

Today's food system is broken

The food system today is unjust and discriminatory. It is causing almost irreversible damage to health of people and planet.

The food chain is controlled and manipulated by cartels; whose sole objective is to make money. Heavy investment in monocropping, of staples like rice, wheat and maize; over-centralized planning and decision-making resulting in a 'one-size-fits-all' approach to agriculture practices; ultra-processing with salt, sugar and harmful additives for extending shelf life; scant respect for health related dietary guidelines by WHO and national governments – have resulted in a food system that makes the most unhealthy, detrimental foods most accessible and affordable for majority of the population. Exorbitant expenditure on marketing and advertising, with the objective of numbing the mass consumer's mind which disables him and her from making healthy food choices.

Volume and price are the only metrics that seem to matter. The wealth created from food and agriculture is concentrated in the hands of a few who are far removed from the actual act of producing food. Sales and marketing of food has become an industry with a life of its own, completely separate, full of middlemen with no stake in either the production system or in the consumer. The food industry has no link with the soil, the seed and the plant.

The producers of food, the farming families, are left with losses – financial, nutritional and environmental – and have no means of overcoming them. They are forced to fall back on subsidies, loan waivers and sops given by government, which renders them weaker and broken.

Food – that which sustains life – is a fundamental right of all human beings. But the current system has weakened its power to sustain life. For the rich, food is a sensorial experience. For the poor, it is a means to somehow stay alive. Good food, which gives nutrition and immunity, without damaging the environment, is unaffordable and scarce.

The environment – soil, water, air – is depleted and vitiated. Fertile lands and eco-rich terrains are turning into deserts and wastelands. Rather than being ReGenerative, the system seems to be terminal. Poverty is the deeper

manifestation. What we don't seem to realise is that the veritable 'race to the bottom' is on. It has almost reached a point when even the rich and powerful will not be able to escape this catastrophe.

The Future Food System – Our Vision

In 2050 we will have a food system that celebrates human health, that would be locally self-sufficient yet globally supportive. It will carry an attitude of enhancing the balance between human life and the environment, rather than being a competitive struggle for survival. It would be driven by science that integrates biology, physics & chemistry, mirroring nature to create a harmonious loop of progression. Its design would ensure resilience and robustness to withstand shocks and create local societies that are less vulnerable and globally united for a fortified existence. Each building block or stakeholder in this system will add value and receive adequate returns. Policies would focus on incentivising these priorities. In our vision for 2050, no one would be anxious about nourishment and food security. The PQR framework – Profit for farmers, Quality food and Regenerative agriculture – will be the bedrock of this food system. Availability of healthy food in abundance, around the year, to all, will be the crowning characteristic of this food system. This is resonated in the 2020 Global Nutrition Report that says “food systems everywhere must become equitable, nutritious, efficient and inclusive.”¹ A small beginning in this direction has been made by Naandi Foundation through the creation of the Arakunomics model in three different parts of India – tribal hilly region of Araku in the Eastern Ghats; rural drought prone lands of Wardha and the metro city of Delhi. In over 15 years of work, we have been able to prove that it is possible to ensure food and nutrition for all as well as profits for farmers without any collateral damage to the environment. We believe this template can scale up to become a national food system.

¹ <https://globalnutritionreport.org/reports/2020-global-nutrition-report/>

The three cardinal principles of this vision are:

1. Terroir
2. Regenerative Agriculture
3. Shared Value

Terroir

Philosophy

If agricultural uniformity and the 'one-size-fits-all' approach of chemical fertilization and monocultures were the benchmark of twentieth century agriculture. Then biodiversity, appreciation of distinct identities of soil and climate profiles will define twenty first century agriculture. The age-old principle of terroir - accent on regional soils, climate and the farmer's intimate association with his terrain, his land, will be the vehicle for realizing this 21st century goal. Terroir will ensure optimal quality food, and usher in a new paradigm of human and environmental wellbeing – the essence of our vision for the food system in 2050.

