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Input and price subsidies vs. payment for environmental services? Two contrasting scenarios for Andhra Pradesh in 2050

National Workshop on “Harnessing the Potential of Natural Farming” ICRISAT, Hyderabad, 15-17 September, 2022

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**Input and price subsidies
vs. payment for environmental services?
Two contrasting scenarios for Andhra Pradesh in 2050**

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Workforce livelihood
Food
A World Without Farmers
A World With Farmers and Nature

Agro-industrial scenario?
Agroecological scenario?

**National Workshop on “Harnessing the Potential of Natural Farming”
ICRISAT, Hyderabad, 15-17 September, 2022**

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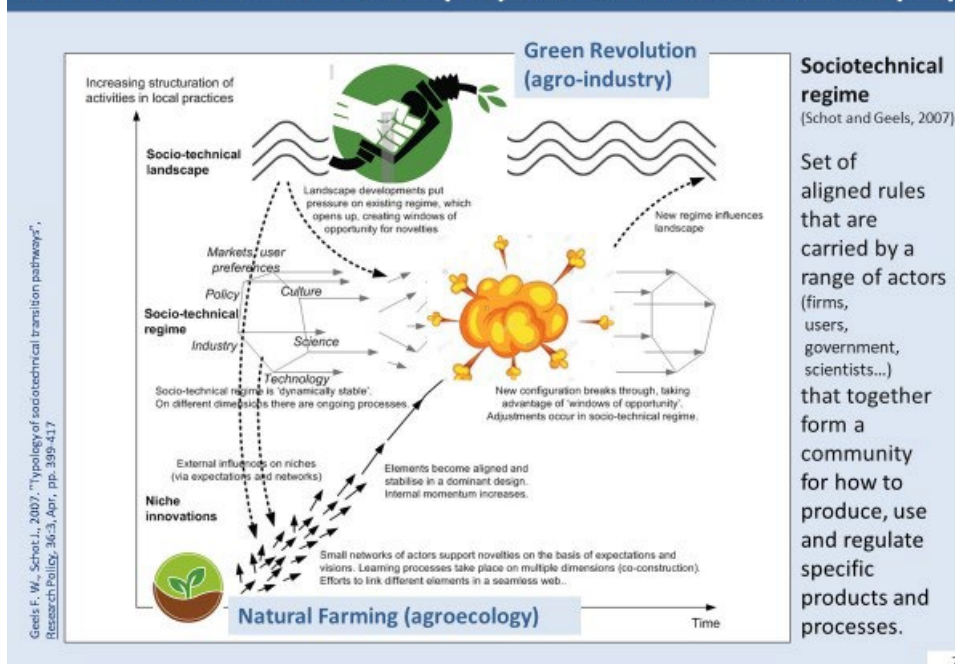
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Dear colleagues,

I was very honoured and grateful to ICRISAT for inviting me to share views and work on Natural Farming in India during this national workshop on “Harnessing the Potential of Natural Farming”.

Today, I will present you some preliminary outputs of our foresight study “AgroEco2050” with the Government of Andhra Pradesh, the FAO, my research institution Cirad and a group of Indian experts of about 30 persons. With these preliminary results, I will also present you some basic estimates I have made regarding public incentives to reduce the huge and growing inequalities that prevail in Indian society today.

Incremental innovation (GR) vs radical innovation (NF)



[*] In our foresight study, we imagined and compared two contrasting scenarios for Andhra Pradesh in 2050, based on two archetypes of sociotechnical regimes:

- (1) that of industrial food and agriculture which prevails in India today through the techniques and institutions of the Green Revolution,
- (2) and that of agroecology which is embodied by the current development of the Andhra Pradesh Community-managed Natural Farming, or “APCNF”.

Agroecology and APCNF clearly challenge our conceptions of land and labour productivity in economics or agricultural sciences. They challenge the current global regime of industrial food and agriculture. In other words, they challenge a set of aligned rules that currently dominates amongst scientists, government, firms and users that together form a community for how to produce, use and regulate specific products and processes.

