Food Vision Report 2030

HEALTHY FOOD AND HEALTHY PLANET FOR ALL

food future foundation

Aligned with the UN Food Systems Summit, the Foundation has published 'Food Vision Report 2030'.

The report attempts to create a shared vision for food system transformation in India. It incorporates multiple perspectives from many stakeholders and linkages amongst various areas.

CII Confederation of Indian Industry

FACE CII-Jubilant Bhartia Food and Agriculture Centre of Excellence

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Preface

Food is our basic need. The way we produce and eat food has changed completely. In early years of human history, small, nomadic bands of hunter-gatherers collected food to feed themselves. This was followed by human settlements for cultivation. Further development led people to produce more food than they could consume. Over time, new farming techniques and inventions led to a massive increase in food production. More recently, 'Green Revolution' focused on increasing food production as it was considered fundamental to fighting hunger, reducing inequities and lifting families out of poverty. It did bring widespread benefit to millions. And yet there is a flip side. Incentives and focus on few staples and large-scale production marginalized small holder farmers and nutrient-dense crops like pulses, fruits and vegetables. Just three food crops – rice, wheat and maize now provide nearly two-thirds of global dietary energy intake.

Technological developments of the nineteenth century changed the food industry forever. It played a key role in making food available around the globe. It helped food safe, stay longer in the shelf and travel places. Many advancements together opened the doors for the massive consumer-led market that is present today. Today, food that we eat comes through long and complex supply chains often spanning the entire globe. The food system involves activities right from production that includes agriculture, animal husbandry, or fisheries, to food processing, storage and its transportation, distribution and retail. It is a very large and complex system and includes the broader economic, societal and natural environments in which these activities are embedded.

The current system requires food production to be intensified and standardized. Food production has become more capital-intensive and supply chains have grown longer as basic ingredients undergo multiple transformations before the final product. Value chains shift power from producers to retailers and supermarkets. Standardization benefits larger suppliers rendering global markets more difficult to access for smallholder farmers. Family agriculture and associated (agro) biodiversity is being marginalized.

Amid plentiful production, about one third of the food that is produced is wasted globally. There are 690 million people who are hungry that is chronically undernourished and their numbers is rising. Apart from rising hunger, unsafe food and malnutrition in all its forms are most serious threats to human health. Food systems are also driving the degradation of the natural environment – soil, water and air quality, biodiversity loss and climate change – and dangerously undermining our future well-being. Food systems have huge implications on livelihoods and

inclusiveness. Alongside this, two billion adults worldwide are now overweight or obese. This is the picture of the current Food System that threatens both people and planet.

Our current food system, therefore faces serious challenges. Creating a food secure, safe, healthy and sustainable world would require an urgent transformation of the food system. Given that it has so many interlinked aspects, a holistic approach, simultaneity and mutual causation and an understanding of synergies and trade-off is needed. This would also require whole of government approach, and aligning the interests of multiple stakeholders at all levels – from local to national and even global. Further, harmonizing public policy, private sector activity and investments and civil society actions would be needed.

Realizing the importance of food as the single and most important lever to optimize human health and environmental sustainability on earth, the UN Secretary General convened the Food Systems Summit in 2021 as a part of the Decade of Action to achieve Sustainable Development Goals 2030. Recognizing that new approaches are needed urgently for food system transformation, the Summit was preceded with wide consultations with all stakeholders across the world to gather ideas and insights. It resulted in emergence of many solution clusters and formation of several coalitions.

As the world's most populous country with a population of 1.5 billion in 2030 (about one-fifth of the global population), India has a key role in affecting food systems transformation globally. In India, the Food Future Foundation (established as a public trust in 2019) organised multi-stakeholder dialogues to develop India Food System Vision 2030 keeping both the country context and global imperatives for change in mind.

The report has been developed by involving larger groups of stakeholders and experts from different areas of the food systems through the process of drafting > discussions > redrafting > reviewing. After sifting through various aspects of the food system, 32 actionable areas were identified. Draft papers were then developed on each of the 'actionable area' based on standard template. This included the issue, status, vision 2030 and pathways to reach to the vision. This draft was then discussed in small consultation groups that included subject experts as well as practitioners, NGO and industry leaders. Incorporating their insights, the drafts were revised and the revised drafts were again reviewed before being presented here.

