

AGRIFACTURING: THE GAME CHANGER THAT INDIA DEFINITELY NEEDS

Largescale manifold improvement in its very low farm yields to global best-in-class levels by massive technology adoption, largescale value enhancement by food processing “exclusively” by Farmers Collectives, and largescale rural employment generation in food processing is AGRIFACTURING - which will allow India to realize the \$2.5 Trillion annual incremental Market Opportunity to feed additional 2 Billion people globally over next 30 years - and become the Feeding Bowl of the World – and in the process comprehensively addressing a large number of socio-economic problems faced by our country.

About two years ago, having decided to quit the corporate world to work pro-bono in the villages, I was seeking advice from a top policy maker of Government of India on areas to focus on in the villages. *His categorical advice was, if at all I want to work in the villages, I must work for upliftment of the farmers.*

Sometime later I came across two quotes from Bill Gates: *“If we are going to win the fight against poverty, we must help farmers”*. And *“Melinda and I believe that helping the poorest small-holder farmers grow more crops and get them to the market is the world’s single most powerful lever for reducing hunger and poverty”*.

These direct and indirect advices to me became the guiding light for me, and I dived headlong to understand what farming was all about. In the last two years, I have travelled over ten thousand kilometres in Rajasthan, Haryana, UP and MP visiting hundreds of villages, meeting several hundred farmers of all hues – super rich very large landholder “MSP farmers”, creative and entrepreneurial farmers, corrupt and unscrupulous farmers, small-holder farmers living at the fringe, marginal farmers fighting for subsistence, and landless farmers eking out a living where other farmers have given up. I have visited several Agri Centre of Excellences and Agri Research Centres of the Government, met with Agri officials, experts and workers at Centre, State and village level. And for last two years I have been specifically working with the farmers of 9 villages in Alwar District in Rajasthan. I think I have a good “outsider’s ring side dispassionate view” of what ails our Agri-sector and what potentially can be a fix.

For the uninitiated, ~70% of India (that’s ~900 million people – three times the population of the US) lives in the villages, and most of rural India is engaged in agriculture or associated vocations. Almost all of India’s ~70 million extremely poor (below poverty line) lives in its villages, almost 80% of youth (~390 million employable rural population) is unemployed in our villages, all our measurement parameters for education and health get overwhelming skewed by underperformance in rural India. Our children are hungrier, more undernourished, more wasted, more stunted in our villages. Our women are more anaemic in our villages. Average income from agriculture is abysmally low (more on it later). The life that we take for granted in the urban areas, doesn’t exist in our rural India. The inequalities in rural India just multiply manifold as compared to inequalities of urban India.

In not so distant future, the rural India, backed by pervasive internet access and therefore access to eye-opening information for the first time, will question vehemently the favours accorded to urban India at the expense of rural India (why Delhi’s Government schools should be so slick and rural schools be in shambles, and likewise rural dispensaries, and likewise rural infrastructure, and

likewise rural security, etc.). In short why should Urban India have so much resources dropped in for bettering its quality of life – at the expense of Rural India? The time for elitist India to decide what is ok for rural India, I think is over. I believe rural India is waking up as never before to demand its fair share of India's prosperity.

Unless we fix rural India, there will be no equitable prosperity in India. And unless we fix farming, we can't fix rural India. For India to realize its fullest economic and developmental potential, we must galvanize the Agri-sector – there is no alternative to it.

As we would do in the Corporate world, let me try to build a "Business Plan" for fixing the Agri-sector by making a case for "AGRIFACTURING".

A. PROBLEM STATEMENTS:

1. **Very low income from farming:** Foremost, the average income from agriculture for "rural household" (with average 4.94 members per household) is INR 3140 per month – that's less than a third of "an unskilled daily labour" in the city/town. If we slot it on India's monthly income pyramid (more like a lizard's tail), where 90% of India earns less than INR 12,000 a month, and 50% of India and 75% of rural India earns below INR 5,000 a month, farmer's average income from farming is nearly a third of India's national per capita income.

As most of rural India (that is ~70% of India) is engaged in farming or associated vocations, low income from farming becomes single most important influencer in dragging down the average per capita income (INR 11,254 per month), and more importantly dragging down the median income (which stands at INR 4815) a truer measure of income distribution.