Agro-industry (GR) vs Agroecology (NF)

AGRO-INDUSTRY

- **Specialization** in a few standardized mass-productions (wheat, rice, corn, soya, palm oil, sugar cane, cow's milk...) to enable their mechanization/robotization and generate **economies of scale**, the profit-driver of any industrial activity
- With the use of **inputs produced by science & industry** to increase land productivity (genetic materials, water from dams, canals or pumps, fossil energy, chemical fertilizers, pesticides, herbicides or fungicides, growth hormones or antibiotics, robotics, artificial intelligence...)



AGROECOLOGY

Land and labour productivity based on a **mosaic of local agroecosystems** that, each in their own way, **stimulate and optimize biological synergies between many plant and animal species** beneath and upon the earth's surface, from soil fungi to cereals, pulses and trees, from bacteria or earthworms to large bovids
(Dorin et al. 2013, Dorin 2017, Dorin 2021)



3

- [*] The current global regime of industrial food and agriculture has two main characteristics:
- (1) One: the specialization in a few standardized mass-productions such as wheat, rice, corn or palm oil, to enable their robotization and generate economies of scale, the profit-driver of any industrial activity
 - (2) Two: the use of inputs produced by conventional science & industry to increase land productivity provided you add and pay for genetic materials, chemical fertilisers, pesticides and now artificial intelligence.

[*] On the other side, you have “agroecology”, which I define as follows: “a mosaic of local agroecosystems that, each in their own way, stimulate and optimize on small plots of land biological synergies between many plant and animal species below and above the soil, from soil fungi to cereals, pulses and trees, from bacteria or earthworms to large bovids”.

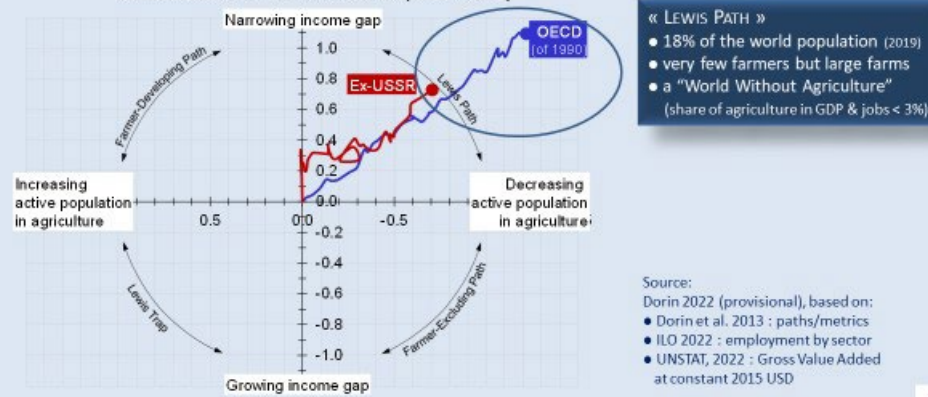
Success and dead ends of agro-industry

■ “Modern growth” & “Structural transformation” (Lewis 1954, Kuznets 1966...)

- Value (GDP) and jobs migrate from agriculture to industry and services
- Up to a “World Without Agriculture” (Timmer 2009): agriculture = 2-3% GDP & 2-3% employment
- With:
 - large specialized, chemical and robotized farms (thanks to abundant and cheap fossil fuels...)
 - cheap (but unhealthy...) food (household income is no longer just for food!)
 - income convergence between farmers and nonfarmers (rural poverty eradicated!)