Each paper in the vision report 2030 identifies first actionable area in brief. It then explains in detail what exactly the issue is and why this actionable area is relevant for which vision needs to be developed, what the challenges are and what needs to be done. The status section narrates where we stand now in that particular area, what are various government initiatives and private sector initiatives to overcome the problem and what is their status, what changes and impact they have made.

It is hoped that this document would help develop a shared understanding of the key issues to be addressed, taking into account the long-term outcomes for food system transformation in India. This would also help in spurring collaboration and establishment of multi-stakeholder structures to bring about such transformation.

- India Food System Vision Report Advisory Group

Vision Report Team

Advisory Committee

Rajan Sankar, Senior Advisor (Nutrition), Tata Trusts

Pawan Agarwal, Former CEO, FSSAI & Secretary, Govt of India

Meetu Kapur, Executive Director, CII-FACE

Rajeev Ahal, GIZ, New Delhi

Editorial Team

Milind Kokje

Ritoja Basu, Deputy Director, CII-FACE

Archana Sinha, Nourishing Schools Foundation

Anju Khosla, Food Future Foundation

CII-FACE Team

Dr Indrani Ghose, Strategic Advisor, Food Safety and Quality

Mr. Sam Thomas John, Counsellor, Food Safety and Quality

Ms. Radha Joshi, Counsellor, Food Safety and Quality

Ms. Roli Pande, Director, Agriculture

Ms. Ritoja Basu, Deputy Director, Agriculture and Policy

Ms. Neha Aggarwal, Deputy Director, Food Regulations

Dr. Richa Malik, Deputy Director, Nutrition

GIZ (India) Team

Mr Rajeev Ahal

Mr Ashirbad Das

Ms Liesa Nieskens

Ms Lena Korber

Ms Nadine Bader

Ms Neha Khara

Mr. Kirti Prasanna Mishra (consultant)

Mr. Santosh Gupta (consultant)

Contributors

List of contributors is given in each paper.

Design and Layout

Woodapple Team

Joy Banerjee

Pradeep Kumar Badajena

Yamini Baghel

Executive Summary

Overview

The impact of poor diets and unsafe food on human health is well understood. However, the environmental consequences of the way we produce our food are not well understood. Rising hunger, unsafe food and malnutrition in all its forms are most serious threats to global health. Our current food production system is driving the degradation of the natural environment – soil, water and air quality, biodiversity loss and climate change – and dangerously undermining our future well-being. Food systems have huge implications on livelihoods of a large number of people and hence consequences for inclusiveness as well.

The UN Food System Summit 2021 had resolved the food systems must work towards achieving Sustainable Development Goals by 2030 in three fundamental areas, namely -

People
"Nourishing Everyone for Health and Wellbeing."

Planet
"Producing in Harmony with Nature."

Prosperity
"Inclusive, Transformative and Equitable Recovery for the 2030 Agenda."

In future, the Summit had stated that The food systems must focus on feeding growing populations in ways that contribute to people's nutrition and health and well-being, restore and protect nature, are climate neutral, adapt to local circumstances, and provide decent jobs and inclusive economies.

Given its complexity, it is recognised that the above challenges of our food systems cannot be addressed in a top-down, pre-planned, and linear fashion. Instead, the solutions require all key constituencies and its stakeholders to change the way they operate. It must begin with developing a shared vision that takes into account multiple perspectives of many stakeholders and steer a positive narrative for change and then propel and promote change. It must build linkages to showcase and learn from experiences of others to drive continuous improvements, build excitement and commitment for change. This requires a systems approach to develop action-oriented roadmap for countries looking to accelerate and scale inclusive innovation that meet the needs of all stakeholders in the food system and support countries to invest in their capability to innovate.

Vision for 2030

On this backdrop, the Food Future Foundation, a non-profit organisation from India jointly with the support of CII-Food and Agriculture Centre of Excellence and the German Society for International Cooperation (GIZ) undertook an India-centric exercise of developing 'India Food System Vision Report 2030'. The Vision 2030 Report looks deeper into various facets of food systems keeping in mind that our people are adequately fed but at the same time environmental systems and processes are pushed beyond safe boundaries of food production.

