessarily have to boil it.
Returns to farmers	Explicit information of farmers' returns on the website	Farmers quote their price (based on the market price) when their produce is bought by the firm	It has ethical Sourcing program through which the small farmers are connected directly with the firm. The elimination of middleman leads to better income to the farmers.

TraceX Technologies

TRACEX was founded to facilitate traceability of the food products of Jiva Bhumi with the support of Blockchain technology. While doing so, the founders realized the significance and applicability of such services for other food products also. As the consumers get more conscious, it has become important for consumers to know the original source of any product that they buy. Irrespective of whether the products are organic or non-organic, the consumers want more information about the products. TRACEX digitises the whole supply chain and documents all the records into a digital ledger supported by the Blockchain technology. Comprehensive pre-harvest and post-harvest data is recorded. In pre-harvest, the entire structure of the farming ecosystem— farmer organisation, farmer producer company, farmer's profile (verified in-person), geo-mapping of the farmer's land are recorded. If the produce is organic, then the entire organic certification process, existing certificates etc. are also added.

Next, the crop planning- from sowing, planting, pest management activities, nutrition activities, crop protection activities and several other activities are recorded till the harvest.

The post-harvest data covers the whole supply chain from the harvest until it reaches the consumers. Depending on the products, the data is recorded at different stages of the supply chain. The system is flexible to accommodate supply chains of different products and different producer organisations/ companies.

These digital records back up the claims that are made by the firms about their products. As the data is collected, each step in the supply chain is recorded. The model is specifically designed for Indian farmers keeping in mind the kind of farmers that are operating in different areas and considering the challenges in practical implementation.

To sum up, the firm positions itself as a platform that is building a transparent supply chain and promotes sustainable farming. The digital records vouch for the claims of the company and this forms the basis of trust between farmers and consumers.

Stellapps

Stellapps provides tech products to other businesses to facilitate digitization of the dairy supply chain. As the dairy industry is highly unorganized, the firm aims to digitize the supply chain and bring integrity in the industry. It has a range of products that can be used to digitize all the functions in a large scale cattle farm. Along with providing tech support to 200+ dairy companies to digitize, Stellapps is maintaining a digital record of farmer data to introduce traceability in the market. It has 200+ dairy companies as customers in India like Nandini, Karnataka Milk Federation.

Role of Technology

In order to digitize the dairy supply chain, Stellapps focuses on three fundamental aspects of a dairy business with the help of different devices/applications:

Cattle Monitoring

Stellapps has a pedometer for cattle which detects heat and various disorders based on the cattle activities and resting behaviour. Live activity tracking helps to provide timely alerts to the producers so that corrective action is taken immediately. It also has a herd management application which gives recommendations to optimize herd performance. It enhances milk quality yield by providing nutrition plans based on breed, stage in life cycle, milk quality and yields etc. This helps to improve the overall productivity of the business.

Stellapps has its own payments platform that brings attractive financial products including loan and insurance to rural population as part of their plan for financial inclusion. It also provides an option of instant payment for farmers. Their own payment gateway has facilitated the farmers to get smooth payments which in turn leads to winning trust from the farmers.

Stellapps acquires data from sensors which are embedded in animal wearable, milk procurement and chilling infrastructure and uses this data to optimize farm and supply chain operations by providing data driven actionable insights.

Milk Procurement

Stellapps' smartAMCU is an Automatic Milk Collection Unit controlled by an android IoT device. It enables IoT-based, real-time acquisition and dissemination of milk procurement

data at the collection centers. smartAMCU is integrated with cold chain management and farmer payment gateway so, all the data collected at the milk collection points is updated instantly. It replaces the manual milk collection and brings transparency in the collection process. This is helping in retaining the trust of farmers that are connected to the dairy as the farmers get instant notifications about the milk quantity, milk fat, price and payments. The dairy/company now has digital record of all the farmers that are trading their milk at the collection point.

