Agribusiness in India

SIL 802

10 February, 2015

1. Agriculture in India

We will try to explore the field of agriculture in the India, mainly focussed on the Supply-Chain management. As we know India has large variety of geographical advantages. Some of them are listed as following:

- 52% cultivable land compared to 11% world average
- All 15 major climates in the world exist in India
- 46 out of 60 soil types exist in India
- 20 agri-climatic regions
- Sunshine hours and day length are ideally suited for round the year cultivation
- Large livestock population , Variety domestic animals
- Large coastline
- Largest producer cereals
- Large irrigated area
- Prime location to connect to other countries

India is also one of the largest producer of many commodities among other countries in the world. As shown below:

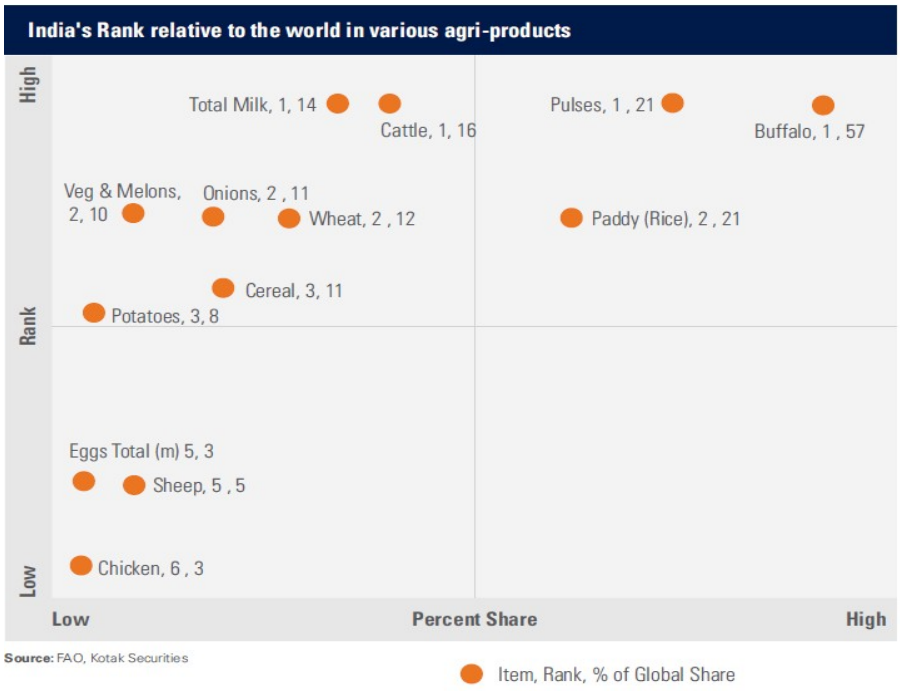

Figure 0 Production of various commodities in India in comparison with world production

Agriculture is one of the major sector in India. It has share of approximately 14% in GDP. Agribusiness has 11% of total export earnings. 49% of country's workforce is associated in this field. BRICS's study says that 1% growth in the agribusiness can be 2 to 3 times effective to bring down the poverty.

So as we saw above, India has such a large agriculture sector and also its ranked among top 5 in many commodities, still there are some major concerns. One of them is, despite bumper production of food grains, 25% of all undernourished people in the world are living in India. All demographic and food demand projections suggest that, by 2050, the planet will face severe food crisis due to our inability to meet agricultural demands. 70% of world's population will be urban in 2050, compared to 49% today. Also, in 2050, global population will be 9.3 billion, 34% higher than today, so Food production must increase by 70%.

2. Problems Faced by this sector

So some of the problems are as follows:

- **Agri Problems** – Segmented land, agricultural land being exploited because of increased urbanisation
- **Laws** - APMC , Essential crop act
- **Supply Chain Problems** – intermediaries
- **Logistics and Infrastructure** – warehouse , transportation , material handling
- **Finance**- difficult to get loans
- **Gap In Information** – No means to receive updates on new farming methods or market price information

We will look into some of in detail.

a. APMC Acts: What and Why?

<u>APMC acts run on two principles:</u>

1. Ensure that intermediaries (and money lenders) do not compel farmers to sell their produce at the farm gate at throwaway prices, so that farmer is not exploited

2. All food produce should first be brought to the market yard, that needs to be sell through auction, so that farmers gets good money.

<u>Under APMC Acts:</u>

- A State is geographically divided and Market (Mandis) are established at different places within the states.

- Farmers have to sell their produce through the auction at mandi.

- To operate in Mandi, a trader has to get license.

- Wholesale, retail traders (e.g. shopping mall owner) or food processing company etc cannot buy farm output directly from farmer. They've to get it through the Mandi.

i. Old APMC Acts and their Problems

1. **Membership:** State APMC Market Committees have 10-17 members. Either elected or nominated by Government in accordance with provisions of the respective State APMC Act. But in several States, regular elections of APMCs are not held. APMC board are administrated by bureaucrats. As a result APMC bodies have lost democratic nature.

2. **Farmers Cheated :** Most Mandi traders do following:
   - Even after receiving the fruit/veggies/grains, they delay payment to farmers for weeks and months.
   - If payment is done on spot, then trader would arbitrarily deduct some amount, on excuse that he has not received payments from the other parties.
   - To avoid tax/cess, the traders don't give sale slips to farmers. Later it is difficult for farmer to prove his 'income' to get loans from banks.
   - on an average basis the farmer is able to receive barely 1/4th to 1/3rd of the final retail prices
3. **Double Commission:** Middlemen at Mandi charge commission on both seller (farmer) and buyer (the urban retailer / food processor). Due to this double commission, final consumer has to pay even more!
4. **Resistance to Reform:** Middlemen have rent-seekers mentality. They resist anything that'll increase transparency or reduce transaction cost and time. Even when electronic auction centres were established like the Safal National Exchange in Bangalore, the existing markets did not allow the transition to a transparent system.
5. **No Value Addition:** Middlemen have no facilities to do grading/sorting, all they do is pass the produce from farmer to final consumer and charge truckload of commission in between. Thus, post-harvest losses continue to be in the range of 18 to 40 per cent for several commodities.
6. **Price Discovery:** For cereal, pulses and oilseeds, government announces Minimum support prices (MSP). So farmers know in advance, what the price of their produce. But for most perishables fruits/veggies, government doesn't declare MSP. Thus, farmers are completely dependent for price discovery and on intermediaries. During peak production of seasonal crops, prices drop so drastically, the farmers can't even cover the cash expenses of transportation to markets, leave alone the cost of production.
7. **No auction:** The licensee traders and commission agents have formed informal cartels at mandis. No auction takes place. Even if auction is held, collectively these traders keep low bidding so farmer never benefits.
8. **Cess:** Cess is tax on tax. In every Mandi, every transaction is subjected to market tax + market cess. This Cess money is to be used for further development of Mandi infrastructure-sorting grading storage facilities etc. But money is not used for that purpose. As a result, fruits and veggies often get rotten due to lack of processing, storage facilities at the Mandi.

ii. Major Problems with APMC

a. Problems with License System

To operate in an APMC Market (Mandi), you need to get a license. This license system leads to following problems:

1. In most Mandis, the pre-condition to get license, you must own a shop or warehouse in the Mandi. But Shops / warehouses are limited n number, so extremely high prices.

2. If you can't find a shop/warehouse, then you'll have to find an old man who has license but leaving business due to age/health problems and his sons not keen to join this profession.

Then you buy his shop/license at extremely high price (because there will be other buyers too outbidding each other to *buy* his license!)

3. In any business where license is required, bribes have to be paid. Be it Telecom or mining or APMC mandi. So again, you must exploit the farmers to recover your (bribe) investment.

Because of above reasons, Commission agent/middleman/trader has to make heavy investment to start his business in APMC. So, he decides to exploit the farmers to recover that big *investment.*

In Mandi, even weighmen, Paddlers, Hamals have to get license. They also need to pay huge bribes, so they also overcharge the farmers to recover their (bribe) investment.

b. Hoarding

Over the years, India's Agro-production has increased but number of intermediaries in APMC remained constant. Their cartel controls the supply. That leads to hoarding, opportunistic profiteering. Big traders, agents, they buy potatoes from farmers at throwaway prices in the Mandi. They rent large cold storage houses across different states for storing potatoes only. (Majority of cold storage facilities in Uttar Pradesh and West Bengal only devoted to Potato-storage). Thus these traders "control" the potato supply across India. And whoever can control the supply, can control the prices. Similar is the case for onions, tomatoes, daal and everything else.

c. MSP (Minimum Support Price)

In APMC Acts, the definition of "agriculture" is very wide and vogue. Although main focus was on cereals, pulses and oil-seeds, even horticulture produce (fruits and veggies) also came within the broad definition of agriculture. And over the last five decades, the share of perishable produce in the APMC market is increasing For example, the Azadpur Mandi in Delhi principally caters to perishable crops rather than cereal or oilseeds.