The purpose of framing vision for 2030 is –

To create awareness about food systems approach and its core into the whole sustainable development agenda

To maximize the co-benefits of a food system approach across the 2030 agenda while meeting the climate change challenges

To list ambitious new actions, innovative solutions, and pathways to transform food systems

To align various stakeholders around a common understanding and narrative of a food systems framework for concerted action

To make food systems a more widespread issue for action

While serving these purposes it was ensured that the vision that the experts and stakeholders would like to see in 2030 has to be positive, inspiring and motivational to excite the stakeholders to initiate actions. The vision and pathways have been devised in such manner that they are actionable and concrete. They are also inspiring and motivational so as to excite the stakeholders to take action.

Process

The report is developed by engaging with a large group of stakeholders and experts from different areas of the food systems through the process of drafting > discussions > redrafting > reviewing > finalising. After sifting through a large pool of areas, 32 actionable areas were identified. A paper was then developed on each of the 'actionable area' based on template developed by the experts which contained actionable area, issue, status, vision 2030 and pathways to reach to the vision.

Smaller groups of experts or in some cases individual experts developed an initial draft. This draft was then discussed in smaller consultation groups that included subject experts as well as practitioners, NGO and industry leaders. Incorporating their insights, the draft papers were revised and the revised drafts were again reviewed by smaller groups of experts who finalized them.

Framework

Each paper in the vision report 2030 identifies first actionable area in brief manner. It then explains in detail what exactly the issue is and why this actionable area is relevant for which vision needs to be developed, what the challenges are and what needs to be done. The status sub section narrates where we stand now in that particular area, what are various government initiatives and private sector initiatives to overcome the problem and what is their status, what changes and impact they have made.

Each paper identifies the actionable area and current status and initiatives taken by various stakeholders. The vision 2030 for the actionable area, followed by a detailed list of pathways to reach that vision.

This helps to develop the vision for 2030, which is narrated in 2 to 3 points. The vision is then followed by a detailed list of pathways to reach that vision. The 32 essays are divided into three sections – People (11), Planet (10) and Prosperity (11).

People

More than a quarter of children and adolescents stunted, and pervasive micronutrient deficiencies such as anaemia, and an estimated loss of US$12 billion in GDP every year due to vitamin and mineral deficiencies alone; the rapidly rising obesity and non-communicable diseases such as diabetes, heart disease, and hypertension accounting for more than 60 percent of the deaths in the country. Globally, 20% disability-adjusted life years are

lost due to malnutrition more than any other contributor and the poor diet contributes to 6 of the top 10 risk factors for the global burden of disease.

About 100 million cases of foodborne diseases (FBDs) are reported every year, and unsafe food costing the country an estimated $15 billion a year. Globally, FBDs kill 420,000 each year, with children particularly vulnerable. Low- and middle-income countries are estimated to experience a productivity loss of some US$110 billion per year as a result of unsafe food.

Healthy diets are needed to nourish everyone for health and wellbeing. Such diets require carbohydrates fats proteins in right proportions along with macro-and micronutrients. Indian diets are predominantly cereal based. These are deficient in proteins and several essential micronutrients. These deficiencies are not only confined to the poor, however the poor, women and children are most affected by it. Diet diversity, nutrient-rich foods (fortified / bio-fortified) and nutrient supplementation are key strategies to make diets healthy. Safe food. Food cannot be considered healthy if it is not safe. Unsafe food does not nourish, it harms. Harmful effects of unsafe food would make it impossible to achieve desired nutrition objectives. Thus, food, if not safe, is not food. Microbial contamination especially of milk, meat and F&V, improper temperature control and adulteration are key issues in food safety. Ensuring only safe food is available for all is the governmental responsibility and has to be addressed by having adequate standards for safe food and ensure its compliance. However, given that a large part of food businesses are small and tiny and lack proper culture food hygiene and understanding of food safety issues. There it is a serious change.

On this backdrop, the ‘People’ section looks at understanding the enablers which will allow for a sustainable food system towards healthier consumption by consumers. It focuses on aspects of nutrition, heath supplements, food safety and traceability. The enablers identified will directly contribute towards the Sustainable Development Goals (SDGs) of *Responsible Consumption and Production, Good Health and Well Being, as well as Reduced Inequalities*.

While India is a food surplus nation, 14% of India’s population, 189.2 million people are undernourished. This is further intensified in Children as 34.7% of the children aged under five in India are stunted. In the Global Hunger Index (GHI) 2019 India is ranked 102 out of the qualifying 117 countries that were assessed.

It focuses on aspects of nutrition, heath supplements, food safety and traceability.