Cold Chain Management

Stellapps' ConTrak enables IOT-based, real-time management of cold chain with enhanced reporting and improved monitoring through web and mobile app portals which are applicable to Bulk Milk Coolers (BMCs), silos, cold rooms, deep freezers, etc. It keeps track of the volume and temperature and also optimizes the route for the trucks. It helps keep the milk in optimal conditions. With the help of these sensors, the large scale companies can monitor the milk during transportation and ensure proper storage.

Traceability

The technology is designed for the large scale dairy companies. The application of these software is not possible for a small scale cattle farm. Moreover, the field level data records are not maintained due to lack of infrastructure among the farmers. The data related to milk is collected but the records about the type of feed, fodder of the cattle and farm conditions are difficult to maintain although the firm's software solutions have the potential to do so. In the future, after collecting data and establishing its own digital supply chain, the firm intends to provide the traceability feature to its customers.

Integrated Organic Farming– Ramesh Chandra Dagar

Integrated organic farming

Integrated organic farming is a cyclical procedure where waste products from one process are cycled in to be used for another process. It is an organic farming system which does not merely mean not using pesticides but also adopting an overall sustainable approach where high quality organic food, feed, fibre and renewable energy are produced using resources such as soil, water, air and nature as well as regulating factors to farm sustainably and without polluting the inputs. The process involves practices such as bee keeping, dairy management, bio gas production, water harvesting, composting and making the most appropriate, sustainable use of naturally available resources.

There is no need to use chemical fertilizers, as cattle excreta (dung) is used as manure as a natural fertilizer. Crop waste can be used to create compost, to generate natural gas for satisfying the energy needs of the farm.

Idea

Mr. Ramesh Chander Dagar, with the use of integrated organic farming, is able to generate an average income of more than Rs. 10 lakhs per year from one hectare of land. There were claims of many that small land holdings were not viable for agriculture so, he set aside one hectare of his land to begin experiments in maximizing income generation through integrated organic farming. He follows a simple strategy: before sowing a new crop he conducts a market survey to understand the demand of a particular product and only when he is 60% sure of getting good returns, he takes the 40% risk of sowing a particular crop. His farm includes bee-keeping, dairy management, water harvesting, composting, agriculture in a chain of processes. A good combination of all these practices to make organic farming successful, both ecologically and financially.

Business Model

Mr. Dagar learned these practical aspects from first-hand experience. He started with a 1.6 hectare farm in 1971 and has more than 44 hectares of land, all completely under integrated organic farming. All seasonal vegetables, fruits, paddy, wheat, mushroom and flowers are grown organically. He has also started growing exotic vegetables and fruits such as lettuce,

baby corn, and strawberry for export. One hectare of land has been set aside for a laboratory for research purposes. That lab comprises of composting pits, farm pond with fish, bio gas and flower plots all interlinked in various agrocycles to complete the integrated process.

For vermicomposting (compost made using earthworms), Mr. Dagar uses paddy hay and paddy discards as raw material for vermicompost. 300 tons of vermicompost are produced annually for farm use and some surplus is sold at Rs. 3 per kg. According to Mr. Dagar, vermicompost is the best soil nutrient as it retains soil moisture and also reduces water consumption by nearly 25%. The same raw material is also being used as substrate for growing mushrooms. Mushrooms fetch him Rs. 3 lakhs per annum.

Another agrocycle at the farm is dairy, biogas and composting. There are about 50 buffaloes in the dairy farm. Their dung (manure) is fed into an 85 cubic metres capacity biogas plant. Setting up the plant cost him about Rs 1 lakh. The gas is then used in personal kitchen, and also used to run the fodder-cutting machine. The 'waste' from the plant goes to the composting pits. The farm pond collects rainwater, which is used to wash buffaloes. He has also introduced fish into the pond; that fetches him about Rs. 30,000 per annum. So, it not only recharges groundwater, but is also quite profitable.

The most important element of Mr. Dagar's farm practice is bee keeping. It increases his crop output by 10-30 percent (bees are very effective in natural pollination). Also the honey produced has great demand. He has about 150 bee boxes; each generates about 35-40 kg of honey. His total annual income from honey is Rs. 4 lakh. Mr. Dagar has also set up solar panels at a total cost of Rs 4 lakh. He spent Rs 67,000 on it and the rest was provided from a government subsidy. At his farm, solar power is used to run the pump that draws groundwater for irrigation. The surplus power is used to recharge batteries of the household inverter. The farmland has a greenhouse spread on an area of 500 square metre, which is used to grow exotic crops that fetch him Rs 1 lakh per annum.