So what's the problem? Government declares minimum support prices (MSP) for many cereal, pulses and oilseeds crops, so that middleman at APMC cannot exploit the farmers beyond a level (otherwise he can sell it to the FCI). But for fruits and veggies, government doesn't declare minimum support prices (MSP) that gives plenty of opportunity for the middleman to exploit farmer (as well as end consumer). Because of this most farmers tend to grow cereal crops rather than cash crops.

Figure 0 Effect of MSP

Here is the graph showing the boost in the price of the MSP for which it is defined. Due to such hikes, farmer tens to grow the crops for which MSP is defined.

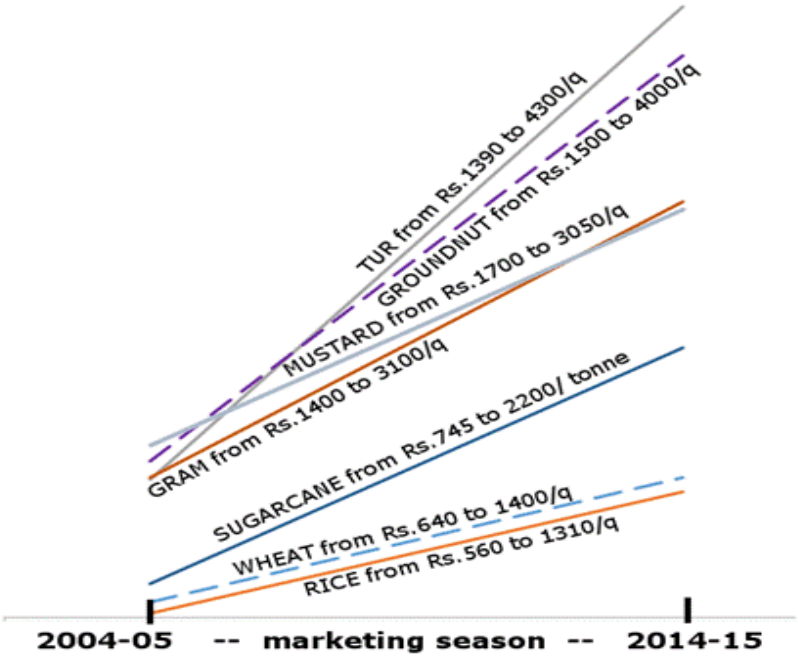

Figure 0 MSP Prices for various crops over the years

iii. MSP Act – Revised

Here is list of some of the new features which have been brought up in the revised Act.

- Farmer doesn't need to bring his produce to APMC Mandi. He can directly sell it to whomever he wants.
- Farmers Processors, exporters, graders, packers, etc. can buy agricultural produce directly from farmers.
- Permits Private market yards, Direct Purchase Centers, farmers' market for doing trade in agriculture produce.
- Public Private Partnership in the management and development of agricultural markets in the country for post-harvest handling, cold storage, pre-cooling facilities, pack houses etc.
- Increased the responsibilities of APMC committee
    - Transparency in pricing system and transactions
    - Ensure timely payments to farmers along with receipts
    - Publish data on arrivals and rates of agricultural produce brought into the market area for sale etc.

So far, Only 16 states adopted the Model APMC Act (as of 2012). Why? Because Middleman/trader lobby made truckload of cash from exploiting farmers and consumers. Part of that money given in election funding to ruling parties in States. Also, Model APMC act is not 'uniformly' adopted, states have made their own modifications.

b. Essential Commodity Act

- Essential commodities are several commodities announced essential, by government which when obstructed would affect the normal life of people. By the act of announcing any commodity as essential, the government gains the powers to control production, supply, distribution etc. of these commodities for maintaining or increasing supplies and for securing their equitable distribution and availability at fair prices.
- The intention may be noble - after all one cannot deny that hoarding and creation of artificial shortages do happen. The retail price of onions in Delhi has been double of what it is in the Azadpur mandi.
- But invoking the Essential Commodities Act is problematic :
    - Stockholding limits do not distinguish between food processing industries and food retail chains, which need to hold large stocks for their operations. Food processing industries especially need to keep stocks for a few months at a time so that fluctuating prices don't throw their economics out of gear. But under the Essential Commodities Act, these can become liable at least for harassment. These are corporate entities with large, earmarked storage facilities which can be easily identified. So it is easy for inspectors to go after them.
    - Identifying the actual hoarders is not at all easy. These may not be small traders but their operations are not corporatized and they have many avenues to spirit away and hoard supplies. The conviction rate under the Act is also abysmally low. So the hoarders go scot free and genuine players in the food economy are harassed.
- The Act is not in tune with present times. It made sense at a time when the transport infrastructure across the country was poor and markets not integrated. So a production shock in one part of the country could lead to hoarding and black marketing. That's not the case anymore. Shortages in one part of the country can be countered if there is ample supply somewhere else.

- **Why India does not see a steep price rise of Coca Cola but does see that for onions??**

- Impose Essential Commodities Act on Coca Cola and see the ‘tamasha’ play out!

- Right now when traders expect a demand surge for Coca cola in any part of the country, for whatever reasons, Coca Cola trucks rush towards that area Instead of putting it under essential commodity and figuring out the hoarders. All traders, honest and dishonest alike, invest money to hoard Coca Cola in that area and since there are so many competitors vying for that business, except for slight increase in prices , they primarily profit by increasing volume coz raising prices is not that viable an option due to intense competition.

- So the deficit is resolved by not catching hold of the people responsible for it rather by bringing more and more competition for that commodity by acquiring commodities from parts where there is surplus of them.

c. Financial Problems

Bank reluctant to give loans to farmers because of the following reasons:

- Lack of credit discipline among farmers
- Agriculture is risky business: agriculture is a risky business because of pests, vagaries of monsoon which may lead to crop failure.

- Low repayment rate
- Some farmers wait for government to disburse their loans: Some farmers wait for government will launch another debt-waiver scheme just before election and thinks that their loan will be forgiven!

- Small credit loans: Farmers need small loans e.g. 10-20-50,000 rupees. Banks need to employ a large staff to look after all the documents and processing work creating additional salary burden and cost of giving loan increases. Banks find it more lucrative to use the manpower in urban branches where individuals need loan in larger amount (e.g. 12-15 lakhs or more in each home loan).
  - No Documentary proof: Many small-marginal farmers don't have documentary proofs for their land/cattle ownership. Which creates problem while filling up the loans-application forms.

    So for the banks giving loan to farmers is risk business and also has low returns.

d. Gap in Information

Farmers mostly depends on the local traders/commissioners, friends or relatives to get the price information. 60.8 % of onion farmers in Karnataka depends on commission agents for price discovery. Also, there is lack of awareness is found among farmers about schemes launched by government. Lack of technology is also one of the major concern.

3. Basic Supply Chain System in Agriculture System

Stakeholders involved in system are as follows:

- **Stakeholders included in Supply Chain**
  - *Creators:* Farmers, Food Entrepreneurs
  - *Contributors:* Middlemen, Retailers, Commodity Exchange
  - *Consumers:* Domestic and Foreign

- **Stakeholders influencing Supply Chain**
  - *Government*: Laws, Taxation, Incentives
  - *Infrastructure*: Transport, Storage, Power

Here is the example of one such supply-chain management:

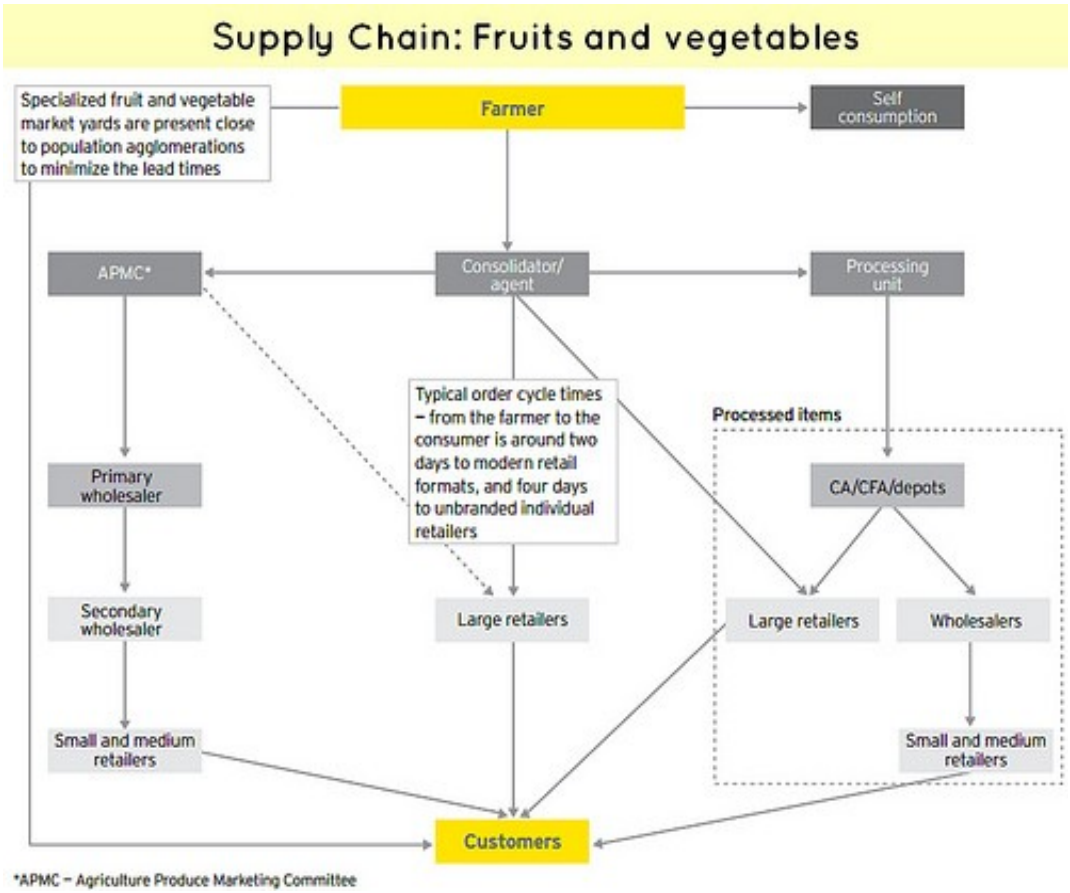

Figure 0 Supply Chain of fruits and vegetables

Due to this large supply chain, each actor involved in chain tries to add his profit in while passing to the next actor in the chain. So at the end, consumer pays very much high cost as compared to what farmer is getting.

4. Some of the Solutions

Now, we will discuss some of the initiatives which government has taken to overcome previously discussed problems:

a. Contract Farming

Contract farming is a forward agreement between farmers and buyers. Buyers agrees to buy produce from farmer at predetermined price. Usually provides inputs (Seeds, fertilizers, pesticides), technology and production practices so that final produce meets his desired quality. Farmer agrees to grow and supply the produce to the buyer at predetermined quality, quantity and prices. So it is a contract between buyer and farmer, what, how much, and of what quantity to grow. This is specified by buyer and is satisfied by farmer. So no intermediaries in between.

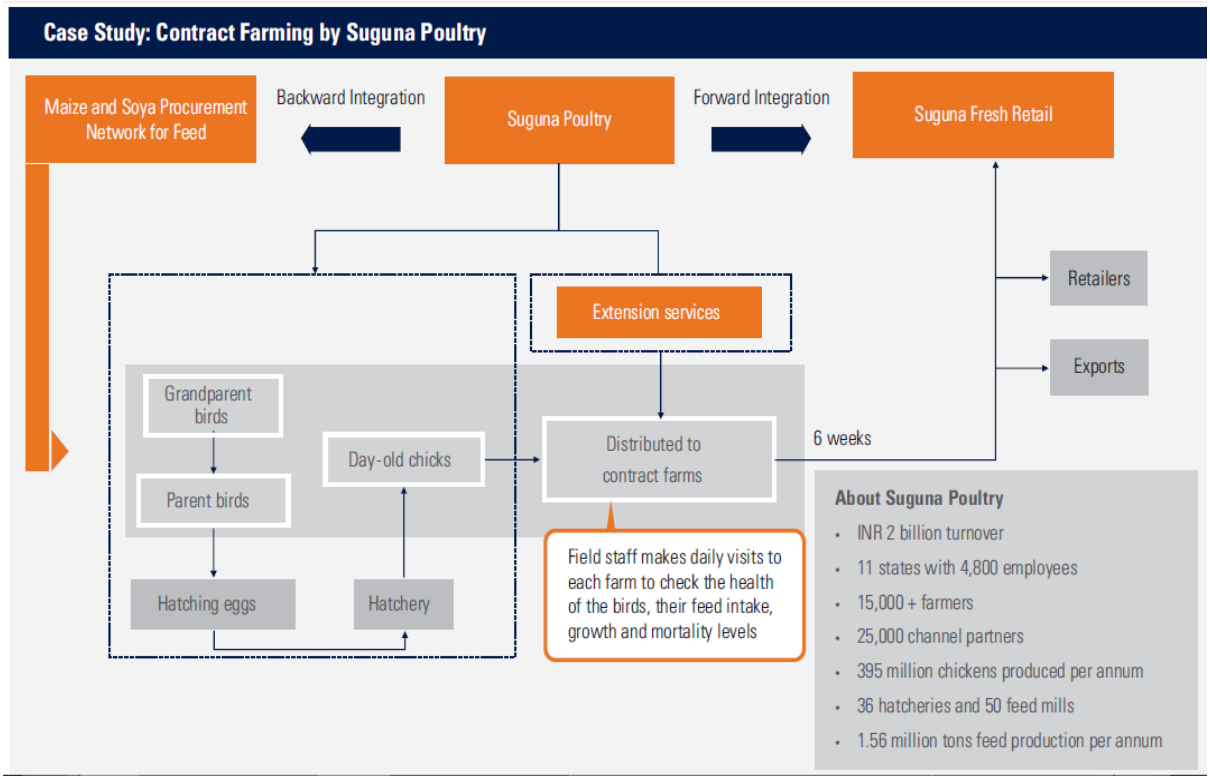

Figure 0 Contact Farming (Example)

Contract farming is prevalent only in those states, **where the APMC acts are favourable** for private player e.g. Andhra Pradesh, Himachal Pradesh, Madhya Pradesh, Maharashtra who adopted the model APMC Act.

Examples of contract farming are as follows:

State	Farm produce	Area under contract farming (acres)	Buyer company
Punjab	Potato, Tomato, Chilli	6000	Pepsico (for their potato chips)
	Basmati, Maize	400	Mahindra Shubhlabh
	Soyabean	1200	ITC
Karnataka	Ashwagandha	700	Himalaya Healthcare
Madhya Pradesh	Wheat	15,000	Hindustan Unilever

Table 0 Contract Farming Examples

Contract Farming also done for export oriented cropping of Basmati, Chilli, Gherkins and soybean.

b. Rythu Bazar

It was started by Andhra government in 1999. Its main motive was to eliminate middlemen and to help farmers directly sell their produce to customers. Every farmer in the Rythu bazaar sells his produce as a retailer.

Currently there are more than 100 Rythu Bazar, which covers more than 2000 villeges and more than 40000 farmers.

Similar kind of direct markets are also opened in other states as follows:

State	**Name Of Market**
Punjab and Haryana	**Apni Mandi**
Rajasthan	**Kisan Mandi**
Tamil Nadu	**Uzhavar Shanthigal**
Maharashtra	**Shetkari bazaar**

Table 0 Direct Marketing Initiatives

In South Korea, with direct marketing of agricultural products consumer prices declined by up to 30% and farmers' income rose by up to 20%.

c. Virtual Markets

The transactions at virtual markets are done with the help of negotiable warehouse receipts unlike traditional commodity exchanges at mandis. The prices of potatoes, onions and others vary significantly between peak harvesting season and lean season. The middlemen at APMC control this storage and supply to make profits.

Then why don't farmers themselves store their produce for the lean season? Because a farmer cannot afford to wait selling his potatoes for such long time in hope of getting better money. He needs quick cash so he can buy seeds, fertilizer, pesticides for the next round of cropping cycle. (and to settle the loans he took for the previous cycle).

The negotiable warehousing receipts can help farmers in saving commodities for future so that they have greater bargaining power and can sell commodities at favourable prices.

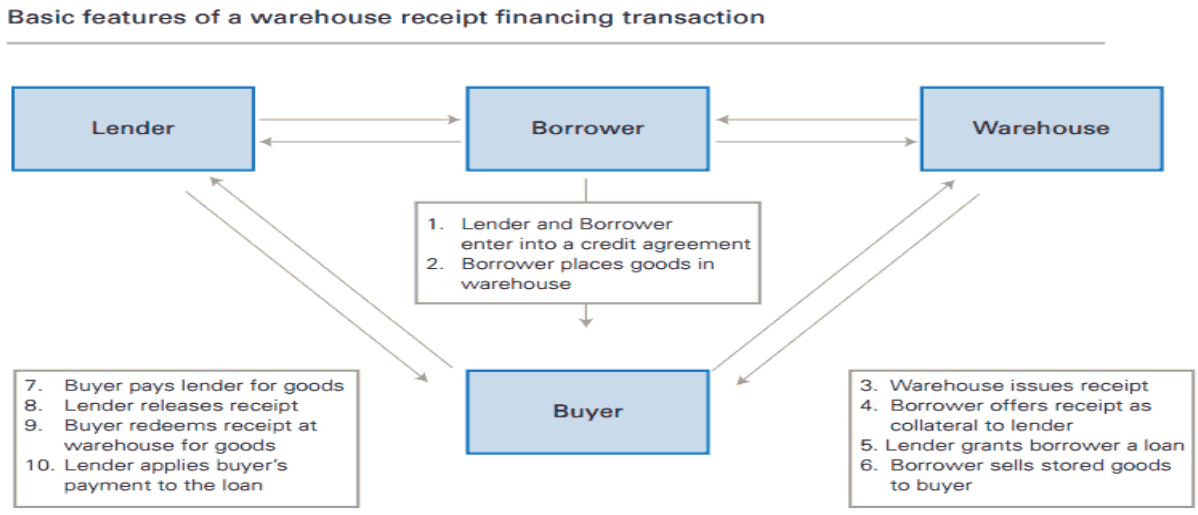

Figure 0 Basic Features of Warehouse receipt system

- Farmer bring his produce to a certified warehouse/cold storage of WDRA (Warehousing Development and Regulatory Authority.).