2. **Unsustainable Farming:** Farming has become very unsustainable primarily for two reasons - low landholdings and low productivity - resulting in very low income from farming. The landholding of Indian farmers is abysmally low. Average farm holding per farmer is ~1 hectare (compared to average farm holding of 125 hectares in the US). 87% farmers in India are small-holders (35% with <1 ha holding) or marginal farmers (32% with <0.4 ha holding). Small holdings take away the ability to access capital and invest in farming.

Second reason is very poor productivity per hectare as compared to global best in class productivity for almost all commodities (for e.g. Wheat, India 2.8 tons per hectare, best in the world 8.9 tons per hectare; Rice, India 3.99 tons per hectare, best in the world 12.03 tons per hectare; Onion, India 16.6 tons per hectare, best in the world 67.3 tons per hectare, etc.). This is primarily on account of very low technology adoption and highly inefficient agriculture practices.

3. **Very large unemployed youth in villages:** There are nearly 390 Million employable rural people today. While 100% rural youth prefers a Government job (in order of preference, Armed forces, paramilitary forces, police, teaching, state government administration, including peon, etc.), less than 10% get accommodated in Government jobs. An equal number leaves the villages to join private sector in the cities. The balance 80% village youth, largely unskilled, does menial casual farm jobs or no job at all. This has significant ramification for socio-economic and democratic fabric of the country.

4. **Not enough food to feed growing global and Indian population by 2050:** By 2050, world's population will be nearly 9.7 Billion – nearly 2 Billion more than the current population. Of these 2 Billion, 400 Million will be the population growth in India over next 30 years, making us at 1.7 Billion people, the largest population country in the world.

In addition to the growth in population, as the per capita GDP increases in the developing world, so will per capita food consumption. It is estimated that the world would need to produce at the least 50% to 70% more food from the current levels to feed the global population.

The world has concluded that with our current resources and technologies, we will not be able to feed increasing global population. (If the world doesn't figure out ways to cultivate far more food on less land, we'll need to convert nearly two India's worth of forests, grasslands, and other ecosystems to agricultural fields according to a study by World Resources Institute – that in turn would increase annual emissions by 15 billion tons of carbon dioxide and equivalent gases – far exceeding the 4 billion tons permissible under models that hold global warming below 2° C). This equally applies to India.

While there are significant investments being made in various parts of the world in developing alternate technologies for upping productivity to be able to feed another 2 Billion people in next 30 years, we in India are still not sensitive to this catastrophe in the making. We are currently (2019) ranked 72nd (of 113 countries) on Food Security Index, we are ranked 102nd (of 117 countries) on Global Hunger Index. We don't have enough food, and what we have, we are not distributing it right and feeding our children right.

B. THE DRIVERS:

Presented below are key Business, Market, and Socio-economic Drivers.

1. **Days of Traditional Largescale Job Creation in every sector are over.** India's foremost thought leader, Nandan Nilekani believes that we will not see traditional largescale job creation by both the Government and the Private sector as in the past. Technologies like AI, IOT, ML, Robotics, Automation etc. will replace repetitive jobs (the largest number of jobs). With 3D Printing, large scale traditional manufacturing will undergo a massive change where largescale jobs will be replaced by fewer jobs and small entrepreneurs.
(<https://swarajyamag.com/books/the-jobs-crisis-is-going-to-get-worse-nandan-nelikani>)

In rural context, this spells doom on the unemployed 390 million – largely unskilled/semi-skilled young people.

2. **Traditional Manufacturing (Industry 3.0 or 4.0) in India will not be a massive job generator as it has been in China or the West.** Manufacturing is undergoing a massive change with automation, robotics and upcoming 3D Printing. Not just this will reduce number of jobs significantly, it will pull back manufacturing closer to the market, taking away manufacturing jobs from countries like China and India. India further has a significant disadvantage as its large MSME (Micro, Small and Medium Enterprise) segment – the surround needed for a successful manufacturing segment, barring a few sectors (Auto), is uncompetitive and lacks the teeth in every aspect be it quality, cost, scale or market access.

There are no miracles that will happen in traditional Indian manufacturing sector that can generate millions of jobs, as they have done in China.

