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## India's Biggest Challenge: The Future of Farming

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*India has enough food; does it have too many people working in agriculture? The pressure on land is an outcome of policy, which condemns most people to marginal farming. India needs a different set of solutions for agriculture and for those working the land.*

India is an agricultural country. Agriculture is “only” ~16 % of GDP but the largest sector for employment. Officially farmers are only a few hundred million, but adding family members who help or occasionally farm, as also wage labourers, the number of farm workers is likely to be closer to half a billion people. But how many people would India need farming if it were as labour efficient as the US for growing crops? I am not suggesting it is possible, or even desirable (large, mechanised farms with massive chemical and water inputs) but as a thought exercise? Just four million people.

The US is extreme; with less than 2% of its population growing food sufficient for almost 2 billion people, but much of it is fed to animals. The US also focuses on many crops suitable for mechanisation, but even using metrics from many East Asian countries, with about 10% of the population in agriculture - as opposed to half the workforce for India - that is hundreds of millions of people who could shift to alternative options.

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Jobs aside, India needs to shift from basic farming to more efficient, sustainable, and productive farming. Unfortunately, today's agriculture policies fail to recognise how crop choices, input costs, and the supply chain are intertwined, perpetuating marginal farming. Moreover, growing more food isn't the solution to providing employment. There is enough food, especially considering calories as opposed to micronutrients. Exports are possible but require extensive value add, and it is not clear how much of this would benefit the farmer as opposed to the processor or trader. Fundamentally, India must figure out a way to provide meaningful employment to hundreds of millions of people outside agriculture. Failing to do so means not just a failure of human development, it represents a political if not social powder keg – underemployed and disaffected youth are a national security threat, becoming fodder for radicalisation, a life of crime, or worse.

### Farming as a Viable Livelihood?

Agriculture is dying, OK, not as in the production of food but as a desirable profession. For all the bucolic if not romanticised portrayals of farming and a rural lifestyle, it is really a thankless, risky, and even back-breaking job, especially as undertaken by the masses, which is *subsistence agriculture*. One bad yield, whether due to errant rains, pests, etc., and most farmers have no buffer available. This also makes farmers risk averse, with an implicit cost of capital some 50-100% (!), which is essentially one season or one year of horizon. Most are not able to undertake long term investments, innovation, or major change.

The clearest indicator of the problems of agriculture as a profession is how there are actually shortfalls of labour in some areas, with larger farms relying on imported farm labourers, drawn not just from the neighbouring states but from the far ends of the country (especially the north-east) and even Nepal. Younger generations do not want to follow their parents' footsteps, which pushes urbanisation. Unfortunately, urban areas, while offering more opportunities, also relegate many to low-end jobs.

Farmers tell me the Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA or MGNREGA, formerly NREGA) has heightened the problem. In fact, Schedule I Clause 12 of NREGA (2005) states, “As far as practicable, a task funded under the Scheme shall be performed by using manual labour and not machines.” This highlights how MNREGA has really been about jobs, instead of output or productivity. But instead of slicing the pie, agriculture needs to focus on growing the pie. Adding employment into farms is unlikely to change yields much, and certainly will not increase revenues sufficiently to compensate for increased labour costs. One possibility is for MNREGA to coordinate with cropping cycles, to enable a more steady balance of opportunities (and labour supply). Not only are farm sizes in India very small, they are declining due to population growth and competition for land. Per National Sample Survey Organisation (NSSO) estimates the average size is some 1.2 hectares only, and the median is lower. Other estimates places

indicate 70% of farmers operating below one hectare in size. In farming, size matters. On average, smaller holdings lose money, i.e., their household costs are higher than revenues, a chunk of which come from non-farming activities. The smallest farms are afloat since they do not pay for labour, relying entirely on the family, and they consume much of what they produce, influencing the choice of crops.