- He Deposits his produce, gets a piece of paper called “Warehouse receipt”.
- He deposits this “Warehouse receipt” to bank, as a collateral and gets short-term loan for next cropping.
- The farmer can decide to sell his warehouse-produce when prices are favourable (during lean season) and use it to settle the loan.

Example of virtual markets are Future Exchange, Spot Exchange, Warehouse receipt System and Web Marketing. In India, the Multi Commodity Exchange (MCX) and the National Commodity Derivatives Exchange (NCDEX) are the two biggest players in the agro-futures market.

NCDEX :

- Setup an e-mandi (online wholesale market).
- Farmer will first deposit his produce to a NCDEX nominated warehouse, gets receipt.
- This receipt can be traded by the participant on the e-mandi across the country.

MCX:

- Working on similar project like above, with help of Yes bank.
- MCX online portal for commodity trading also available in regional languages to help non-English speaking farmers.

d. Below APMC-Mandi Market

Below the Mandi markets, there are primary assembly markets such as village-bazaar, weekly haat in tribal areas etc. There is wide variation in their governance. Some states run them under Panchayati Raj institutions, some states put them under supervision of district administration. Condition of cattle markets and fish markets are even worse. Most of them do not have even basic amenities like sheds, sanitation or drinking water. Immediate reforms/upgrades necessary in all these markets.

e. Schemes under 12th FYP

Work	12th FYP projection (crores)
Horticulture development	more than 50,000 cr.
post-harvest management + cold storages	more than 7000 cr.
food processing	more than 15000 cr. (in 11th FYP this was barely 4000 crores)

Table 0 Schemes under 12th FYP

12th FYP wants following:

Overall	**1.** Develop the food processing sector to **reduce food inflation and food wastage**

	2. Create **1 million additional jobs** during the Twelfth plan period in the food processing sector
Schemes	1 Set up National **Mission on Food Processing** with State governments' involvement **2** Integrate of various ongoing schemes for horticulture development (NHM, HMNEHA, NHB, CDB, NMMI and NBM) into one **Integrated National Horticulture Mission** 1 Setup 120 integrated cold chain projects, of which 20 projects would be of irradiation facilities. 1 Existing infrastructure development schemes – **Mega Food Parks** Scheme, Integrated Cold Chain Scheme= Expand and modify them.
Finance	1 Setup of **Innovation Fund and Venture Capital Fund** to promote innovations and technology development in Food Processing.
Fancy Things	1 Knowledge sharing and HRD via a. National Institute of Food Technology **Entrepreneurship** and Management (NIFTEM), b. Central Food Technology Research Institute (CFTRI)
Export	**1** Harmonise Indian Food Standards with International **Codex standards.**

4.5.1 Kisan Vision Project

It was initiative by Railway Ministry of India in Mamta's rail budget 2009. Its motive was to encourage creation of facilities of setting up cold storage and temperature controlled perishable cargo centres through Public Private Partnership (PPP).

Under this Kisan Vision project, 6 Perishable Cargo centers were to be developed at:

1. Nasik (Maharashtra)
2. New Azadpur (Delhi)
3. New Jalpaiguri (West Bengal)
4. Singur (West Bengal)

5. Dankuni (West Bengal)

6. Murshidabad (West Bengal)

A Pilot project was started at Singur, WB in 2009 itself but yet to take off because

- Although facility has the capacity to store more than 1,000 tonnes of potatoes, but lack of proper roads for trucks to enter the area. Most schemes seek to get investors to pump money in *(Cold storage)* infrastructure without providing the necessary *(road)* support for the utilization of the infrastructure.

- Cold storage projects have to be near the market, especially the multi-purpose ones. This project was located far away from the market and could not find many takers.

4.5.2 Horticulture Train

We can transfer the produce via three mediums, Air, Road or Rail. Air is very costly and Road transportation is also costly. So, Rail Transport is very effective way of transporting goods in large quantity together which also reduces the cost.

Why Horticulture Train?

Because conventional goods trains have following problems

1. Have no ventilation so fruit/veggie gets rotten

2. Since there is no ventilation, they keep the doors open leading to theft during transport.

3. Slow speed

Benefits/Features of Horticulture trains:

1. Specially designed containers with good ventilation, which increases the shelf life of the produce

2. Container train has been designed to run at a top speed of 100 kilometre per hour (kmph) as against the maximum speed of 75 kmph of conventional railway wagons and truck, faster delivery less rotting.

3. Accepts small quantities, to the unit of one container without agents or middleman. Even small farmers who wish to transport goods to various destinations now have the chance to do so without coughing up huge sums to middle-men or clearing agents.

Let’s see an example, “Banana Train”= connects Maharahstra to Delhi. Lauched in Sept.2012

core cargo	Direction
Banana	Jalgaon (MH) to the rail yard of the Azadpur mandi in Delhi.by the way, Azadpur Mandi at Delhi= Asia’s biggest market for fruits and vegetables.
Potatos	in the return journey (i.e. from Delhi to MH).

4.5.3 Mega Food Parks

The Scheme envisages setting up of 10 Mega Food Parks in high production areas across the country and provides for a grant of up to Rupees Fifty Crores for each Food Park to be implemented by a consortium of companies. Land cost not included in project cost.

The Mega Food Park is an inclusive concept which is aimed at establishing direct linkages from the farm to processing and on to the consumer markets, through a network of collection centres and Primary Processing Centres. Efficient logistics facilities will connect the collection centres to the primary processing centres, which in turn will be connected to a central processing centre.

The Mega Food Park will have a Central Processing Centre as the nuclei of all value addition activities facilitated by Primary Processing Centres, which will act as point of aggregation and primary handling to provide ready to use raw materials to be processed further in the units to be set up in the CPC (Central Processing Centers). The PPCs (Primary processing centers) will be fed by field Collection Centres which will be the first point of contact with growers.

The collection centres which will be managed by local entrepreneurs will serve as farm level aggregation points for adjoining areas within a radius of about 10 Kms. The collection centres, while serving as the primary nodes for the Mega Food Park network will also enhance farm level value realization by providing direct market access to the farmers. Also it is expected that the collection centres will in course of time emerge as centres of rural commerce thereby spurring economic activity in the area.

The primary processing centres which will be located near natural aggregation points will serve a number of collection centres lying in close proximity. The primary processing centres will provide facilities for storage, sorting grading cleaning etc. Some of the PPCs may also house facilities for carrying out primary processing like pulping and juicing. Each primary processing centre will also have transportation facilities like refrigerated vans, trucks etc for transportation of goods from the collection centres and to the central processing centre. Storage facilities will include all weather warehouses and cold storage / modified temperature storages wherever required.

Facilities at Mega Food park

Core Infrastructure Facilities	• Weighing bridge, cleaning, • grading, sorting, packing, • dry and temperature controlled warehouses, ripening chambers, reefer vans etc.
Non-Core Facilities	• administrative buildings, conference room • internet-wifi connectivity for download mp3, movies and games. • training centres, • trade centre/display centres, marketing support system etc • workers hostels, canteen, guesthouses

Common Facilities	• bore well, overhead tank, water treatment plant • sorting, grading, packing, specialized and dry warehouses, • irradiation facilities • testing laboratory, stems sterilization units, food incubation cum development centers • Post office, ATM, Bank branches
Basic Infrastructure	• road-road connectivity • drainage, sewage, water supply, effluent treatment • electricity, telecom-internet • parking bays
Services	• hiring of domain consultants for preparation of DPRs, • supply chain management, logistics

How will these food parks help?

- Reducing post-harvest losses
- Maintenance of the supply chain in sustainable manner
- Additional income generation for the farmers
- Shifting the farmers to more market driven and profitable farming activities.
- It will be a one stop shop where everything will be available at a single location.
- As per experts, it will directly employ 10,000 people.
- This integrated food park will help us reduce supply chain costs.
- It will also reduce wastage across the food value chain in India and improve quality and hygiene to create food products in the country.