Application

While terroir is considered a French 'invention' and commonly associated with fine wines of Bourgogne yet the fundamental regional principle of terroir has always been universal in nature. From the Nile delta, to the Gangetic flood plains to the innumerable macro/micro-terroirs throughout the planet.

The basic premise of terroir enables decision making at the local level. The specific soil type and climate along with the skills and cultural traits of human society create a specific microcosm, and places having commonalities in soil, climate and culture can be said to have the same or similar terroir. This scope for decentralised decision making results in higher quality diverse crops and better yields. This is very different to the conventional one-size-fits-all approach.

We have converted an entire mountain range spanning 700 villages into a coffee terroir landscape – having collected key soil and weather indicators for each parcel of land and plotted them on a map to demarcate distinct terroirs. We have had this terroir map validated with the help of Hippolyte Courty, an agronomist from Paris. This kind of granular knowledge mapping not only empowers farmers to be highly productive, but also infuses an element of transparency that is one of the hallmarks of the Arakunomics model.

The decentralised terroir approach puts farmers and environment at the centre of an enabling web of support in infrastructure, logistics, research and marketing. It was this Arakunomics that allowed the excellence of Araku coffee to shine through

via awakened soil life, flora diversity, coffee bush health and processing science. It is the same diversified, decentralised, cluster approach in all spheres of agricultural production that will deliver nourishment for a nation's people, with sufficient calorie-nutrients, quality and taste and a healthy eco-rating with regard to climate-change values.

Terroir experiences point us towards a unified set of biological charter principles applied regionally according to the geographic and climatic realities of the agriculturalist's domain. In the end it is this symbiosis within our respective macro and micro bio-spheres that will transform the way we nourish ourselves and the environment around us.

Example

There are six major terroirs identified in the Araku region, through painstaking collection of data on soil characteristics, weather patterns and land slopes, geographic exposition etc. These are spread across more than 10,000 acres and as many farmer families. Each family knows their respective plot intimately and works with the distinct soil and climatic conditions to produce and harvest good quality coffee. Skills in coffee forest shade management, bush management, bio-inoculant soil amendments and mulching evolved over time and coffee quality got better as soil and bush improved year after year. The yield, nutritive content as well as taste profile of the coffee began to excel. Soil organic carbon percentage went up along with soil water retention and these changes were clearly discernible to the farmer family. Each year, as a harvest celebration, coffee quality is assessed on international Coffee Cup of Excellence standards – and evidence of improvement is seen. Processing became more exacting and in a few years an average 'organic and fair trade' coffee became a 'gourmet and specialty' one, scoring 85 and above on a scale of 100. Attracting better profits for farmers is only one of the many positive fallouts of the upward trajectory in quality of coffee, for his land, his diversified ecology regenerates as fertility evolves and yields get better.

This systematic adaptive, regional application of skills can be applied in all agriculture regions, with both food and cash crops.

ReGenerative Agriculture

'Agriculture is an ecological act'

Philosophy

'Agriculture is an ecological act' is a logical corollary to read along with Wendell Berry's memorable line: "Eating is an agricultural act."² These two phrases

² <https://www.ecoliteracy.org/article/wendell-berry-pleasures-eating>

encapsulate and define the broad scope of the transformative nature of regenerative Agriculture and by consequence the food system that we envision for 2050.

Agriculture that is about sustained, long term, continually growing and enriching journeys of the soil, the seeds, the microbes, the plants, the water table and the environment, we would hitherto like to refer to as ReGenerative. The opposite of the scarcity and inequity that the current conventional methods of agriculture are imbued with. The current system, which can be described as terminal, has nothing that sustains – seeds have to be procured for each season, soil has to be prepared afresh for every season, overuse of external chemicals suppresses natural microbial activity in the soil, plants are stressed, water is extracted continually to meet increasing irrigation needs. The farmer is disempowered, having to purchase higher quantities of inputs each season, at ever increasing prices. Profits are concentrated with a few powerful sectors that control everything. ReGenerative Agriculture on the other hand, supports biological investments in the soil to make it more dynamically fertile and nutrient-rich so that external input requirements each year keep decreasing; it nurtures water retention and other natural resources in the environment. The accumulating 'goodness' of the soil and biosphere year on year become a solid bulwark for the farmer family to lean on. Farmer families are able to make profits in a way that does not affect the environment adversely. ReGenerative Agriculture is equitable and life-giving, it guarantees abundance of food and nourishment for people and planet.