So how does a farmer make more money? Let us hold off on changing crops, as market-focused changes often lead to future risks with debt and price volatility, such as for the fabled *guar* plant, whose gum has been exported for shale gas production to the US. The simplest means to make more money is to produce more with less input, meaning productivity. But herein lies the fundamental problems. Indian productivity is not so low, and is very good in selected crops, especially sugar. For cereals, using Food and Agricultural Organization (FAO) data for 2012, the yield of Indian cereals is 2.88 tons/ha, versus 3.67 for the world average. Even Western Europe showed a yield of 6.65 tons/ha, implying we can double our output per hectare, but not much more.

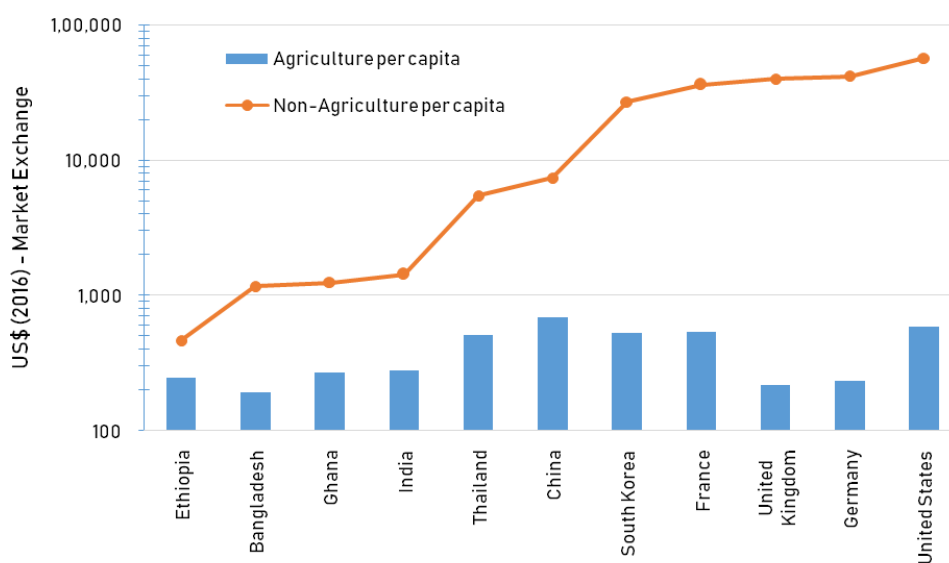
However, even if we doubled or tripled our output, would that double or triple farmer's earnings? No, since a glut would reduce prices. I have met cutting edge farmers who use high-tech methods (importing their seeds from Israel and the Netherlands), whose per acre yields are 20 times the average. But their much higher yield does not even require additional labour – and much of what they need is for packaging, which is seasonal.

More than simple supply-demand equilibria, the agricultural sector has many distortions and dislocations, not just middlemen, but also a very poor supply-chain, with lack of cold storage and efficient transport. While not precisely known, India [wastes some 20% of its fruits and vegetables](#), and highly perishable/seasonal ones (which are often worth much more in rupee terms) may lose more. As economist Ajit Ranade and others point out, a number of improvements are needed in terms of [markets, flexibility, etc.](#), allowing farmers to choose whom they sell to, at what terms, etc.

The last point worth considering is that food and agriculture are not the same. Expenditures on food span the value-add, including processing, preparation, service in restaurants, etc. This is why in the US, food is now one of the biggest household expenditures, with extensive “eating out”. In India, eating outside the home is still low, but the trend is rising, not just as a luxury but with changes in demographics.

Importantly, farming revenues will not rise much even as India's income rises. In fact, the ratio of total agriculture income to total population is relatively flat across countries *regardless of* per capita income. Rising GDP means growth of non-agricultural incomes. As Figure 1 below shows (in log scale), India is not very different from a number of advanced countries in absolute GDP coming from agriculture spread per capita. There is some room for growth, but far less than growth in GDP. This tells us farmer incomes normally rise only when there are fewer farmers.