What will be the benefits of the food parks?

- This will also bring employment, apart from good remunerative price to farming community.

- Good project of food parks to enhance value of Agriculture sector of India. Poultry and fish production should also be encouraged at village level to increase income of poor farmers.

PM Modi inaugurated mega Food Park in Tumkur, Karnataka on 24th September 2014. Till date, 50 units have been established for food processing.

4.5.4 Cold Chain Infra

What does this cold storage scheme do?

Helps creating integrated cold chain and preservation infrastructure facilities without any break from farm to consumer. Under this scheme, following facilities created:

1. Minimal processing centre at the farm gate level having facilities like weighing, sorting, grading, pre-cooling, cold storage and normal storage facilities;

2. Mobile pre- cooling vans and reefer trucks;

3. Distribution hubs having facilities such as multi-purpose cold stores, variable humidity stores, blast freezing etc.

4. food irradiation plants

Why is Cold storage important?

1. Reduces losses due to spoilage

2. Reduces gluts and distress sale by growers,

3. Reduces transport bottlenecks at the peak period of production,

4. Maintains quality of the produce

5. Ensures that a crop harvested over a period of one or two months is capable of serving the round the year market demand.

Desi cold storages have high operation cost than their foreign counterparts, mainly because of high consumption of electricity.

Reason: Food entrepreneur doesn't buy efficient (and expensive) equipment on Engineer's advice. Instead, they buy cheap quality equipment on CA's advice. Why? Because we saw earlier, government schemes have 'low-ceilings' + if project cost increases too much food-entrepreneur won't get loans under Priority sector lending of Bank and won't be eligible for various tax benefits available to MSME industry.

Food Irradiation:

Food irradiation: foods are exposed briefly to a radiant energy source such as gamma rays or electron beams. This kills harmful bacteria and increases the shelf life of the crop. Food irradiation increases onion shelf life by stopping sprouting which causes the crop to spoil. BARC had setup a food irradiation unit in Lasalgaon in Nasik district of Maharashtra. This Lasalgaon plant can irradiate 10 tonnes of onion per hour.

But In the last four years, not a single onion has been irradiated here. Irony is many of the farmers in this area are not even aware of this facility. So there is need to bring awareness among farmers regarding this.

5. Food Processing Industry

Food processing industry provides plenty of direct and indirect employment opportunities, because it acts as bridge between Agriculture and Manufacturing

When food processing plants are setup near agro/rural regions, they reduce:

1. Poverty among villagers,
2. disguised unemployment
3. exploitation of farmers
4. rural-urban migration
    1. unplanned urbanization,
    2. slums/hygiene/social problems in cities

In the last few years Food inflation has been a major problem. Food inflation is eventually passed through into manufactured goods through higher money wages. Therefore persistent high food inflation is bad for general macroeconomic stability. Well-developed food industry along with compact supply chain can reduce food inflation via:

1. Disintermediation (meaning no middlemen/commission agents)
2. less wastage/spoilage of perishable products

Thus food industry is significant for reducing food inflation. Also, level of Food Processing in India is very low as compared to other developed countries. Some of the statistics are as follows:

Level of Processing across segments (Source: MOFPI Annual Report 2007-08)		
Segment	**Level of Processing**	**Comments**
Fruits and Vegetables	2.2%	USA (65 %), Philippines (78%) and China (23%);
Fisheries	26%	
Poultry	6%	60-70% in developed countries
Buffalo Meat	20%	
Milk	35%	60-75% in developed countries

Figure 0 Level of Processing in India and Other countries

5.1 Food Processing- Challenges

Here are some of the challenges which are faced by food processing industry:

- **Price Sensitivity:** Indian public has low per capita income, so they have higher price sensitivity and higher income elasticity in relation to food expenditure.

- **Preference for Fresh Food:** Indians prefer freshly cooked products as compared to packaged products. Traditional mind set of Indians is that if food is fresh then only it is nutritious.

- **Agri Problems:** Land holding is small and fragmented, Area under cultivation is decreasing due to urbanization, real-estate development, industrialization, There is no common policy on contract farming throughout India.

- **Supply Chain Problems:** High cost of raw material (driven by low productivity and poor agronomic practices), Presence of intermediaries, high cost of packaging, finance, transport and distribution

- **Logistics:** In India, Logistics accounts for about 13% of GDP, which translates to over USD130 billion. This cost is significantly higher as compared most developed countries.

- **Infrastructure:** Inadequate infrastructure of storage, sorting, grading and post-harvest management, Private sector unwilling to invest in logistic or infrastructure under prevailing economic conditions and policy paralysis.

- **Finance**: Hard to get loans (for both farmers and food-entrepreneurs)

- **Taxation:** Taxes on processed food in India are among the highest in the world. Except India, No country distinguishes between branded and unbranded food sectors for taxation.

- **Laws:** Food laws are often inconsistent and overlapping.

5.2 FHEL's Apple Business

It is initiative of Container Corporation of India (CONCUR), a PSU under Railways ministry. Fresh and health Enterprises Ltd (FHEL) is a subsidiary company under CONCUR, started in 2006. The aim was to create world class cold chain infrastructure in the country.

FHEL's Apple Upstream:

FHEL directly procures Apples from Shimla & Kinnaur districts of Himachal Pradesh and transports them to Sonepat for sorting, grading, packing & storage. Company has its own trucks, as a result apples reach to from HP to Sonepat within a day. The company has state-of-the-art storage technology to ensure that the apples last up to 8 months in the storage and sorting, grading, packaging facilities.

FHEL sends Agro-scientists to the Apple farmers on its own cost. These scientists interact with the farmers, help improving apple quality and productivity, post-harvest management. FHEL also arranges all inputs required by the farmers like nutrient packages, pesticides/ fungicides, packing materials, farm implements, etc. FHEL was among the first companies to procure apples directly from

the farmers and has now refined the procurement system. This has eliminated middlemen in the chain. FHEL works in an open and transparent manner (unlike UPSC), therefore, when FHEL procures apples, all the farmers in Himachal Pradesh know the rates offered by it. This acts as a benchmark and all the farmers are able to bargain well with other apple traders.

FHEL's Apple Downstream

FHEL sells its apples

1. via Marketing Associates in Delhi, Mumbai, Chennai, Ahmedabad and other big cities

2. Via Cash and Carry wholesale or Retail Chains such as Bharti Wal-Mart, Big Bazaar, Aditya Birla retail, etc.

With the above upstream and downstream arrangements, FHEL has **shortened and optimized its supply chain** and as a result

1. less spoilage / wastage of apples

2. More profits to both company and farmers, since middlemen are eliminated.

3. Apple available at cheaper price to consumers

5.3 Milk Supply chain

Amul Supply Chain works as follows:

Village Level: In the given village, a dairy Cooperative Society (DCS) is formed. Every dairy cooperative society has approximately 110 farmers. Combined, all DCS together handle more than 18 million kg milk / day. They're equipped with Automatic milk collection unit (AMCUS), computer analyses fat content of milk, automatic printing of receipts etc. So farmers can go to such collection centers and can sell their milk directly to the company. Depending on the quality they are paid and also receipts for the payment is also given to them.

District Marketing Co-op. Union: They process milk and produces butter, ghee, milk powder, cheese, ice cream etc. Example is Banaskantha District Cooperative Milk Producers' Union Limited known as Banas Dairy. They manufacture a large number of dairy products under AMUL, SAGAR and BANAS brands. Usually "Banas" products sold locally, and Amul products sent to other states. Similarly Gandhinagar District Co-operative Milk Producers' Union Ltd. Known as Madhur dairy, in Surat it is Sumul Dairy, etc.

They can sell their products under the brand name "Amul" as long as they meet the requirements of GCMMF. (e.g. must collect 30,000 litres milk daily for a period of three years)

State Milk Co-op Federation: The main head is Gujarat Cooperative Milk marketing federation (GCMMF). All of above district cooperative unions (Banas, Madhur, Sumul Sursagar) etc. fall under GCMMF umbrella.

Amul has more than 5000 outlets of own- at high streets, residential areas, Railway Stations, Bus Stations, Educational Institutions, across India. This "Amul Model" eliminates middlemen and directly engages farmer with the processor (dairy). These cooperatives form part of a national milk grid which links the milk producers throughout India with consumers in more than 700 towns and cities.

6. Role of ICTD in Agriculture

Role of TCTD is to remove information gap, to provide farmers particular information about price, how to grow crops etc. as most of the farmers rely on the commission agents for the price information. So in this section we will discuss how technology can bring change in supply chain management to help farmers as well as buyers.