Methodology

Soil is the foundation for production of good food. A good soil is a reservoir of a multitude of microbes which include bacteria, fungi, actinomycetes etc. The soil-plant-microbe interactions result in enormous amount of health benefits to humankind. The presence and formation of health-promoting compounds like antioxidants, flavonoids, anti-cancer compounds, carotenoids, beta-carotenes, vitamins and minerals is the result of such interactions taking place in healthy soils and plants. The disruption of the soil-plant-microbe interaction results in a dying soil unable to give optimal nutrition to the plant, which in turn is unable to nourish the human body that consumes it. This is what has been happening now for many decades. Soil has been treated as a mere anchor for plants when in fact it is a biologically integral part of the ecological cycle.

This valuable soil-plant-microbe interaction is facilitated in ReGenerative Agriculture by investing in the creation of a new layer of topsoil. This creates a restorative soil microbiome that leads to an efficient biology-oriented nutrient cycle for the plants. The soil microbiome and its symbiotic nutrient web promotes the creation of

disease suppressant soils and through its abundant soil carbon, stores water efficiently.

This new topsoil is created by aggregating locally available biomass and composting it with the addition of microbial starter inoculants and natural nutrient additives (rock phosphate, rock dusts, oil cakes etc) customised to regional terroirs. These microbial cultures are developed using known beneficial herbs and flowers like Himalayan nettle, oak bark and other locally grown flowers. The probiotic effect of these inoculants is to populate the composting material with beneficial microbes that can then transform soil microbiomes when seasonally applied to soil.

After the soil transformation has begun, in combination with specific land management practices, there starts a continuous and ongoing increase in fertility reinforced regularly with compost and its vital soil organic carbon (SOC). As the fertility of the land increases, both from a SOC perspective and soil microbiome perspective, the porosity of the land and its water retention capabilities increase. Both the soil and plant hence achieve better resilience to weather patterns. This combination of an efficient nutrient cycle and availability of secondary metabolites lead to a nutrient dense curative produce. Studies show that a healthy soil microbiome has a direct link to the human microbiome which leads to immunity in humans³.

ReGenerative Agriculture addresses all the agronomic elements of crop and livestock management - from soil fertility, seed quality, efficient farm management through to judicious selection of cover crops and crop rotations, biodiversity, nurturing of pollinators and beneficial insects and constant skilling of human resources to approach agriculture in an organised and entrepreneurial way.

Shared Value

Philosophy

Creating shared value is now a widely known concept, since Porter and Kramer⁴ first spoke of it in the early 1990s, raising the question of whether businesses were focusing on profit at the cost of people, environment and society. In our vision for the food system of 2050 shared value is a moral philosophy. We see food as a fundamental right of every human being, and the food system must ensure that this right is respected.

³ <https://pubmed.ncbi.nlm.nih.gov/31450753/>

⁴ <https://hbr.org/2011/01/the-big-idea-creating-shared-value>

Inequitable transactions affect each component of the food system today, resulting in unequal outcomes ranging from poor availability and unaffordability of healthy food to an overabundance of food of low nutritious quality.⁵

Our philosophical commitment is towards fair distribution of profits across the value chain. This will be possible when sustainability (environmental) and viability (financial) in each section of the supply chain is ensured. This is echoed in our PQR framework, in which P is profit for farmers. In our vision, food will transcend the realm of economic activity to become a harbinger of culture and wellbeing.

Methodology

Small holding farmers, who are the overwhelming majority in India, are the most exploited and impoverished link in the whole food chain. They are trapped in a web of negative cash flows, reduced landholdings, poor crop planning, increasing input costs, low market intelligence, uncertainty about yield and prices. There is a chain of middlemen - merchants, transporters, processors, packagers, and advertisers who make profits at the expense of both producers and consumers.