■ The “Lewis Path” of the OECD countries (Dorin 2013)

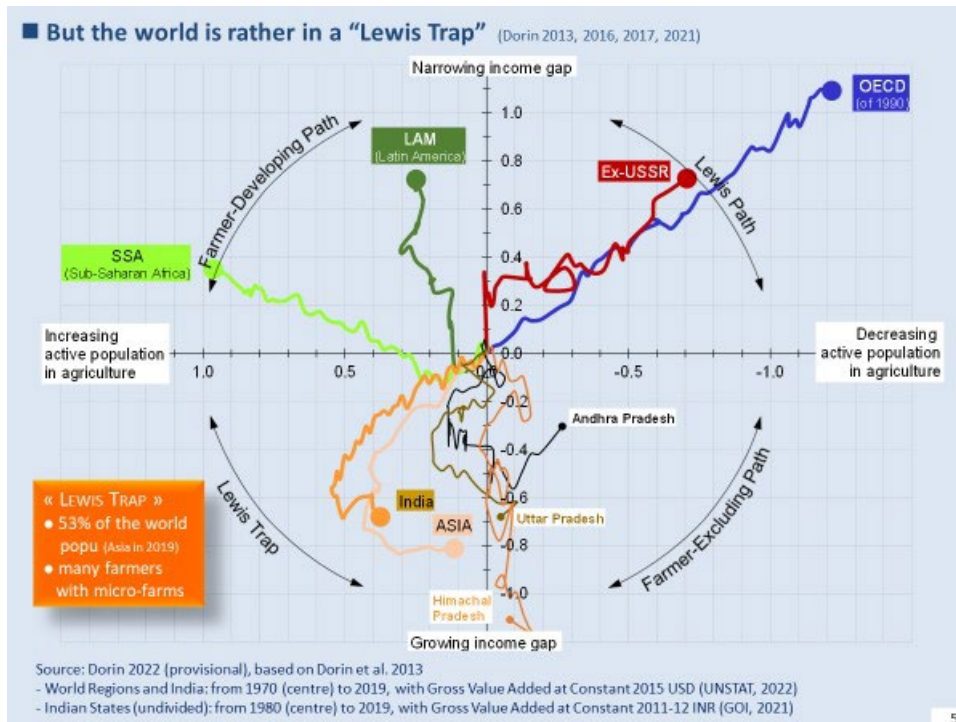
Path of structural transformation (1970-2019)



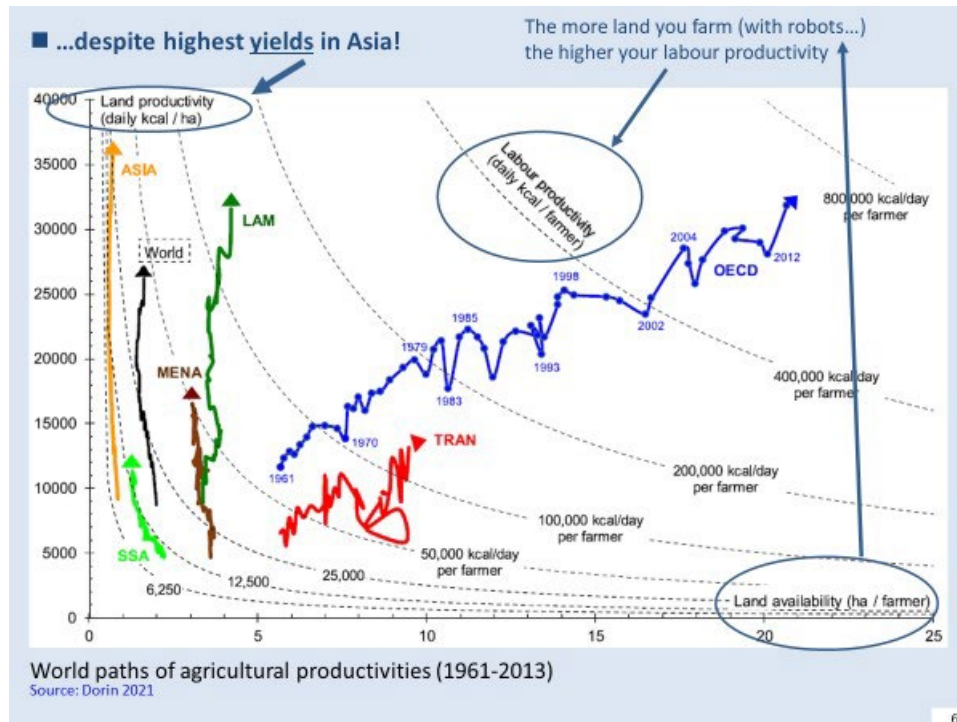
[*] Now, let us talk a little more about the world of industrial food and agriculture. It is in fact part of a bigger world called in economics “modern economic growth” or “structural transformation”. In this world, in a nutshell:

- modern economic development means values and jobs migrating from agriculture to industry to services
- until arriving in what Peter Timmer called a “World Without Agriculture” where agriculture does not represent more than 3% of GDP and 3% of employment, as today in all OECD countries
- in this “World Without Agriculture” fed by ever-growing quantities of fossil fuels, we have large specialized, chemical robotized farms, producing cheap food. The average income of farmers and non-farmers has also converged. In other words, we emptied the countryside of farmers but made those who stay much larger and richer.

[*] I called “Lewis Path” this canonical path of structural transformation, and I tried to see which countries or regions of the world had really followed it since the year 1970, positioned here in the middle of the graphic. As you can see, I found only the OECD and transition countries. In 2019, these two regions represented about 18% of the world population. The big question is now: “what other paths has been followed by most of mankind over this half century, and why?”



[*] In facts, more than half of the 2019 world's population, located in Asia, had been following what I called a "Lewis Trap", where average farm size has shrunk instead of getting bigger, and where the income gap with nonfarmers has widened instead of narrowing.

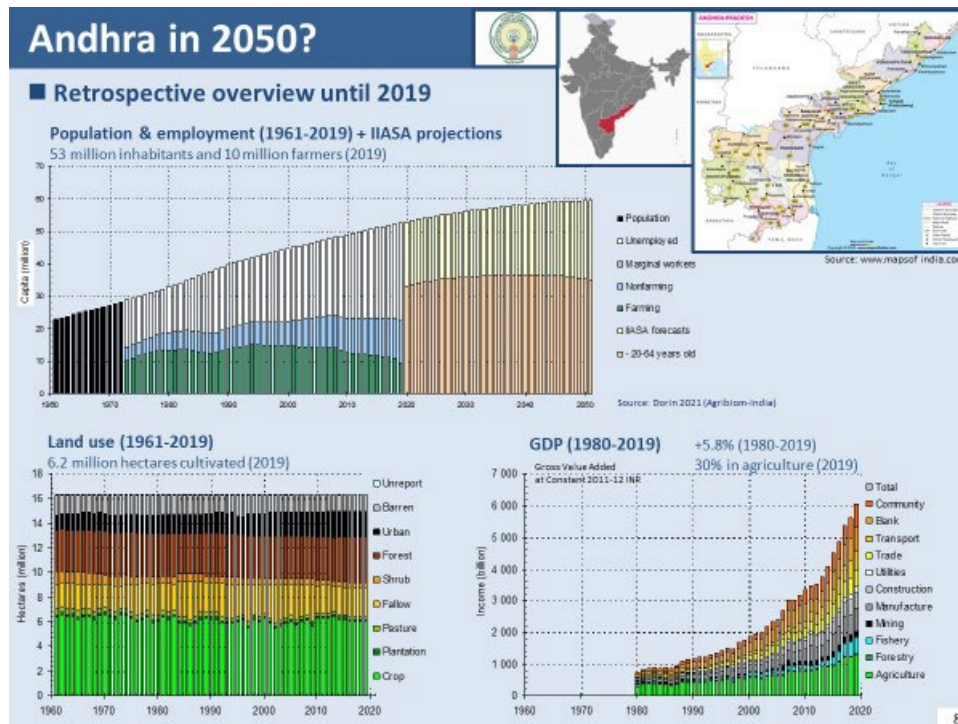


[*] Last but not least, this worrying trajectory of Asia is not due to lower agricultural yields compared to OECD countries as we can still read in the academic literature. On the contrary, with an overuse of groundwater irrigation, chemical fertilizers, pesticides and price incentives for few industrial crops such as wheat, rice and sugarcane, Asia is now the world region where we find the highest average yields in calories per ha. This prevented starvations from occurring as before the Green Revolution, but did not solve undernutrition in protein, fiber, vitamins and minerals, while causing an increase in overweight, obesity and diabetes, especially among the urban population and as in many other regions of the world with industrial food and agriculture.