6.1 Supply-Chain Management (SCM) Systems

Functions of Supply-Chain Management Systems:

Supply-chain management (SCM) software running on networked computers and handheld devices typically performs some or all of the following functions:

- ***Stores information about suppliers.***

In the context of sourcing agricultural products from smallholders, this function would allow a food processing company to know which farmers grow what, as well as other information, such as farmers' names, locations, previous transactions, and previous performance. Such a database makes it much easier to deal with a large base of smallholders.

- ***Enables the company to transmit an order to farmers.***

The order would specify what is required, when it will be collected, and how much will be paid for it.

- ***Ideally, allows production to be monitored***,

Making it possible to manage quality and incentivize high performing suppliers or support poorer performers. The software could provide answers to questions such as which farmers are on schedule, which are behind, and how much product has already been collected from each farmer. If connected to the bank accounts or mobile transaction accounts of the procurer and supplier, such software might also transfer payments when orders are fulfilled.

- Finally, SCM software might ***track the transport of goods*** from the farm gate to the warehouse or retailer.

6.1.1 ICT in Agriculture and problem with above software

The lack of context-appropriate software, the prohibitive cost of hardware, and the lack of supporting infrastructure once made it quite difficult to use SCM systems in developing countries. The diffusion of ICT devices (especially mobile phones) and infrastructure has eased these constraints by making it possible to aggregate smallholders virtually. A secondary-source survey of ongoing or recent efforts toward smallholder inclusion using ICTs and their applications suggests that these technologies can solve many supply-chain problems associated with transactions (ordering, invoicing, payment); logistics (collection, storage, transport), quality assurance (safety, traceability); process management (production oversight, input distribution, extension support); and product differentiation (specialization in organic, fair trade, or regional labels) (figure 10.3). The development of ICT applications for SCM can be driven by a wide variety of agents in the private and public sector, but collaborative partnerships appear to yield more effective applications. For example, agribusiness companies, mobile network operators, third-party service providers, and software firms as well as development institutions and research institutes may participate.

No single ICT application is ideally suited for all procurement contexts or types of producers and actors along the chain. Organizations vary in size, budget, and operations. Some source perishables; others source staple grains. Supply chains encompass larger and smaller ranges of regions and

producers (whose languages and education levels also vary). Not surprisingly, the varying degree of sophistication in ICT applications reflects this diversity. Bigger firms can extend their SCM solutions; other, smaller firms, turn to the off-the shelf software or applications for mobile phones that are increasingly available; still others rely on spreadsheets. Some applications handle everything from transactions to logistics and quality control. Others focus on a smaller subset of areas.

They rely on different combinations of software and hardware, but a combination of mobile phones, PDAs, networked computers, and centralized databases figure prominently in the architecture of most applications. (Module 2 discusses how the accessibility and affordability of ICT devices and infrastructure influence their use.)

For smaller operations, world-class SCM systems may be neither necessary nor cost-effective. These players develop odest systems in-house to manage sourcing challenges. In Bangladesh, EJAB relies on Microsoft Excel and printed forms to track and manage relationships with its potato farmers (USAID 2011).

6.2 e-choupal

Why e-choupal?

According to the MP Agricultural Marketing Act of 1972, every farmer is required by law to sell his or her produce in these regulated markets. According to Upton (2003), transactions outside the mandis were officially prohibited by the government to protect farmers from exploitation by unscrupulous buyers. Open auctions were considered the best safeguard against this." Nevertheless, an estimated twelve percent of the produce is sold by farmers to cooperative societies and village merchants outside these spot markets.

However, ITC used a provision in the by-laws of the Act to procure soybean from farmers at its hubs from October 2000. The state Marketing Act was subsequently amended in April 2003 allowing farmers to explicitly sell outside the mandis provided that the buyers obtain a `Purchase Center License'

Method of Auctioning:

Farmers transport their produce by animal-drawn carts and tractors to a nearby mandi where it is sold through an open outcry ascending bid auction. Field studies reveal that farmers travel 30-40 kms. on average to reach a mandi and they usually make this trip a couple of times each month (Upton 2003; Anupindi and Siva Kumar 2006). The farmer displays his produce in a heap in the mandi yard or simply stands besides his tractor. The auction begins when the auctioneer (a government employee) visually inspects the quality and sets the initial bid. From here the traders bid upwards until the produce is sold. This is a very rapid process and in a matter of seconds the final price is decided. The government employee and the traders move from heap to heap picking up samples of the produce and making a price estimate. In principle, edible oilseeds are traded on the basis of fair average quality (FAQ) determined by the presence of dirt, damaged seeds and moisture content in each lot of produce offered for sale. For instance, the highest or the FAQ price is offered to a sample of soybean that is on a 2-2-10 quality scale (sample contains not more than two percent dirt, two percent damaged seeds and ten percent moisture in the seed).7 Traders start to discount the price of beans when the proportion of dirt, moisture and damaged seeds exceed that level.

Once the final price is set, the farmer's produce is bagged and weighed on a manually operated balance scale. After weighing, the full value of the farmers produce is calculated and the farmer is paid in cash. Oilseed grading is undertaken in an unscientific manner in nearly all mandis; formal testing of the oil content to discern quality is not performed (World Bank 1997). It is important to clarify the various dimensions of soybean quality in this context. The transactions between farmers

and buyers are based on observable features of quality such as the amount of moisture, dirt and damaged seeds in each lot of produce offered for sale. This is mostly dependent on the storage technology used by farmers, which is likely to be highly correlated with the farmers' income. However, there is an unobservable dimension of quality that refers to the amount of oil and protein content of the seed. This aspect of quality is dependent on the variety of seeds planted by the farmers, the timely application of pesticides and fertilizers and use of farming techniques.

Interviews with ITC officials revealed that the distortion of quality undertaken by the agents meant that the company paid a high price for a lower overall quality of soybean, which upon processing yielded less oil and more contaminated DOC. ITC believed that by bypassing the intermediaries, it would be able to better control the quality of the produce and also lower its transaction costs.

Working:

Each internet kiosk was designed to cater to its host village and four other neighbouring villages within a five kilometer radius.

Each e-choupal equipped with a computer with broadband internet connectivity through VSAT and operated by a trained local farmer. The VSAT connectivity, though relatively expensive, effectively overrides the last mile connectivity concerns and enables reliable broadband access to internet based services at the village level.

Internet kiosks were set up in villages that provide information about mandi prices to soy farmers in the state. Along with this information, ITC's own offer price at its 45 hubs is also posted. Specifically, each evening, ITC posts the prevailing mandi prices and its offer price for high (FAQ) quality soybean at the hubs that is guaranteed for the next day. In addition, farming techniques and weather updates are also available in the local language to farmers through the kiosks.

Hubs are mostly warehouses that are established in towns. The 45 hubs include the processing plants leased by ITC. Hubs represent a point of contact between farmers and the ITC. A farmer can sell directly to ITC by going to the nearest hub. ITC's goal is to have a hub within a 30-40 km. radius of its target farmer.

Operation at hub:

Once the farmer arrives at one of the hubs, his produce is carefully tested to discern quality. ITC can offer a price below the posted FAQ price if quality is below the FAQ level. However, the Minimum Support Price (MSP), declared annually by the Government of India, is the lowest price that ITC can offer for a certain poor quality threshold.15 ITC is not allowed to buy below MSP (a condition imposed by the government on ITC). Transactions below minimum support price can only take place in mandis. After the price is set and accepted by the farmer, his beans are weighed on an electronic weighbridge, and the weight is multiplied by the offered price. The farmer then receives cash instantly

The presence of kiosks in a district is associated with an increase in the monthly mandi price of soybean by 1-3 percent, taking into account mandi and month fixed effects and district-specific time trends.

In addition, the dispersion of soybean prices across the affected mandis in Madhya Pradesh decreased after the intervention.

ITC calculated that it saved Rs. 12.9 million in the first year of operation through better quality oil and DOC obtained from processing soybeans procured through the e-Choupal intervention."

The seed, fertilizer and other inputs offered through eChoupals cost substantially less than from traditional sources and have guaranteed quality. On the grain marketing side, in the traditional mandi or local market system there was markup of 7–8% on the price of soybean from the farm gate to factory gate. Of this about 2.5% was borne by the farmer and 5% was borne by ITC. Farmers selling directly to ITC through eChoupals saved about Rs 120 (1 US$ is approximately Rs 44) per metric ton on transaction costs and gained access to good quality inputs and knowledge, while the Company also saved about Rs 215 per metric ton on its transaction costs and had access to good quality produce for its trade and processing industry. In areas covered by eChoupals, the percentage of farmers growing soybean increased from 50 to 90% and the volume of transactions through the government mediated mandis fell by 50%. Soybean farmers who used the eChoupals reported average increases in income, as a consequence of lower input and transaction costs as well as better quality of output, to be of the order of 20% . By 2005, eChoupal services reached out to 3.5 million farmers growing a range of crops–soybean, coffee, wheat, rice, pulses, shrimp–in over

6.3 RML:

Mobile phones are the easiest way now a days to reach farmers / rural people, as they are used widely now a days. So how can we use mobile phones to provide reliable and up-to-date information to market participants?