In our vision for 2050, small holding farmers would have been able to break out of this abject poverty by becoming entrepreneurial in their approach. They will be empowered by the high quality of their produce – made possible with the terroir approach and ReGenerative Agriculture. The increase in the value of their resources and assets – the soil, the ground water, the crops, the residue – enables them to withstand market forces, also leverage the market for their own benefit. The use of technology, knowledge transfer, economies of scale, and sharing of market information will make it possible for them to move away from the subsidy-loan-waiver-sops paradigm into one of entrepreneurship and negotiations on equal terms.

Fair practices will govern the entire chain of food production and supply. No hoarding, no usurious moneylending and holding the small farmer at ransom, no forced or distress sales. In fact, the farmer, with access to smart information – on weather prediction, on market prices, on efficient farm management practices – will be an enthusiastic entrepreneur, moving up the value chain. Farmers' children will aspire to take on the mantle of this kind of entrepreneurship.

The farmer family is at the centre of this food system. Not only are they producing food, they are also consuming the food – they are a self-contained circle. And because of the centrality of their role, they are also the 'barometer' of how the food system is functioning. Are they healthy? Are the farmer producers growing diverse

⁵ HLPE, 2017. Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.

crops to ensure there is diversity in diet? Are they making losses? Is it leading to indebtedness? Is suicide becoming their only way out? Or are they healthy, happy, profitable, and in a position to make informed choices about their present and future? ReGenerative Agriculture aims to ensure that it is the latter.

The responsibility of ensuring shared value lies equally with the consumer. In the vision for 2050, the consumer will know the value of food - where is it coming from, how was it grown, what is its nutrient value, how does it help the body, what was the ecological impact of growing it, was there any wastage? Consumer will no more be a passive unquestioning audience, uncritical and dependent, looking at food as a stand-alone market commodity, to be purchased for answering a biological need. Food will be seen as a nourisher of life, bringing in nutrition, immunity and energy – those building blocks of a healthy and fulfilling life.

Consumers will be mindful of the journey of food and the future of their food security. Their economic, geographical, cognitive and social distance with food will decrease, giving way to a growing emotional connect. Consumers will be deeply invested in the idea and process of growing food, will understand the implications for future food security. Diets will be all about a close health-and-food connection. This engagement will create a powerful demand 'pull' for healthy nutritious food grown through ReGenerative Agriculture, making it an increasingly viable proposition for farmers.

A fundamental right such as food cannot be left entirely to market forces. In addition to keen awareness throughout the food chain and focus on quality, there will be pro-active work on influencing policy. As has been our experience in the past decade, on the issue of child malnutrition in India, impacting policy through evidence based advocacy has to go alongside efforts to change the way people think and behave. When we conducted a large scale detailed survey of the prevalence of malnutrition, it caught the attention of all sections of society – from the ordinary man on the street to the Prime Minister of the country, leading to progressive policies and action by the government to address the issue. Similarly for ensuring shared value throughout the food chain, various initiatives will have to be ongoing – from a study that juxtaposes food product labels against the price and identifies trends thereof, to inspiring governments to fill in the cash gap when a farmer or a distributor wants to use ReGenerative methods even if they are expensive.

ReGenerative Agriculture embraces the entire cycle of production, distribution and consumption. The shared value chain provides the critical mutualistic link of

customer demand to production of the farmer. This sharing and caring cycle of Arakunomics is the vision for food systems of 2050.

Food System Architecture

Philosophy

The architecture of this food system is based on the cardinal principles of terroir, ReGenerative Agriculture and shared value. The main 'bricks' are self-sufficient entities interlinked to create a grid that maximizes efficiency and resilience. These decentralized bricks leverage their terroir to contribute to the larger fabric. Consumption and production are clustered together, making the units self-sufficient, reducing food miles and carbon footprint. The design is modular in nature, which enables it to be replicable and scale with ease. This design philosophy is embedded at every level of the food system.