This shows a clear need to focus on pathways towards delivering nutrition to all, and specific nutrition delivery for children. With a vision to ensure food and nutrition security by increasing the availability, accessibility, affordability, and sustainability of iron rich fortified products to consumers as well as vulnerable groups through social protection schemes, the 2030 vision document sets clear pathways such as adopting a ‘Positive Deviation’ model in the ongoing programmes, integrating transparency and surveillance and strategic focus on academic research among others.

To overcome the problem of micronutrients deficiency in the Indian population, it is essential to look at fortification and bio-fortification as a complementary strategy. It is needed to end all forms of malnutrition related adverse outcomes and ensure a nutritionally secure generation by 2030. Further, Health Supplements and Nutraceuticals need to be leveraged towards strengthening the immunity of the people as a 'preventive health care' mechanism. This is critical given that lack of vital micronutrients in the Indian diet is not limited to any particular geographical area, socio economic section, gender or age group anymore, and dietary and nutritional approaches are of paramount importance in the management of non-communicable diseases (NCDs).

Towards long term nutrition security, there is a need to focus on nutrition for current working population as well as children who will enter the workforce in future. This is required in order to focus on strong human capital to act as driving force to move away from low skilled jobs to knowledge-based economy.

Not only nutritious food, but access to safe and nutritious food for all is the end goal. Unsafe foods containing pathogenic microorganisms and toxic chemicals are responsible for more than 200 diseases - from diarrhoea to cancer. The Indian government has taken several steps towards ensuring food safety; the Food Safety and Standards Act (FSSA) 2006 was designed to improve the overall food safety and the food trade within and outside the country, Food Safety and Standards Authority of India (FSSAI) conducts and plans several trainings and capacity building initiatives to improve the food safety environment, Ministries of Agriculture and Food Processing Industries also undertake advisory and awareness programmes towards the same. However, more effective implementation of food safety programmes is needed on a national scale for access to safe and nutritious food for all.

Along with nutritious food, access to safe water is not only a basic human right, but also a critical enabler to meet the SDGs of Good Health and Well Being, as well as Clean Water and Sanitation. As less than 50% Indians currently have access to safe drinking water, implementing a large-scale clean drinking water programme is essential. The 2030 vision document provides actionable pathways leveraging community, government and private stakeholders towards the same. There is also a need to set up additional infrastructure such as testing labs, desalination plants, community water purification plants, etc. towards meeting the vision of safe drinking water for all.

Traceability is a critical enabler towards food safety. While globally several countries have effectively integrated traceability into their food systems, for India the concept of traceability of foods is still in nascent stage. Consumers' concerns about the methods of food production (organic, inorganic, genetically modified) have also increased now, which is primarily motivated by foodborne disease outbreaks and chemical contaminants. Hence, implementing 'farm to fork' traceability is an essential requirement under food safety. The 2030 vision document provides specific pathways for how all stakeholders of the food system, including small farmers, farmer groups, retailors, value chain players can integrate traceability solutions and the necessary incentives need for the adoption of the same.

While both the government as well as the private sector have undertaken significant efforts towards bringing nutrition to the

forefront of Indian food systems, the challenge of consumer acceptance still remains. Thus, the section on 'People' focuses on means to create an informed society fully aware of sustainable eating and lifestyles in harmony with nature; and strengthening 'Eat Right India' movement to bring in behavioural change and enable access to safe and nutritious food.

Planet

Current food production system causes many environmental concerns arising from huge food loss and waste, deteriorating soil health, loss of biodiversity, use of plastics in food packaging, and its improper disposal. Globally, food systems account for 80% of freshwater consumption, contribute 20-30% of global greenhouse gas emissions, and responsible for 70% of terrestrial biodiversity loss and 80% of global deforestation. And nearly one-third of all food that is produced is lost or wasted. The world is off-target to meet the Paris Agreement climate target of limiting global warming to a 1.5°C rise. The biodiversity trends are negative; and the poverty levels are on the rise again due to the pandemic.

Shift from conventional to sustainable farming practices is good for both, people and planet. Given that India's farm sector is dominated by small holding famers, this is all the more desirable. Small-scale farmers connected through agri-food value chains, community-driven approach that creates self-sufficient local food ecosystems reducing storage and transport costs and post-harvest losses provide eco-friendly solutions. Drip irrigation and water harvesting could be mainstreamed and help India to achieve zero-water wastage. The production of crops could shift to millets, traditional food crops and regional grains as per local needs. In this context, mainstreaming regenerative and climate-smart agricultural practices and empowering farmers to transition to net-zero, nature position food production becomes a priority. This also creates additional co-benefits, such as increased socio-economic resilience, improved livelihoods and enhanced soil and water health. Indian agriculture has to shift from a 'grow more' to a 'growth plus' model which integrates natural resource management and better nutrition.