Overall, in Asia, we thus find the highest land productivity with the smallest farms, but also the lowest farm labour productivity with hundreds of micro-farmers committing suicide every day due to over-indebtedness to buy costly seeds, pesticides, fertilizers, pumps and other equipment. All this while malnutrition and health costs have increased dramatically, as well as the depletion of natural resources on all fronts: soil, water, air and biodiversity.

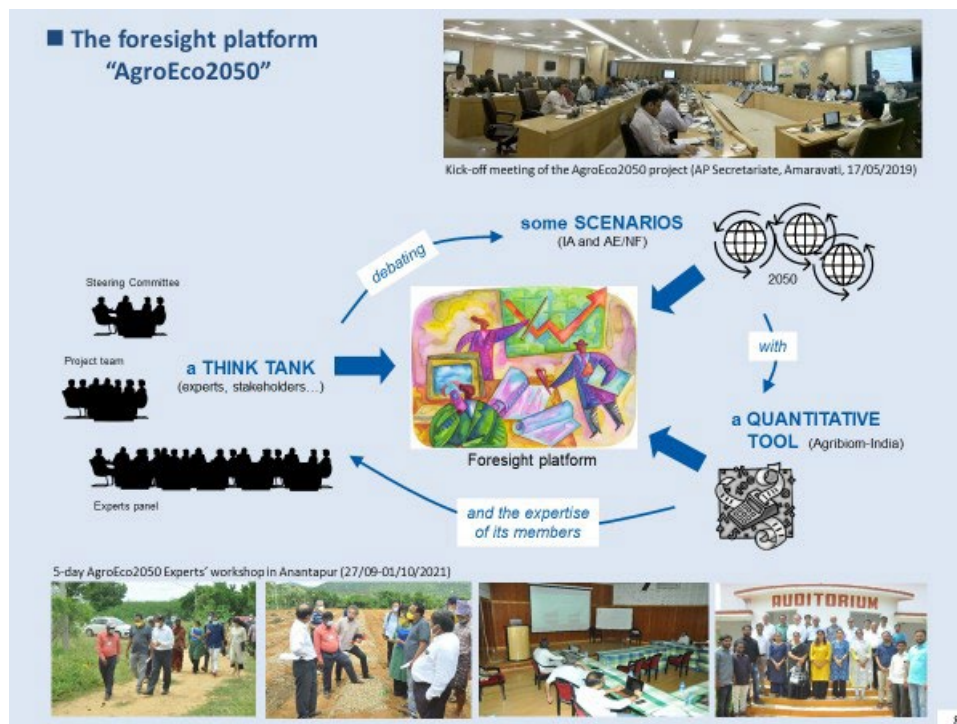
Is it not time to invent and encourage another socio-technical regime than that of industry which, thanks to fossil fuels and economies of scale, concentrates land, capital, technology and income in a few hands? All this when Indian farmers are condemned to farm at a micro scale, since they can (1) no longer emigrate *en masse* to the land-abundant Americas as Western Europeans did in the late 19th century, (2) nor emigrate *en masse* to other sectors where opportunities are now much lower than in the past all over the world, even in time of strong economic growth?

In other words, shouldn't we be looking for a much fairer, healthier and sustainable regime like the one the Community-managed Natural Farming in Andhra Pradesh seems to aspire to?



[*] I will now present you some preliminary results of our foresight study AgroEco2050, after reminding you here that Andhra Pradesh is a State of South India with approximately 53 million inhabitants and 10 million farmers in 2019 according to NSS surveys. In the same year, Andhra Pradesh cultivated 6.2 million hectares, and 30% of its GDP was generated by agriculture and allied activities.