3. **Urbanization of India will create more ghettos and deplete for everyone whatever quality of life exists.** Its being predicted by top consulting companies as well as by Government agencies that urban population in India will grow from 30% today to nearly 60% by 2050 when we will be nearly 1.7 Billion Indians. That's nearly 1 Billion Indians in cities – up from 400 Million today. The problem is that is 600 Million people (twice the number of people in USA!) moving from rural India to urban India – with no/low quality jobs, in cramped spaces/ghettos with overstretched underwhelming infrastructure, in overwhelming pollution and with zero quality of life. This largescale rapid urbanization will result in significant discontent (not just for the movers, but also for the incumbents) that will be severely detrimental to social as well as democratic fabric of the country.
4. **Doubling farmers' income is truly an underwhelming goal.** The goal to double farmer income from INR 3140 to INR 6280 a month does not solve anything for the farming community. A housemaid in metros earns nearly two to three times of average farm income – INR 12000 to 15000 or more, minimum wage of unskilled worker in cities like Delhi is INR 14,842. Where is the incentive for our farmers to toil to earn INR 6280 from farming? It will not enable “equitable prosperity”, it will not enable to invest in technology or access capital, it will not be a disincentive to move to cities. Doubling farmers' income is a short-term fix (that is actually not a fix) of a massive structural problem.
5. **Farming in India, with its current practices, is among the biggest contributor to Carbon Footprint and it appropriates extraordinarily large Resources.** There is no national crop planning resulting in improper crop farming disregarding suitability of climate, soil and water for growing a crop, and coupled with excessive use of water, fertilizer and pesticides, and very low technology adoption, it results in increasing carbon footprint, depleting soil and water quality and significantly depleting resources. Farming consumes 89% ground water in India, it is one of the largest consumers of electricity and polluting Diesel. It is also one of the largest beneficiaries of Government subsidies and doles with poor commensurate returns.
6. **One of best use case for top technology development will be farming.** The enormity of the problem of feeding additional 2 Billion people in next 30 years – with increasing per capita consumption – without increasing the carbon footprint, will be a major driving force in developing new farming techniques and upping the productivity. 5G, AI, IOT, ML, Big Data Analytics, Droning, Gene sequencing and genetic engineering – all of them will have massive use case in farming.

C. THE MARKET OPPORTUNITY: BECOME THE FEEDING BOWL OF THE WORLD

Global Food market is about \$4 Trillion today with average per capita annual consumption at \$537 (highest being \$5000 per capita for Hong Kong, US and Scandinavian countries around \$2600-\$3000 per capita, lowest being around \$200 per capita for Uganda, Tanzania, Uzbekistan).

India's Food market is about \$480 Billion today with average per capita annual consumption at \$372 (India's IT and ITES sector in comparison is about \$180 Billion today).

By 2050, even at constant per capita annual consumption (\$537), for feeding additional 2 Billion people, the incremental annual Global Food market size will be \$1.1 Trillion. However, as per capita GDP increases in the developing world, so would per capita food consumption. It is estimated (by FAO) that the world would need between 50 to 70% more food from the current levels to feed the global population. That would be a whopping additional \$2 to 2.8 Trillion food products from current levels.

This ~\$2.5 Trillion Incremental Global Food Market is the big Market Opportunity for India for becoming a Global Food Market Leader.

Consider this:

- India has the 2nd largest pool of arable land (160 million hectares) in the world after US (174 million hectares)
- India has the 2nd largest irrigated farmlands (68 million hectares) with 43% of its arable land being irrigated (US has only 15% arable land irrigated)
- India is the 2nd largest food producer in the world – it is among the top 3 producers in the world for every major commodity cereals, fruits, vegetables, milk, etc.
- But India’s farm yields/productivity per hectare are 2 to 6 times less than the global best-in-class farm yields/productivity per hectare for every commodity. (FAOStat)

Yield Comparison				
Commodity	Average Yield India (Tons/Hectare)	Most Productive Country (Tons/Hectare)		India’s Headroom for Growth Best-in-Class/India (Times)
Wheat	2.8	8.9	Netherlands	3.2 X
Rice	3.99	12.03	Australia	3.0 X
Sugarcane	66	125	Peru	1.9 X
Cotton	1.6	4.6	Israel	2.9 X
Mango/Guava	6.3	40.6	Cape Verde	6.4 X
Banana	37.8	59.3	Indonesia	1.6 X
Potato	19.9	44.3	US	2.2 X
Tomato	19.3	524.9	Belgium	27.5 X
Fresh Vegetables	13.4	76.8	US	5.7 X
Onions	16.6	67.3	Ireland	4.0 X