Income of Mr. Dagar in the year 2004

Source of income	Annual income (Rs in lakh)
Vermicompost	5
Dairy	1
Mushroom	3
Honey	4
Fishery	0.3
Total	13.3

Source: <http://www.indiaenvironmentportal.org.in/> (Ramesh Chander Dagar 2004, Akbarpur Barota village, Sonipat, Haryana.)

Challenges

The biggest challenge is to certify the organic produce as there is not one particular certifying body that provides certification in India. Not all third-party certifications are accepted internationally. Moreover, each process in the system has to be certified separately. Therefore, it becomes quite expensive for the farmers to get certification to be able to sell under the label of 'organic'.

Case Studies on Companies that use Blockchain

Curry and Company and Intel Connected Logistics Platform (ICLP)

Curry and Company, a major supplier of fruits, in Oregon. This particular case study focused on delivering blueberries from the farms to customer distribution centers. Since blueberries are perishable, it becomes onerous to transport them in optimal conditions. With the help of Intel Connected Logistics Platform (ICLP), Intel Hyperledger Sawtooth Blockchain and Microsoft Azure, a digital supply chain was created.

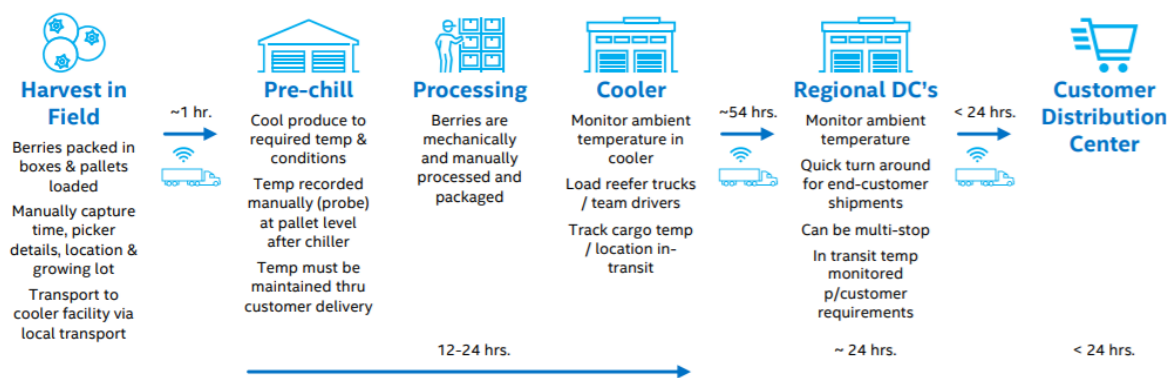


Image 1: Blueberry Process Flow

Challenge: Blueberries begin to ripen as soon as they are harvested. So they must be kept in a climate-controlled environment.

Solution:

- Intel's platform connects the suppliers, original device manufacturers, logistics agents, retailers and end customers. ICLP sensors record all the data starting from harvest till the product reaches the consumer.
- The ICLP monitors the environmental conditions such as weather, humidity, light and location etc. with its sensors and uploads live data to cloud and creating an immutable record on blockchain. This helps companies to take action as quickly as possible.
- The digital trail reduces the scope of any human error and establishes secure chain of custody.
- Live tracking can help companies make changes in real time in case of any contingencies.

- The data is recorded at each step of the process so the handling of each product can be verified when it reaches the customer.
- Blockchain relies on distributed ledger which is maintained and updated by each participant of the supply chain after each transaction in the supply chain to create a digital trail that can be verified.

Fair Food’s platform- The Trace and Trabocca Coffee

The Trace focuses on supply chain mapping and product traceability. Most companies do not know who is in their chain. Trace helps them build a chain by inviting partners until the first link (the farmer) is reached. Once the farmer is identified, a transparent supply chain is established. This chain can be accessed by a link or a QR code that is placed on the product. The transactions are registered each participant and a trace is formed.