As you can see in main figure, in 2050, Andhra's population should reach 60 million people according to IIASA forecast, including nearly 35 million in the working age of 20–64-year-old, meaning 3 million more in absolute numbers compared to 2019 but slightly less as a percentage of the total population. We kept these population projections constant in our two scenarios for 2050.

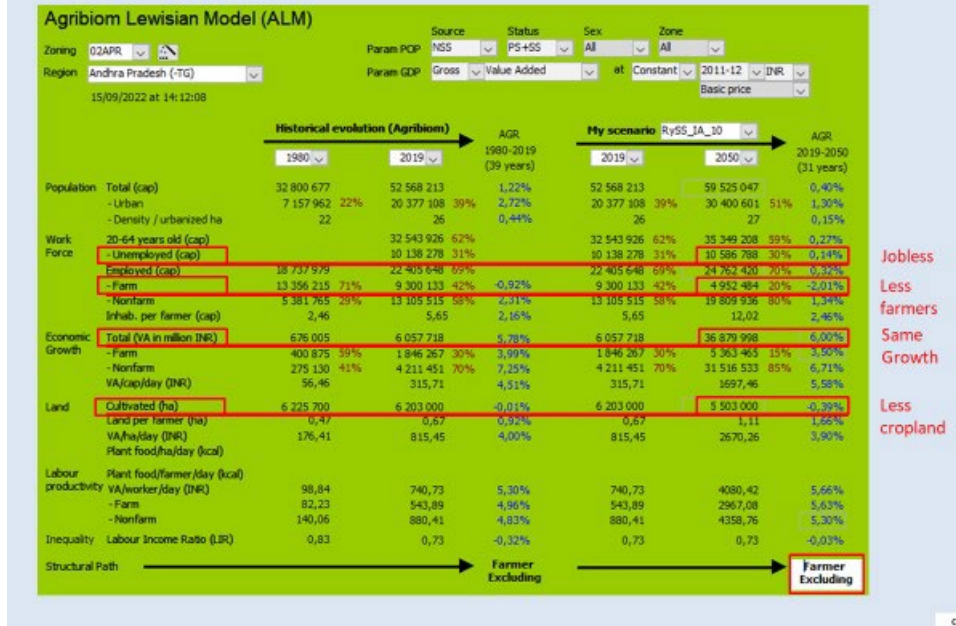


[*] Our two contrasting scenarios for Andhra Pradesh were developed through a three-component foresight platform, with a thinktank discussing possible future scenarios with the diverse expertise and knowledge of its members, and a quantitative model called Agribiom that I designed to foster collective foresight and the quantification of theoretical narratives or policy objectives.

Our "AgroEco2050" collective foresight began in 2019, will end this year after a final Experts' workshop at Andhra Bhavan in Delhi at the end of November, and has three main objectives:

- (1) firstly, to provide an image of what could look like a complete agroecology transition in AP, especially with a view to better understanding the conditions of such a transformation;
- (2) secondly, to compare this ideal type of transformation with the one of industrial agriculture which has guided public policies, industries, agricultural production and food since the 1960s in India;
- (3) thirdly to contribute to national and international debates and researches on agroecology and the future of food and agriculture, such as today at Hyderabad with ICRISAT.

■ Trend scenario: Industrial Agriculture & Food (AgroEco2050 provisional results)



[*] Now let us shift to a very quick presentation of our two contrasting scenarios for 2050, starting from the trend scenario of industrial agriculture and food.

On the left side of the table you have historical figures from 1980 and 2019 in various areas, from population to labour productivity and a proxy of income inequality between farmers and nonfarmers, and on the right side our assumptions for 2050 and various estimates that can be deducted from them.