For a subscription fee of approximately Rs. 80 ($2) per month, RML provides information on local market prices and volumes transacted, highly localized weather forecasts and crop-specific advisory (such as which fertilizer to use or how deep to plant specific seed varieties), as well as national and international news stories related to agriculture

Figure 0 Services provided by RML

Subscribing to RML is a relatively simple process. Prospective subscribers purchase a subscription card from RML's local distributors, such as agricultural supplies stores. To activate a three, six or twelve month subscription the subscriber must call RML's dedicated call centre, and select two crops and three markets for each crop for which she will receive price/volume information, her local taluka (similar to a US county) for which she will receive weather forecasts, and one of nine languages (Bengali, English, Gujarati, Hindi, Kannada, Marathi, Punjabi, Tamil and Telugu) for the text messages she receives. The subscriber begins receiving RML text messages within two days of activating the subscription.

To gather the price and volume information, RML dispatches a market reporter to each market it covers on every day the market is open. The market reporter records the high and low price of the day, as well as the total volume transacted for the highest quality grade of each commodity. In auction markets this is done by simply observing the daily auctions, while in terminal markets the market reporter visits each of the individual traders' stalls.4 The market reporter confirms the price and volume information collected with the APMC officials at the market and transmits this information either via voice call or text message to the central RML system. The information is first validated by an automated system that flags any obvious errors such as typos or unusual price patterns. A chief market reporter then independently checks the prices for several markets and resolves any discrepancies with the relevant market reporter, before submitting the final price and volume information to the system. This information is then relayed to subscribers via bulk text messages. The time of day that price text messages are sent to the farmer depends on the crop and determines whether the information is actionable on the day it is received or the following day. It is worth emphasizing that the system only collects and reports prices for produce of the highest quality. Farmers with lower quality produce can expect to receive lower prices.

Figure 0 Impact of RML

There was an independent study carried out to study the effect of the RML on farmers and in price dispersion of crops. Ministry of Communications & Information Technology of the Government of India directed Telecommunication providers to immediately disable bulk text messages throughout India on the evening of September 22, 2010. The ban was lifted on the night of October 4, 2010 and operations at RML returned to normal on October 5, 2010. For the twelve days of the ban, RML collected price information without being able to transmit it.

Study shows that price dispersion went high about 12% during this period in the area with large number of subscribers as compared to area with low subscribers. After the ban lifting again price dispersion reduced.

One possible alternative explanation is that, as the Indian government expected, there was civil unrest at the time of the text message ban. This would be correlated with the ban dummy and could potentially be correlated with prices if market participants changed their behaviour due to the civil unrest. For example, if there was significant civil unrest, farmers may have felt too unsafe to harvest their crops and visit the local mandis to sell them, and similarly traders may have been scared to go to the market to buy goods. In this case, supply and demand would be thin and price dispersion might increase irrespective of the availability of information. We do not believe this is the case for four reasons.

First, one of the authors was working on the project in India at the time of the bulk text message ban. While civil unrest was expected on the days surrounding the Ayodhya verdict, none was reported on the news, heard of, or personally observed.

Second, even if civil unrest in areas coinciding with the largest number of RML subscribers per volume was a legitimate concern we should be able to identify this in the data through a significant decrease in transacted volumes during the ban in these areas relative to areas with a low number of RML subscribers per volume.

A second alternative explanation is that traders colluded to offer low prices during the ban when farmers did not have the price information. If traders colluded in some markets and not in others, or if the extent to which traders were able to collude differs across markets, then prices in some markets would drop more than in others and we would observe an increase in price dispersion.

Limitation of RML:

It provides price for the produce of highest quality only. So, farmers with low quality produce have to expect low price

6.4 E.I.D. Parry's Indiagriline Services

EID Parry is a large, publicly traded Indian company that sells sugar and fertilizer. It is innovative because it uses a franchise model to create a network of service and collection kiosks. The kiosks distribute information and other services for smallholders to improve sugarcane production; in turn, they make it easy for farmers to sell their sugarcane to EID Parry. EID Parry depends on smallholders to remain competitive. It sources sugarcane from 80,000–100,000 farmers for nine sugar-processing plants it operates in three states of southern India and earned over US$ 280 million in revenue in 2010 (EID Parry 2010).

Supply-chain information comes to farmers through EID Parry's Cane Management Software, which enables farmers to forecast demand, access records of their previous transactions with the company, register their sugarcane area, submit payment information, and monitor demand, among other services. Most of the content consists of the extension information provided by state universities or independent foundations in partnership with the company.

In the pilot launched in 2001, 16 kiosks, called "Parry's Corners," were deployed with the Indiagriline system in 16 villages near the largest sugar factories. These kiosks were connected to a main Internet server in the factory by a cheap, easy-to-maintain wireless access technology called "corDECT".

Instead of paying for and operating the kiosks, the company opted for a franchise model. Independent local entrepreneurs became franchisees by investing US$ 1,000 for space, computers, and standard equipment such as a printer, power backup, telephone, and furniture. They also pay for operational costs such as Internet and power. The company offers financing through local banks if necessary. In exchange for the franchise arrangement, EID Parry provided training and assistance to the franchisees and the right to use the brand, sell products, and source sugar on behalf of the company. Over the first years of project, EID Parry spent US$ 500,000. Operators can expect to earn US$ 16–40 per month. The franchisees earn their revenue from additional services offered at the kiosks along with Indiagriline.

As FAO (2005) notes, the information system obviously removes critical barriers that have kept farmers from participating in the commercial sugar supply chain. Farmers receive relevant and timely information regarding sugarcane production, the company effectively communicates demand and quality requirements, and farmers can demand a fair price and be assured of a market. Further, agricultural yields, access to finance, agricultural extension services, and time required to transact with EID Parry all have reportedly improved.

6.5 Virtual City's AgriManagr

Virtual City is a private Kenyan technology startup founded by entrepreneur John Waibochi in 2000. The AgriManagr software is used by collection centers to manage the process of buying agricultural produce from farmers. The application runs on mobile phones or PDAs.

When a farmer brings his or her produce to the collection center, it is weighed using an electronic scale that sends data via Bluetooth wireless technology to a handheld device. The data are appended to the farmer's transaction record. The farmer (who is uniquely identified through information on his or her smartcard) is paid without cash through a mobile payment system and given a printed receipt (the scale is wirelessly connected to a printer) noting the current transaction. The receipt also contains a record of the farmer's previous transactions at the collection center. It serves as a proxy for the farmer's creditworthiness, just as a credit history does in developed nations. The farmer can use a record of consistent earnings at harvest as collateral for credit.

Data from the collection center are held in the PDA until they can be uploaded or wirelessly transmitted to a main server in the field office, where all the data from various collection centers are gathered and consolidated. Data from various field offices are sent over the Internet to headquarters, where they are consolidated. In this way, field offices and the headquarters are immediately aware of how much of what has been collected, from where, and when. In the meantime, the collected products are sent to warehouses where entire truck payloads can be weighed. The weight is recorded and sent to headquarters, where it can be cross referenced with the data from collection centers and field offices to ensure no product was lost on the way to the warehouse.

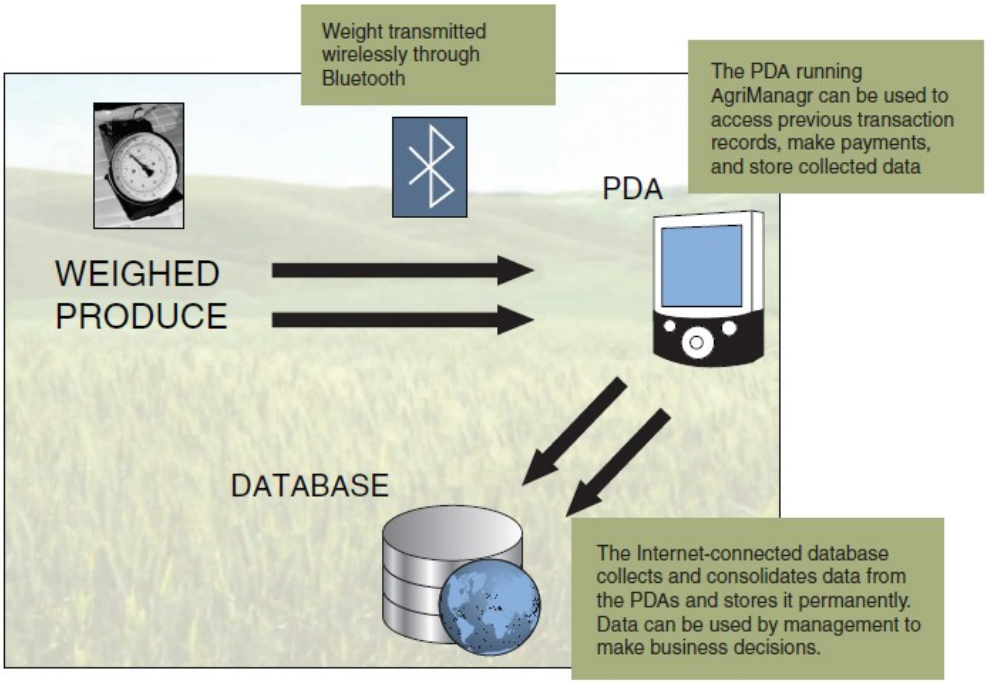

Figure 0 The AgriManagr System

Farmers, the company claims, receives an average weight that is 9 percent higher than weights recorded using manual scales. Farmer presumably benefit from rapid cashless payment and from being able to use their transaction records to obtain credit.