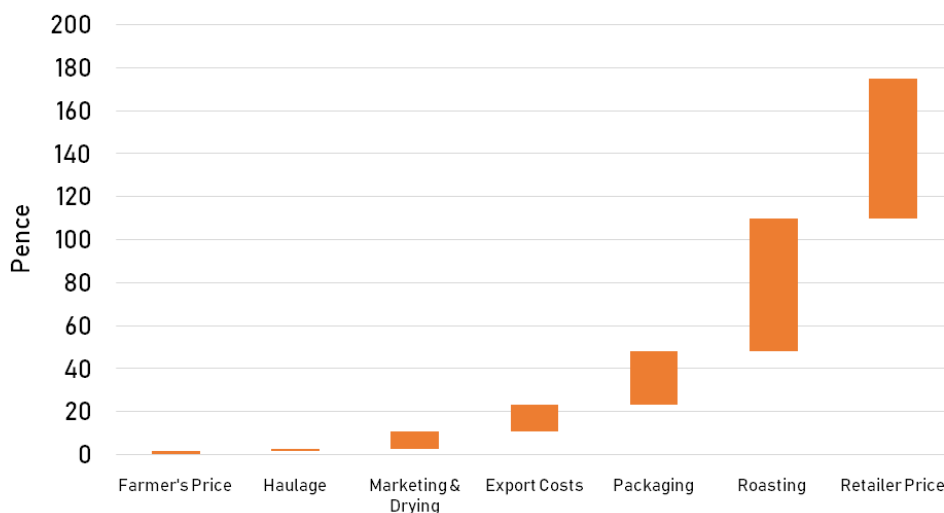
**Figure 1: GDP per capita**



Source: World Bank

How else do we grow farmer incomes? Exports are one option, as are cash crops. Even with these, the share of end-product like a chocolate bar or coffee cup going to the farmer is often miniscule (see a representative retail coffee shop value chain in the UK, in Figure 2 below). Even as we add “processing” to our industrial growth, while that prevents wastage and adds overall value, we have to consider how much (or little) will go to the farmer.

**Figure 2: Value Chain - Cup of Coffee (UK)**



Source: Guardian Earth Special (2003)

While today’s equilibrium share to the farmer may be miniscule, the good news is this suggests it is theoretically possible to raise farmer revenues disproportionately without measurably impacting the final product price much. But how do we make that happen? Can one actually pay just 1-2% more for a cup of coffee but ensure all of that goes to the farmer, doubling his or her income?

**Stop Looking at Agriculture**

We have already seen that size of holding matters – on average only the bigger farms make modest money. As per the NSSO data, farmers on average spend about 30% of revenues on inputs, mostly fertiliser and labour (together almost half of input costs). This is despite the fact that fertilisers are heavily subsidised, and electricity (rather, irrigation) is ostensibly nearly free. But this masks the fact that small farmers lose money, and the median farmer is small.

Actually, the median farmer is a labourer – they don't have their own farm. Socio-Economic Caste Census (SECC) data indicate that when we consider irrigation, 56% of rural homes have no land, often working as labourers in farms, and thus not the beneficiary of “free electricity”. Less than 10% owned any irrigation equipment, mostly electric but including diesel. A small fraction is located where they get canal based irrigation. Almost 30% depend on the rain. Thus, it is only very small fractions who are the beneficiaries of free electricity, and many of them actually sell water to their neighbours. This exposes the justification of electricity distortions in the name of the poor – they don't get free electricity.

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Why do farmers grow certain crops? Smaller farmers end up growing staples, and they consume much of it themselves. It is more the larger farmers who grow cash crops, e.g., sugarcane, which benefit not just from high support prices but also cheap water. And such crops use a lot of water. If we consider the Karnataka-Tamil Nadu Cauvery water dispute, for all the clamour over Bengaluru running dry, [domestic consumption is just about 6% for the entire basin](#) – the majority goes to agriculture, much of it for sugarcane. Support prices combined with distorted retail prices are why farmers pick “bad” crops when it comes to inputs. Why else do we grow so much rice in Telangana, which until the late-1970s instead had coarse grains as the staple diet?