In a nutshell, in this scenario of industrial agriculture in 2050,

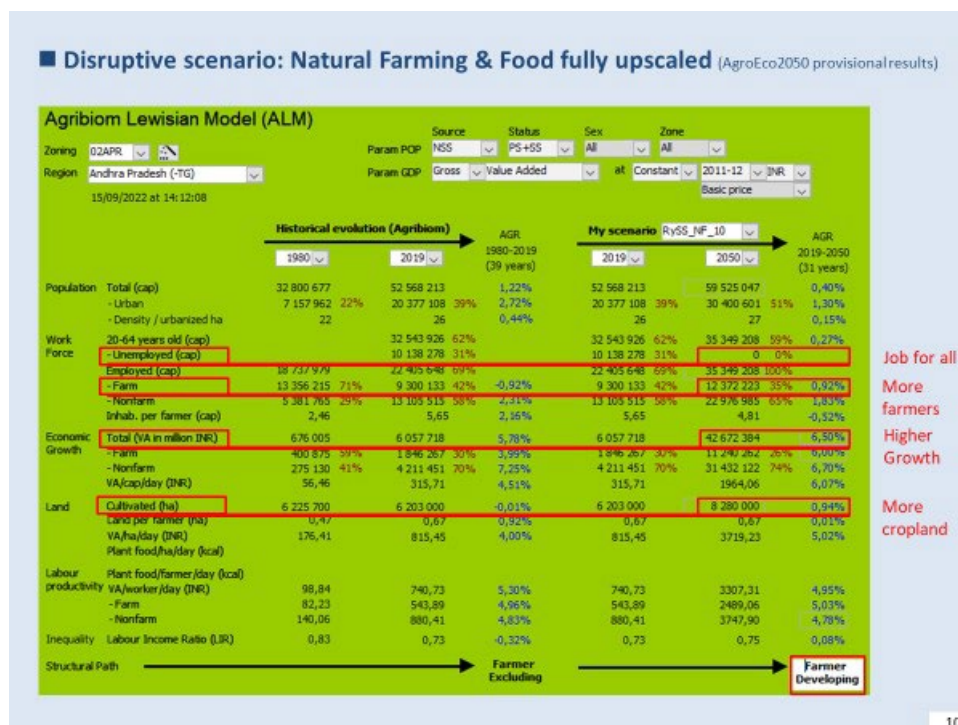
[*] unemployment among the 20-64-year olds would remain at the rate of 30% as in 2019,

[*] the number of farmers would drop to 5 million,

[*] the area of cultivated land would continue to decrease,

[*] and overall economic growth would average 6% per annum from 2019 to 2050, roughly the same level as over the past three decades.

With this scenario, AP will follow what I call a “Farmer Excluding path” (FE), where farmers are fewer and poorer as from 1980 to 2019.



10

[*] In our disruptive scenario of *Natural Farming and Food* fully upscale in 2050, we envisioned a very different world.

In 2050, the 35 million adults in the working age would be all employed, including more than 12 million in agriculture or 35% of the labour force against 20% in the industrial scenario.

These farmers would all practise APCNF, enabling the cultivation of more than 8 million hectares in 2050 – 2 million more than in 2019 – and therefore reversing past trends of desertification and growing fallow areas with industrial agriculture.

This full-employment scenario largely based on agriculture, coupled with larger cultivated lands and the low-input but high-output practices of APCNF all over the year, would lead to a much higher Gross Value Added in agriculture, as well an all-sectors economic growth of 6.5% p.a. against 6% in the industrial scenario.

With this agroecological scenario, AP would then be embarked in what I call a “Farmer-Developing path” (FD), where farmers are more in number but with a narrowing income gap with nonfarmers, unlike in the past or in our industrial scenario.

■ Inequality: UBI + input & price subsidies vs. PES/farmer to close income gaps?