Moreover, it allows the verification of any claim that is made by the company. The blockchain tool holds a library with series of claims related to social, economic and environmental issues. For example: If a company claims its products to be organic then the company can upload the certification and supporting evidence on the digital trail and the customers can access that to check the authenticity.



Image 2: Supply chain of Trabocca Coffee

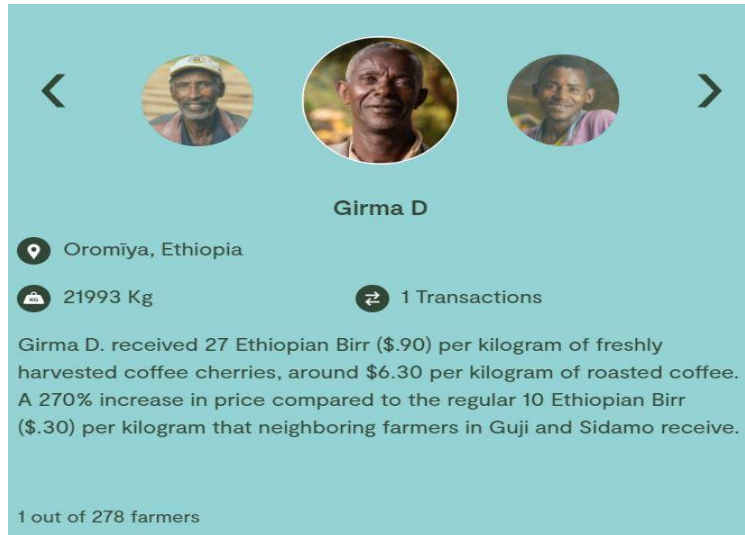


Image 3: Information about one of the farmers of Trabocca Coffee

Image 2 and Image 3 show how Trace established a transparent supply chain for Trabocca Coffee along with detailed information about the farmer, farmer location and the price that was paid to him for the produce. All the information is available for the end consumers to know every detail about the product that they are buying.

Emurgo Traceability and Blue Korintji Coffee

The Emurgo Traceability solution is similar to Fairfood’s TRACE platform. The coffee supply chain project has built a transparent chain for Blue Korintji Coffee tracing the origins and each participant involved in the supply chain.

The purchasers of the coffee needs to scan the QR code displayed on the coffee shop to get all the information about the origin of their coffee.

TraceX and Slay Coffee

Slay Coffee, gourmet coffee brand, is working directly with various stake holders across coffee value chain to build a sustainable, ethical, transparent and traceable coffee supply chain. Focusing on Bean to Cup traceability, Slay Coffee has partnered with TraceX Technologies. Multiple participants across the coffee supply chain such as coffee planters, plantations, roaster and warehousing partners participate on the Blockchain. FOODSIGN™ digitizes the

entire supply chain to capture information flow from the relevant stakeholders across the coffee supply chain starting with Coffee growers, Plantations, Curing Works, Roasters, Central warehousing operations, Café and finally the consumers.

The information, thus, exchanged at various intervention points across the supply chain is stored through blockchain to generate a digital identity representing the movement of coffee from Seed to Cup.

The different stake holders use combination of android based mobile application and web application to track and trace the life cycle of the bean as it moves from the plantation to the cafe and eventually to the consumers.

TraceX and Aditi Organics

Aditi Organic provides organic certification services guaranteeing rigorous standards for products, systems and services. Aditi Organics is using FOODSIGN™ for one of their Projects under Paramparagat Krishi Vikas Yojana (PKVY) for converting the farmer groups into Organic Producers over the next 3 years in the state of Jharkhand.

Digitisation of the certification process:

TraceX has helped Aditi Organics to provide certification to farmers to convert to sustainable farming methods. The digitisation has allowed:

- Realtime information on the projects and the progress on the field. It has created digitized farm diaries and captured granular information at the field level including geo-mapping of the fields resulting in better accountability and traceability.
- This has led to a reliable and transparent certification process which can be easily verified.