A back of the envelope calculation shows the peril. One kilogram of rice requires over 1,500 litres of water to grow (this is a relatively efficient case – the average is worse). If this water is pumped up from deep water tables, this consumes a lot of energy. Say the water table depth is 200 metres – some areas are far deeper. This means by pure physics it consumes 0.8 kilowatt-hours (kWh) of energy to lift the water for 1 kg of rice. But pumpsets aren't 100% efficient – many are very poor, under 50% efficiency, and numerous are only 33% efficient. This means almost 2.5 kWh of electricity per kg of rice. While farmers do not pay real costs, the true cost of electricity supply is at least Rs. 6/kWh (an estimate, varying by state) which means about Rs. 15 of electricity is used per kg of rice for regions with deep water tables. Given the [minimum support price](#) of rice is only Rs. 17.5/kg, clearly this is not sustainable. Admittedly, not all the water comes from pumpsets, but the majority might. We should only be growing rice in places with lots of rain and/or very shallow water tables! Unfortunately, another major cash crop, sugarcane, also requires a lot of water.

The impact of virtually free power for farmers is not second order, it is a key factor for bankrupt electricity distribution companies (discoms). Part of their staying nearly afloat is by overcharging commercial and industrial electricity consumers, something that also directly impacts India's economic competitiveness, and thus jobs.

## Existing Solutions are Outdated or Ineffective

Indian support for agriculture has had multiple drivers, some ostensibly noble (keeping food affordable), some less so (vote bank politics). Support has ranged from administered prices (both to farmers and end-users through ration shops or other schemes) to subsidised or even free inputs such as power, water, and fertiliser.

At some point, we need the political will to question current support mechanisms to check their equity, efficiency, and macroeconomic impact. Perhaps current policies are the wrong medicines for the problems – we blame execution failures as the problem, but maybe it is really a problem of diagnosis. The problem is not just leakage per se, famously diagnosed by a former Prime Minister, but is far worse: a fundamentally broken system.

Beyond liberalisation of pricing and supply-chain restrictions mentioned previously, a few suggestions include:

### 1. Improve productivity and efficiency

This generalism includes harnessing technology to reduce costs and increase yields. More than distortions via pricing signals, crop choices (or even application of inputs like fertiliser and water) are far removed from proper science which should guide best practices based on fundamentals such as soil, climate, water availability, etc. “Conventional wisdom” dominates, and we do not have enough networks of agricultural colleges and scientists. While drones, satellite imagery, soil sensors and IoT (Internet of Things) grab a lot of attention, we still have a ways to go before “low-tech” solutions like drip irrigation become mainstream. Major investments are also

needed in processing and supply-chain, including cold-storage. One [lesson from ITC's e-Choupal](#) initiative was that free information isn't sufficient – alternative physical systems (points of transaction or sale) are also required.

## 2. Think system level and price inputs correctly

One way to improve system level efficiency is to price inputs like water and fertiliser properly. Thanks to subsidies, our fertiliser mix is distorted towards overuse of urea. Today's system of cheap inputs also means farmers have no incentive to save electricity by installing an efficient pumpset. Paying for water isn't just about marginal choices in pumping; it would fundamentally change choices of crops. If we worry about water today, the situation will only worsen as climate change progresses.

There are numerous mechanisms to provide support or subsidies that still align with microeconomic efficiency. Direct Benefits Transfer (DBT) is just one mechanism with lots of promise, but we must also plan for alternatives to ensure the poorest of the poor are not left out.