From a macro perspective let us zero in, step by step, to the heart of the system.

Macro-view – National Food System Grid

- The country is geographically divided into multiple foodspheres that are connected to each other
- Foodspheres have concentrated consumption demand and a series of agriculture production units in close proximity, along with efficiency-inducing infrastructure such as warehousing and storage. All this together forms a self-sufficient Foodsphere.
- India is a large and diverse country, with many types of terrain, climate and social structures. We have, for the purpose of building our vision, broadly classified them into urban, rural and tribal. Our foodspheres will be in all three types of regions, each designed to suit its particular terroir.
- A foodsphere's first focus is to address the consumption demands within that region.
- However, based on the terroir of the region and the main occupation there, the Foodsphere also grows specific cash crops that can be sent to other Foodspheres within the grid.
- This terroir approach helps in production of high quality crops. It also helps with farmer livelihood and profitability because it connects this high quality cash crop to the right markets.
- At the national level all these foodspheres are interconnected, forming a robust grid of independent but connected entities.
- If a foodsphere's production gets affected due to an unexpected emergency – natural disaster or pandemic - the larger grid can continue to support the

consumption demands of that particular region, by redirecting produce from other foodspheres.

- Also in case a region gets geographically isolated due to some exigency, the foodsphere is self-sufficient and can continue to support its own consumption needs. A live example of this was seen during the COVID-19 lockdown in India in April-May of this year. Our Delhi foodsphere continued to function and successfully provided food directly to our customers in Delhi. This was when no goods or people were being allowed to travel across domestic borders, and there was a fear of shortage.
- This simple design at the macro level helps create a robust and resilient system as well as get the best of all worlds, be it the terroir or the market.

The foodspheres

- **Urban foodsphere:** the city is the concentrated consumption centre and the market. Supply is achieved through ReGenerative agriculture clusters (RACs) that are created in the peri-urban region of the city. The number of such RACs will depend on the demand within the city. As the demand increases a new RAC is developed in the peri-urban region.
The main objective of these RACs will be to address the food and nutrition requirement of the city. We have created this model with success around India's capital city, Delhi. The production of 42 varieties of highly nutritious vegetables of excellent quality over two seasons has energised the market for them, with growing demand.
- **Rural foodsphere:** A group of villages become the consumption demand, and similar RACs are created within these villages. Since agriculture is the main occupation in rural India, the objective of these RACs is to address food and nutrition requirements on the one hand, and also ensure farmer livelihoods on the other. For secure livelihoods, terroir of the region is leveraged and certain cash crops are selected for cultivation in the region, which are then marketed across the grid. Such RACs have been developed in the Wardha district, part of the Vidarbha region of Maharashtra. Vidarbha has been in the news for acute farmer distress for over a decade now. Our vision for the food system is slowly beginning to take wing here, and we are confident of returning the smile to the farmer's face.
- **Tribal foodsphere:** Typically tribal areas are remote, with low connectivity and almost no contact with the mainstream, and the tribal people are culturally tuned to be self-sufficient. For centuries they have depended on the forest around them and on the rivers and streams flowing past their homes for sustenance. Today most tribal areas in the country are suffering from deforestation, desertification and these once eco-rich regions are becoming semi wastelands.

To revive the culture of self-sufficiency therefore, it is imperative to protect and nourish the environment.

Hence our RACs in these tribal areas address 3 key elements – food and nutrition security of the people, ecology and livelihood. The RAC creates food forests selecting a judicious mix of trees that give food, nutrition, firewood, fodder as well as cash incomes. In the tribal Araku region, we have developed coffee and pepper, as cash crops for family livelihood needs and created food forests for their nutrient requirements. Pre-farm and post-harvest processing hubs are also created, to bring in quality, economy of scale and convenience.