We have a scenario where the world, with its current farming techniques will not be able to produce enough food for its 9.7 Billion people by 2050; whereas the “huge headroom for growth” that India has – with existing best-in-class farming technologies and techniques available globally, with its second largest arable land - it can increase its yields “2 to 6 times” by just increasing its current farm yield/productivity levels to current global best-in-class levels.

The Market Opportunity for India is to become the **Feeding Bowl of the World** by just adopting Best-in-Class farming technologies and practices – available today (and without being saddled with high cost of R&D in newer technologies being developed) to increase its production by 2 to 6 times across all commodities.

India has all the ingredients necessary to address the huge incremental global market opportunity – very large arable and irrigated land, huge headroom to improve yields, large farm resources, and significant opportunity to reduce carbon footprint in farming.

However, yield improvements will solve only part of the problem by farm income enhancement. The raw produce will still not address many problems associated with farming and rural India – it will not help in generating jobs in rural India, farming will still be at the bottom of the food value chain without benefitting the farmers, raw produce export is and will be heavily regulated by WTO, etc.

We must therefore raise farming manifold in the food value chain by enabling farmers themselves to become food processors - not just enhancing the value of their raw produce manifold, but also generating huge employment in the rural areas.

Largescale manifold improvement in its low farm yields to global best-in-class levels by massive technology adoption, largescale value enhancement by food processing “exclusively” by Farmers Collectives, and largescale rural employment generation in food processing is AGRIFACTURING - which will allow India to realize the \$ 2.5 Trillion annual incremental Market Opportunity to feed additional 2 Billion people globally over next 30 years - and become the Feeding Bowl of the World.

D. PLAN

The crisis in Agri sector requires to address its structural challenges comprehensively and holistically. If we have to have a sustainable resolution to the problems of Agri sector, we must not choose easy, quick fix solutions, and must take hard measures.

Also, we must not look Agri sector as something of a resource guzzler and constantly in need of doles and subsidies. We must grab the opportunity to become feeding bowl of the world, and in the process make Agri sector a thriving and profitable sector gainfully employing millions.

There are three significant and bold transformations that we need to execute:

1. Organize 100% Farmers in Farmer Producer Companies/Organizations (FPC/FPO)

Farmer Producer Companies/Organizations are companies owned exclusively and 100% by farmers. Every farmer, no matter how small or big, owns identical share in the company. The company is registered and governed by laws as any other private limited company in India.

FPC/FPOs provide a platform for the shareholder farmers to aggregate their input and output for better cost and price from the market; it allows access to capital like any other company for investing in solutions (capital equipment, warehouses, etc.) and technologies for collective use by the farmers; it allows the farmers to become entrepreneurs.

FPC/FPOs are a great measure for all the farmers – and specifically for small and marginal farmers who, if not organized, will just not have the ability to survive. The ability of FPC to make farming a business for the farmers is its biggest asset for the farmers.

Despite creating a specific organization for development of FPC/FPOs – Small Farmer Agriculture Consortium (SFAC), and also nominating NABARD as another “promotional” agency for FPCs/FPOs, and allocating budgetary support (for developing paltry 10,000 FPCs each with 1000 farmers - that is just 10 million farmers out of 145 million farmers), the progress in developing FPC/FPOs is very poor.

Lack of awareness in the farmers about FPCs, lack of commitment by the supporting/promoting organizations in really working with the farmers to develop FPCs, and bureaucratic processes for farmers to establish and develop the FPCs are all huge barriers.

What we must do:

- Make a **specific Department of the Government** *with teeth* that owns establishment and development of the FPC/FPOs
- **100% farmers must become a shareholder of an FPC/FPO** over a stipulated period (24-36 months). To ensure compliance, no subsidies/doles should be provided to any farmer who is not a shareholder of an FPC.
- **Significant handholding** by Management Institutes, Corporate India (as part of CSR initiatives) to develop the FPCs. Develop specific FPC oriented Management courses in Management Institutes for developing specific management talent for the FPCs.