2050 (from 2019)	100% Industrial	100% Natural
Population (million capita)	59.5 (+0.4% p.a.)	59.5 (+0.4% p.a.)
Workforce (20-64 years)	35.4 (+0.3% p.a.)	35.4 (+0.3% p.a.)
Unemployment	10.6 (30%)	0 (0%)
Employment	24.8 (70%)	35.4 (100%)
- Farmers	5.0 (20%)	12.4 (35%)
- Nonfarmers	19.8 (80%)	23.0 (65%)
Cropland (million ha)	5.5 M (-0.4% p.a.)	8.3 (+0.9% p.a.)
GVA (trillion INR-2011)	36.9 (+6.0% p.a.)	42.6 (+6.5% p.a.)
- Farm sector	5.4 (+3.5% p.a.)	11.2 (+6% p.a.)
- Nonfarm sector	31.5 (+6.7% p.a.)	31.4 (+5.7% p.a.)
Productivity (INR/day)	4080 (+5.7% p.a.)	3307 (+5.0% p.a.)
- Cropland (ha)	2670 (+3.9% p.a.)	3719 (+5.0% p.a.)
- Farmer	2967 (+5.6% p.a.)	2489 (+5.0% p.a.)
- Nonfarmer	4359 (+5.3% p.a.)	3748 (+4.8% p.a.)
Agri income gap (INR/day)	1392	1259
Structural Path (2019-2050)	Farmer Excluding	Farmer Developing

Social policies
 Universal Basic Income at 1450 INR/cap/day
 Input & price subsidies to close the gap
22% of GDP

Environmental services without scale economies
 PES/farmer to close de gap
13% of GDP

11

[*] With these numbers for our two contrasting scenarios, I have tried to roughly estimate what the cost would be in each case to close the growing income gaps that increasingly plague Indian society.

[*] As I told you, with the industrial scenario, inequality would increase further, both between those employed and not, and between those employed in agriculture and the others. To counter these inequalities and these poverty traps, 22% of the GDP of 2050 could be spent on social policies, which represents a huge sum with little chance of foreign funding.

[*] With our agroecological scenario fully scaled through APCNF, only a fam-nonfarm income gap would persist in 2050, albeit slightly smaller than in the industrial scenario. A fair way to close it and bring harmony would then be to pay agroecological farmers for the environmental services they would provide to society, such as water saving, carbon sequestration or high resilience to climate change. This would then represent 13% of the GDP of 2050, a figure that is still very high but with chances of foreign contributions contrary to the industrial scenario.

Conclusion

All in all, today's societies have to choose between two contrasting paths:

- ① continue to massively produce a few products that are processed, assembled and differentiated downstream, where market values, investments and jobs are increasingly concentrated, particularly to resolve the social and environmental flaws in the system (rising costs of healthcare, water depletion & pollution, soil and biodiversity erosion, climate change...)
- ② produce in symbiosis in and with nature, with markets values, investments and jobs concentrated upstream to provide a diversity of quality products, as well as services (to be paid unlike today) such as water filtering, soil carbon sequestration, or resilience to biotic and abiotic shocks (energy price, climate change...)



With hundreds millions of micro-farmers
(best insurance for high yields + people & nature health)
India has a comparative advantage
to gain and lead with option 2

12

To conclude, this collective foresight exercise has shown that there is an alternative to industrial agriculture and food through agroecology, and that today's societies are now invited to choose between two contrasting paths since each promotes very different values about wealth, happiness, society and nature:

(1) The first path is to continue to massively produce a few products that are processed, assembled and differentiated downstream, where market values, investments and jobs are increasingly concentrated, particularly to resolve the social and environmental flaws in the system, such as rising costs of healthcare, water depletion and pollution, soil and biodiversity erosion, climate change...

(2) The second path is to produce in symbiosis in and with nature, with markets values, investments and jobs concentrated upstream to provide a diversity of quality products, as well as much sought-after but currently unpaid environmental services to small agroecological farmers.

As far as I am concerned, after more than 30 years of work in economics and agricultural sciences including 16 in India, I have now the conviction that with millions of micro-farmers who will not disappear in the future, India can only collapse with industrial food and agriculture, when it could shine with agroecology and natural farming, if of course public policies follow and think outside the box with local stakeholders and knowledge.

Thank you for your attention.