At the heart of the architecture - ReGenerative Agriculture Clusters

- The basic building block of the food system we have envisioned is a ReGenerative Agriculture Cluster (RAC). Each RAC can support around 100 hectares of intense cultivation.
- An RAC consists of a network of farmers and a hub. The farmers grow crops on their own land, and align with the hub for all their ReGenerative Agriculture needs
- The hub occupies around 2 hectares and is home to a wide range of activities from crop planning for network farmers, to production of farm inputs and collection of produce after harvest. Some of the hubs even have post-harvest processing capabilities.
- The hub provides farmers with all their requirements for carrying out ReGenerative agriculture such as seeds, saplings, high quality soil and plant applications, farm management guidance and services and procurement of the produce.
- A majority of India's farmers have small landholdings, covering less than 5 hectares. Hence by concentrating most of the farming activities at a hub, even small farmers are able to enjoy convenience of technology, cost reduction through scale and quality through standardized processes and dedicated farm service teams.
- The RAC supports farmers in planning - crop portfolio, farm plan, and activity calendar - based on terroir, market demand and predicted weather conditions. This helps reduce wastage and price fluctuation due to over-supply or low-supply. It also ensures that there is a constant supply for the consumers.
- An RAC is self-sufficient and the hub is ReGenerative too i.e. the raw materials required to develop all inputs in the hub come from within the cluster area itself. The organic biomass in the cluster which is otherwise considered as 'waste' by the society is used to develop high quality farm inputs. Maintaining standardized processes and monitoring the biological processes regularly leads to conversion of the matter once considered waste into high quality farm applications.

- The waste management aspect of the RAC is highly beneficial in stopping harmful environmental practices that are sometimes carried out by farmers. To take an example from our Delhi RAC – in the last season we procured 1000 tons of paddy stubble from around 200 hectares of paddy farms. Usually this paddy stubble is burnt, leading to thick smog that covers the entire region including the India's national capital city of Delhi. Us procuring this paddy stubble resulted in zero burning. In addition, we take around 7 tons of cow manure from a local cow shelter every day. This cow manure is usually dumped, leading to methane leaching and ammonia volatilization, both of which were prevented due to the RAC activities. We also clear wild green growth from roadsides, playgrounds and common village areas. These weeds are normally a hindrance for community activity. The RAC uses the right ratios of this organic biomass to develop high quality compost and other farm inputs.
- The RAC provides farm services – We train local workers in specific ReGenerative Agriculture skills, and provide them equipment and tools to carry out farm activities. Farmers are able to avail services from these skilled teams. The efficiency brought in by use of right equipment and skill enables the farmer to reduce cultivation costs and increase produce quality & output. In Wardha we call these skilled teams the SAFE Teams (SAFE for Skilled Agri Field Executive)
- Once the network farmers harvest their produce grown through ReGenerative methods, they sell the produce back to the RAC. The RAC cleans, packs and value adds on the produce before directly delivering to consumers.
- There is complete traceability and transparency of the organic, 100% chemical-free produce to the consumers. The traceability starts even before the farm all the way to the fork i.e. even the raw materials used to develop farm inputs can be traced back. This creates a strong trust environment for the consumers and connects them to the farmer and process.
- The RAC can also carry storage options from a food security perspective
- The RAC is a first of its kind all-in-one ReGenerative agriculture ecosystem for small farmers. We currently have 4 RACs in India in different formats and using different local organic biomass as raw materials.

Conclusion

Today Naandi Foundation's vision for the food system is at an inflexion point. In Araku we have demonstrated profitability, quality and universality in horticulture, with cash crops as well as nutritious food crops. Over 20 million trees planted in the last decade stand testimony to the tribal farmers' faith in a functional forest. Recognising the need for fuel and fodder, common grazing lands are being

established and patches of land are being designated for fast growing trees that provide firewood.

Araku is well on its way to becoming a biodiverse reserve, that will create national and global attention at the way a region fought climate change at a local level. Similar beginnings have been made in Wardha and Delhi, radically different from each other in terms of geography and demography. Expanding beyond private farm lands and extending into common property with most of the villagers reaching a level of collective prosperity - ecologically and economically – is the next leap of faith. The kind of economics that will play out across the value chain has already been demonstrated in Araku. Inspired by this beginning, we call the future vision **Arakunomics**, another name for food-economics.