We must target over next 5 to 10 years, we create 145,000 FPCs with 100% farmers shareholder of these FPCs to develop 145 million entrepreneurs rather than farmers.

2. Massive Technology Adoption and Migration to Precision Farming

Indian agriculture is among the most tech starved agriculture in the world. Indian agriculture's Achilles heel is not MSP, farm loan waivers, or even irrigation (we have world's one of the largest irrigated farmland area). It is abysmally low adoption of technology in every aspect of farming:

- Our yields are among the laggards compared to the best in the world, so we are growing less food per hectare and hence our farmers earn far less per hectare
- Our mechanization is among the lowest in the world, therefore we are hugely dependent on farm labor which itself is becoming a massive challenge today, and we are least efficient
- The drudgery involved in farming because of low mechanization and low income (as a result of low yields) is pushing ~390 Million employable rural folks away from farming
- Every part of farming technique employed are archaic:
 - Non-existent national/regional crop planning – we grow water guzzlers like rice and sugarcane in water starved areas, and we grow millets and grams that need less water in hugely irrigated areas
 - Blatant mishandling of the most precious farming resources, Soil and Water. Non-existent pre and post harvesting soil care and rejuvenation, and hugely wasteful use of irrigated as well as monsoon water
 - Inadequate quality seed and sapling availability
 - Negligible adoption of new farming techniques and technologies (drip irrigation, poly-house, mulching, grading, etc.)
 - Non-existent yield prediction and market channelization
 - Huge post harvesting losses (30 to 40% loss of farm produce post harvesting)
 - Inadequate or non-existing post-harvesting storage/packaging solutions

What we must do:

- **National/Regional Crop Planning:** We have no crop planning at all. We must plan - at national level to regional and local levels - our crops based on market demand, climate conditions and monsoon history, soil and water condition, and yield histories. We must optimize all our natural resources to deliver best possible yields.
- **Pervasive adoption of key technologies and solutions:** We must ensure 100% adoption of key technologies and solutions (Drip Irrigation, Mulching, Solar Pumps, Poly-house (for suitable crops), post-harvest storage, chillers, smart packing etc.) that will enable water and soil conservation and help in significant improvement in yields and reduction in farm produce wastage. These technologies should be mandatorily adopted by the farmers – and should be linked with any subsidy availed by farmers – no adoption, no subsidy/dole.

[For e.g. Drip Irrigation allows for 50-60% reduction in water consumption (that mean agricultures' consumption of 89% ground water can be potentially cut down by half), 50-60% fertilizer and pesticide reduction, significant improvement in soil nutrients (by reducing weeds, fertilizer and pesticide consumption and stopping soil run-off) and it helps increase the yield by 50-70%, and it significantly increases quality of the yield. Drip Irrigation alone allows for significant reduction in carbon footprint of farming.]

These key technologies should be either 100% funded/subsidized by the Government, or the FPC should be facilitated with rolling fund to provided interest free loans to the farmers to pay for the unsubsidized cost of these technologies for adopting these key technologies.

- **Migrate to Mass-scale Precision Farming:** We must target to migrate to Precision farming (optimized use of all resources – water, fertilizer, pesticides; conservation of all resources water and soil; reduction in input, increase in output and predictability of input and output) over 10-15 years.

National/Regional Crop Planning: Massive Data Analytics of soil, water, monsoon, yield histories, market demand to develop national/regional crop planning

Soil and Water Management and Care: 5G enabled largescale IOT deployment for soil and water monitoring, management and rejuvenation

Smart Irrigation and Fertigation Solutions: IOT enabled intelligent irrigation and fertigation management

Crop Management: Droning and UAVs for growth monitoring, crop management and crop imaging

Yield Prediction: AI based crop yield prediction

Precision Farming will allow us to have massive control on all aspects of farming.

Precision farming will have two significant by-products:

- **Enabling a very hi-tech, cutting-edge tech - multi-hundred Billion \$ industry around agriculture**, generating large number (hundreds of thousands) of white-collared top tech jobs in the field of farming – attracting the youth and top tech talent to farming.