6.6 ACDI/VOCA's ICT Solutions

ACDI/VOCA innovated by working with Infosys to develop SCM software that reduces the barriers private organizations face in sourcing from India's smallholders. Beyond developing the software, ACDI/VOCA developed the business case for its use by several large food logistics firms.

ACDI/VOCA is an American non-profit with annual revenue of US$ 124 million. To augment their own learning, ACDI/VOCA hired Accenture Development Partnerships to analyse the need for an ICT solution and determine which capabilities would add the most value. In a competitive bidding process, they selected Indian software giant Infosys to develop a product that would be commercially viable and obviate the need for donors to support future development and maintenance. A critical piece of the agreement was ACDI/VOCA's willingness to allow Infosys intellectual property rights over the software.

By 2008, this extensive collaboration had resulted in freshConnect, a software application that could be accessed by networked computers, mobile phones, and PDAs using wireless technologies. The software has three main modules. The first module (Order Placement) allows procurers to place an order, which field agents then divide among suppliers. The application continuously monitors prices at wholesale markets to determine minimum and maximum prices that the procurer will pay when placing an order. The quality required can also be specified when the order is placed. The second module (Order Fulfilment) allows field agents to collect information on the quality and quantity produced at harvest. The third module (Order Shipment) allows field agents, farmers, and procurers to track the produce and trucks in transport.

After a pilot phase, the software became commercially available through Infosys, which charges a setup cost and a transaction cost based on the volume of produce supplied. Two major Indian food retailers, HyperCity and Radhakrisna Foodland (RF), became the first agribusinesses to use the software commercially to source directly from a cooperative of more than 300 farmers.

Impact:

Farmers report earning 15–20 percent more through fresh- Connect. HyperCity and RF report a 10–15 percent reduction in postharvest wastage. An independent evaluation has yet to be conducted to verify these claims.

The financial crisis of 2008 ultimately caused RF to go out of business. At the same time, other commercially developed information services such as RML entered the space. Additional customers have not signed on to use freshConnect because the product is more expensive compared to those of new market entrants. Finally, Infosys has not succeeded in tailoring the licensing terms and marketing efforts to retail grocery chains.

6.7 TIPCEE's ICT Application in Ghana

USAID's Trade and Investment Program for Competitive Export Economy (TIPCEE) in Ghana was innovative in its use of ICTs to enable fruit and vegetable exporters to become sufficiently competitive to link with international value chains. The project used barcodes, GPS, and geographical information system (GIS) to ensure that produce could be traced to the smallholders who grew it—a major requirement to participate in the target export markets.

The project's two main initiatives were to: (1) include smallholders in supply chains by systematically improving product quality and reducing costs and bottlenecks in each supply chain and (2) implement broad policy reforms to improve the enabling environment around the supply chains and make them more competitive.

The TIPCEE project used GIS and barcode applications with GPS readers, barcode scanners, a wireless mobile network, and networked computers to address the traceability problem. GPS readers communicate with global positioning satellites to indicate the exact location of a place on the earth's

surface through latitude and longitude coordinates. These coordinates can be collected from the boundaries of a particular farm and fed into a GIS application on a computer, which can map the location of the farm, often with great precision. Once a farm is mapped electronically, a product from that farm can be traced back easily to the source if the product is marked with the coordinate information, which can be done with barcodes but is typically done by physically marking the items. The advantage of barcodes is that, once assigned, they can be scanned at points along the supply chain to track not only the origin but the path of goods from the farm to the end consumer. In this way, GIS maps can, in conjunction with barcodes, ensure traceability.

The use of precise electronic maps can lead to superior production planning (actual area is often below declared area) and yield forecasting. Knowing the location and size of farms makes it easier for procurers to monitor production and improve the targeting of assistance and inputs. It is unclear whether GIS mapping affected TIPCEE farmers' incomes or inclusion in a particular supply chain, however. What is known is that by 2009,
12,000 farms on more than 20,000 acres had been mapped for all types of crops (USAID 2009). The use of GIS mapping is replicable elsewhere if funding and training are available.

6.8 Some other initiatives:

iCommunity of HP: The iCommunity of Hewlett–Packard (HP) at Kuppam in Andhra Pradesh State. Each CIC functions as an autonomous store that provides services that range from computer training, Computer-based services like email, form downloads, communication, Government to Citizen services, Business to Citizen services, and other Information and Communication services. One such service is the Farm Information System or FIS which provides farmers with modules on package of practices for the major crops grown in the respective regions; tele-agriculture (to solve crop management related problems), market intelligence, training and a supply chain module to facilitate procuring farm inputs and for selling farm produce. The store (CIC) is run by trained local entrepreneurs who recover the operating costs by charging for the services provided [9]. On an average, the number of visitors to each CIC seeking its services varies from 5 to 20 a day. Besides providing for livelihoods to the rural entrepreneurs who own and operate the CICs, the Centres provide several useful government and banking services through a single window. The Centres have also trained several hundreds of rural people and students in the use of computers and computer-based services providing them employment opportunities. In addition to new products, HP is also creating intangible business assets (e.g., new networks and increased familiarity with new markets) that will have an important impact on its bottom line and make the company a stronger competitor in the global economy. The experiment has already created business value to HP. Many of the online products developed at Kuppam have potential for application in other areas in Asia and Africa where HP has set up similar CICs [6].

iKisan.com: The iKisan.com, which is an initiative of the Nagarjuna Group in Hyderabad, India, is more a platform for sale of its own and third party products (farm inputs), services (knowledge based crop management) and information (weather, markets). The investments in ICT infrastructure are limited to maintaining a web portal (http://www.ikisan.com) in local language at the company site and an information kiosk staffed by its trained representatives in villages. The representatives are agricultural science graduates. The village kiosk has dial-up access to the web portal. Last mile connectivity is serious concern and lack of broadband access at the village level requires that much of the content in the kiosks is made available offline by porting it to CDs. Only the weather forecasts, market information and email services are generally available online at the village level. In the State of Andhra Pradesh in India where the services were provided mainly to cotton farmers through 14 kiosks in the year 2000 yields increased on an average by 5% and cost of cultivation was reduced by 14% resulting in net income increases for the farmers.

iVillages of Pondicherry: funds from international donors and multilateral agencies. The hybrid model intranet is quite effective in such sharing and the staff at the hub can even hold video conferences with village knowledge centers if required with domain experts invited to the hub. Typically, each center

provides locale specific information of weather and local weather forecasts, prices of agricultural inputs and outputs, potential for export, entitlement of government and other benefits, health care, cattle diseases, transport, wave heights, areas of abundant fish catch, etc.

n-Logue: The n-Logue case is an example of a rural Internet Service Provider (ISP) setting up rural knowledge centers. n-Logue is a for-profit corporation set by the Telecommunications and Computer Networks (TeNET) Group of Indian Institute of Technology (IIT), Chennai, to provide both connectivity and services based on wireless technologies. Its basis is that if wireless coverage of 15 to 20km is established from the small towns (up to which fibre optic connectivity is available), one can cover almost all villages in India.

Gyandoot: Gyandoot is essentially an e-governance initiative to improve governance at the village level by offering a range of services that include information on weather, market prices and crop management for the farmers. The village information centers are managed by the village panchayats (local governments) which recover part of the operating costs (like operator salaries, telephone and internet charges) by charging nominal fees for services and providing many off line services like computer training.

7. Challenges faced by ICTD

- Internet Connectivity
- Illiteracy of people
- Maintenance of kiosks
- Capital cost of Kiosks
- Failure of online trading on Soybean
- Middleman does not support transparency

8. Suggestions

- Online close bidding: Web based portal can be designed to implement closde bidding where farmer and buyers ab state quantity, quality and prize for the product and using linear programming requests can be satisfied.
- Use of Geographical Information System (GIS) to help farmers in farming
- Contract Farming with the use of SCMs
- Infrastructure development through Private Sector Participation (PSP)
- Harmonisation of taxes
- 100 percent tax breaks in Research and Development (R&D) sector
- Easy Financing
- Promotion of Indian Food in global markets

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