## 3. Start taxing high-income agriculture

Doing simple arithmetic, it is not so many farmers who'd actually have to pay taxes. With today's Rs. 500,000 per annum tax-paying effective threshold, excluding standard deductions, assuming 30% costs out of revenues (post subsidies but excluding transportation), that means some Rs. 750,000 of farming revenues are required to begin to pay taxes. Even assuming, say, Rs. 8/kg revenue for onions (which is often higher than today's farmer receipts), that means almost 100 tonnes of onions must be grown to hit taxation thresholds. Assuming 2 crops in a year (just as a thought exercise), that is 50 tonnes output, which translates to a farm size of about 3 hectares, which puts the said farmer well into the upper 5-10% of the farming population. With these outputs, he or she would pay just the entry level (tier) of income tax, today just 5%, even excluding any of the myriad allowable deductions on income tax, further reducing the applicability of even a minimum income tax.

The point of this tax isn't the exchequer revenue but the signalling it provides. A senior electricity department official shared the information that he tabulated about 2,000 pumpsets with a politician and his clan. That's at least Rs. 7 crore per year of electricity freebies, more if they have good quality supply used year-round (or oversize the pumpsets).

This is before the issue of agriculture being a laundry machine for businessmen or politicians (being tax-free). How many remember the genesis of the term “farmhouse” that described palatial residences (often second homes) for the rich on the then outskirts of Delhi? That was nothing but a loophole contravening limits on the Land-Ceiling Act – large plots were only allowed for “farming”. We need to shut down farming as a loophole. This same loophole is often exploited by providers of water in tankers. A number of them use free power under the guise of agriculture to draw underground water to sell to parched urban dwellers.

## 4. Focus on quality or value, instead of quantity

We want food to be as cheap as possible but why should those same input (subsidy) benefits apply to growers of flowers or cash crops, who also happen to be relatively richer (larger farm size) growers? Perhaps policies need to differentiate between food staples and cash crops.

As long recognised, lack of calories is not India's food problem, but nutrition, especially micronutrients. Cardiovascular disease (CVD) is now the [leading cause of death](#) for Indians, only some of which may be based on genetic risk. Pollution, lifestyles, and diet all matter. In the US, by the 1970s poverty became associated with obesity, not under-nutrition. We're not quite there yet, but it's only the really rich who can afford fresher, varied produce, especially fruits. This is before we touch the massive issue of food adulteration. A parliament committee famously observed that [over two-thirds of milk in India is adulterated](#).

## 5. Go organic

While some people may contest organic being healthier versus not, let's just leave it where the science is not conclusive. But, absence of proof is not proof of absence! Organic is not a fad – as a senior colleague pointed out, when he was a child, *all food was organic*.

Organic is important for India for several reasons. First, we spend lots of taxpayer money on the inputs, especially fertiliser. Second, organic production relies more on labour as a substitute for other inputs, something relevant for employment. Its intensive nature does not favour economies of scale, but that expressly fits well with India's smaller farm sizes. There are also studies showing that over time, especially combined with crop rotation, organic farming requires less water than conventional farming. Third, while the health

impact for consumers is debated, the system-level impacts are clearer. Farmers who have overused conventional pesticides have [high cancer risks](#), and unabated use of antibiotics in livestock rearing is a major cause for drug-resistant infections. While this is a global challenge, India ranks worst in the world in terms of [antibiotics in chicken](#). This is one of the unintended consequences of cheap drugs combined with lax oversight.

Soil scientist [Rattan Lal's Law of Marginality](#) states, “Marginal soils cultivated with marginal inputs produce marginal yields and support marginal living”. What this means is that poor soil needs some inputs, especially as we lose old practices of annual soil flooding and replenishing. Maybe India can start with semi-organic farming, i.e., immediately losing pesticides, but gradually phasing out chemical fertilisers. A variant mentioned in the 2019 Budget by the Finance Minister is Zero Budget Natural Farming, which also focuses on breaking input cost burdens. While it has potential, current [studies](#) are too small to examine scalability and variation.