Massive Big Data Analytics for National Crop Planning for a country as varied as India with massive data-variations is a project significantly bigger and complex than Aadhar.

5G's most comprehensive use case will be agriculture requiring IOT based for real time crop monitoring and data collection for managing soil, water and produce.

Extensive IOT and ML deployment for various equipment for smart irrigation and fertigation.

UAVs/Droning will have largescale deployment in crop imaging and interventions for Precision farming.

AI will be used significantly for yield prediction.

- **Significant Reduction in Carbon Footprint of farming** by use of water and soil conservation technologies, significantly reducing use of fertilizers and pesticides by smart irrigation and fertigation solutions, crop rotation by suitable crop planning.

3. Food Processing Industry Exclusivity to FPCs/FPOs

The yield increases will enable income enhancement of the farmers; however, yield improvements will solve only part of the problem by farm income enhancement. The raw produce will still not address many problems associated with farming and rural India – it will not help in generating jobs in rural India, farming will still be at the bottom of the food value chain without benefitting the farmers, and raw produce export is and will be heavily regulated by WTO, etc.

The difference between the raw produce (say a kg of potato that the farmer sells for INR 10 per kg) and processed food (PepsiCo sells Potato wafers for ~INR 400 per kg) – this manifold (40x in this example) value enhancement by processing the food, makes a strong case for farmers to partake in the pie of enhanced value of processed food for equitable distribution of wealth.

We must therefore raise farming manifold in the food value chain by enabling farmers themselves to become food processors - not just enhancing the value of their raw produce manifold, but also generating huge employment in the rural areas.

What we must do:

- **FPCs/FPOs should have exclusivity over Food processing units.** Food processing should be necessarily reserved for FPCs/FPOs from a cut-off date within next 5 to 10 years. This will allow development of massive rural based Food processing industry that will provide significant value enhancement to the farmers for their produce and will generate massive jobs for rural youth in small to mid to large scale farmer owned rural food processing companies.
- **3rd Party Manufactures of Branded Food processing companies to be transitioned to the FPCs.** Branded Companies (like ITC, etc.) use 3rd party manufacturers extensively. These 3rd party manufacturers should be transitioned to the FPCs and Branded Food processing companies should help develop FPCs/FPOs as Food Processors. (If ITC, etc. can help develop 3rd party manufacturers, why not FPCs)
- As an alternative for protecting existing investment of existing Food Processing companies, they must bring in **FPCs/FPOs as significant equity holders in existing processing companies** to help farmers get equitable return of their produce.

We must enable 145 million farmers to become entrepreneurs/businessmen who control the entire value chain from raw material (farm produce) to finished product (processed food) to elicit fulsome value of their produce, as well as generate millions of jobs for rural population in rural food processing industry.

We must appreciate that India still is largely an agrarian country, where nearly 70% of its people still reside in villages, nearly 145 million families are farmers, Agri-sector contributes nearly 16% to Indian GDP – and yet our rural India is the poorest among poor on all parameters of prosperity – education, health, income and quality of life. If we don't fix this huge inequality with 70% of India, we are in for significant socio-economic turmoil in the times to come.

Although bestowed with some great assets for farming (2nd largest arable land, among the largest irrigated land), the farm sector is mired with many problems with its abysmally low yields as compared to global best in class yields, small landholdings, low tech adoption, low resources (soil and water) conservation, and increasing carbon footprint.

At the same time, India's farm sector is standing at the verge of realizing one of the greatest opportunity ever to become the feeding bowl of the world's additional 2 Billion people in 30 years and become a dominant global player in incremental \$2.5 Trillion annual market opportunity.

AGRIFACTURING will enable India's farm sector to realize this huge global opportunity that will not only significantly increase the prosperity of the farming community and rural India by partaking in the value enhancement of its produce to processed food for global consumption, it will generate large number of jobs for rural youth, it will stem outflux to urban centers and avoid turning them in ghettos, it will enable reduction of carbon footprint in farming by massive technology adoption that enables reduction of harmful elements (excessive use of water, fertilizer, pesticides, etc.) and conservation of resources (water, soil), it will allow development of one of the biggest use case for top technologies (5G, Big Data Analytics, IOT, AI, etc.) generating top-tech jobs in India.

AGRIFACTURING is the Game Changer that India definitely needs.