Organic farming might cost a little more, but there are several more serious challenges that deserve policy attention. First, there is a fallow period where traditionally farmed soil is left to recover, and even the initial yields are low. How will a farmer survive? Second, farmers need a lot of education and hand-holding in this process. Lastly, there are issues of trust – Indians are famous for bending the rules. I have family that isn't against organic, or even willingness to pay, they just believe they are being taken for a ride – paying more for regular produce. Establishing organic as a true offering needs innovative thinking, beyond just labelling and certifications. The state of Sikkim is reportedly 100% organic, proving this can work at scale. This represents a great case study to examine how they did it. If they're producing organics to “export” especially to Bengali elite, that is not a sufficient model across the country, especially not in the short run.

### **If Not Agriculture, What Else?**

Given limits to farming as a viable profession for hundreds of millions of people, even efficient and sustainable farming, the government needs to give other sectors the same political focus they have given farmers. Most job growth has been from the informal sector, partly for structural reasons including small operations and labour regulations that burden growth, but also because of a proclivity for employers to desire “cheap labour”. But existing cheap labour is unlikely to be skilled or efficient.

Much has been written about India's skills problem. Infosys famously runs its “[university](#)” (training campus) for incoming hires because quality from most colleges isn't up to par. If we don't have appropriate skilling for our graduates, what realistic hope is there that some government programs will re-skill farmers for new jobs? Vocational training is one option, but India can also do far more emphasising technology and agriculture skilling efforts such as [Digital Green](#).

At the end of the day, it is hard to “out-China” China. Instead, India needs to focus on its niches, its domestic needs, and gaps that global players might not be filling.

It is beyond the scope of this piece to delve into issues of global competitiveness, but there are a few insights from China, which [used industrialisation \(manufacturing\) to employ about half the people leaving farms between 1992 to 2012](#), a much larger shift than India saw in the same period. Let us leave aside the fact that Chinese government truly supports industry (to a level that other countries find problematic) – in India industry and government policies aren't always aligned. There are challenges to trying to become a global manufacturing hub, notably is the world ready for two China-sized countries being manufacturing powerhouses? China already has a capacity overhang (underutilization), limiting India's competitiveness, at least in the short term.

There are four major components of industrial competitiveness:

1. Energy costs
2. Costs of capital (borrowing or raising money)
3. Logistics and supply chain
4. Labour (including skills)

India does poorly on all four fronts. Let us take the example of manufacturing solar cells, distinct from solar panels. India does not make any solar cells (as of now), despite being the number two country in the world for growth of solar power. To make solar cells, about 40% of the cost is energy. India's electricity for so-called “paying customers” (commercial and industrial) is amongst the most expensive in the world (even before purchasing power parity (PPP) adjustments), much of which is due to nearly free power for agriculture. Indian interest rates are about [5 percentage points higher than China's, and even more compared to many OECD](#)

(Organisation for Economic Co-operation and Development) countries. Logistics is purportedly 13-15% of GDP, instead of the 8-9% in, say, Germany. China’s cost of shipping bulk goods is even lower. Lastly, cheap labour? India’s skill deficit is already well known, and we cannot substitute quantity for quality. Productivity is what matters, not to mention for high-value products like solar cells labour is a small fraction of total costs.

At the end of the day, it is hard to “out-China” China. Instead, India needs to focus on its niches, its domestic needs, and gaps that global players might not be filling. If we consider electric vehicles as an example, freight is considered very tough to electrify, but most of the world is trying to solve the problem of “big trucks” which need a long range and huge tonnage (over 25 tonnes). Such trucks are perhaps only 2% of Indian usage. Most Indian duty cycles are short-to-medium distances and/or smaller size, vehicles that also happen to be responsible for a disproportional share of local air pollution. We can build an entire industry around different and modular designs for electric freight vehicles, catering to unique use cases. The more we can be nimble, differentiated, and integrate hardware and software (including scheduling apps), the greater our niche if not advantages will be.

While non-agricultural GDP growth is critical to solving the farming livelihoods challenge, we cannot ignore farming itself. After all, these are not an either-or proposition. Even if we treat food as a basic right, that does not mean we can not also view it as a commodity. The sooner we move agriculture away from politics, and stop applying band-aids to fundamental challenges, the sooner we can take bold steps in other directions.