Planet section recognises that a food system must be considered in the context of climate change, stress on natural resources, rapid population growth, urbanisation, growing wealth, changing consumption patterns and ensuring food and nutrition security

On this backdrop, the 'Planet' section elaborates on the need for moving to food systems that promote biodiversity, regeneration, nutritious food, equity and healthy people and contributes to the SDGs of *Responsible Consumption and Production, Climate Action, Reduced Inequalities, Clean Water and Sanitation and No Poverty.*

Planet section recognises that a food system must be considered in the context of climate change, stress on natural resources, rapid population growth, urbanisation, growing wealth, changing consumption patterns and ensuring food and nutrition security.

In this context it is important to envision how the principles of decentralisation, diversification and agro-ecology are crucial to reduce the negative ecological footprints inducing economic growth with diversity.

Natural farming is one way to deal with the challenge. Shift to natural farming must also be keeping in mind the surrounding socio-cultural context, focusing primarily on women and small, marginal and landless farmers, also acknowledging local indigenous knowledge systems and agro-ecosystem complexes. It should also be accompanied by integrated farming systems approach by shifting farmers' focus from individual components of household's basic needs for food.

The third approach to think of is the forest–dependent food systems as the tribal living in the forest is an important integral part of the food systems and delivering an affordable but nutritious diet to them is also equally important. It calls for joint efforts of policymakers and researchers to resolve nutrition divide for a sustainable food system for the tribal people. Policy makers need to look at the promotion of Pastoralism, which can play a significant role in livelihood and nutrition of rural people. But it has neither gained recognition in public discourse nor is it appreciated as food system in policies. This further leads to no definition and having no official data. This situation needs to be changed by acknowledging it in national policies and recognising its rights and entitlements.

Climate change has already started showing its adverse effects on the agriculture activities, and they are expected to be even more severe in years to come. The food systems have to foresee the likely effects and develop a climate-resilient food production system. This requires integrating diversity in all forms through collective, collaborative and integrated actions by communities, government, civil societies, consumers and change makers. Under the climate resilient productions system, the important role of wild and uncultivated food should be recognised. Recognition as well as conservation and promotion requires policy and programme support.

The foods systems stretch planetary boundaries. Overemphasis on quantity over quality and mono crops production for low prices degrade the land and natural resources needed for sustained production. Two natural resources that suffer a lot in the process are water and soil. When it comes to water about half of the water demand will be unmet by 2030 if the current demand pattern continues. Science and technology based agro-ecology driven management of water is the only answer to meet the challenge. Agro-ecology needs to be brought at the centre of both – water and land for greater water resource efficiency and environmental justice.

When it comes to soil it is detrimental to global food security and negatively impacts climate, water systems and biodiversity. Working to improve soil health by moving away from exploitation of soils to recycling nutrients and organic material is a way for leading to production and adoptive capacities for sustainable and ecological food systems.

All these steps are required ultimately for agrobiodiversity and nutrition security to go hand in hand. The losing agrobiodiversity needs to be restored since it is critical to the lives and livelihoods of small farmers, rural communities and indigenous people and to their culture and tradition. These steps may answer an important question - how can we feed our growing population and at the same time protect our planet for generations to come. Or on a larger scale, how do we ensure that our food systems are fair, resilient and equitable.

These efforts require a better understanding of how a diverse range of food systems functions. It is critical to ensuring that these systems develop in such a way that minimise their negative impacts and maximises their positive contributions.

Prosperity

Given that food system provides employment to large number of people in our country, understanding the enablers that allow for a sustainable food system towards better price realisation for producers and other actors across the food supply chain is essential for a prosperous ecosystem. Prosperity can be achieved in a variety of ways but essentially by considerably reducing the food wastage and losses, improving quality and quantity of farm products and developing market and consumer linkages. These factors can be achieved by initiating various steps like increasing food processing, developing food storage and integrated cold chain infrastructure, leveraging farm technologies, empowering farming communities etc.

The 'Prosperity' section looks at understanding the enablers which will allow for a sustainable food system towards a prosperous ecosystem. The enablers identified will directly contribute towards the SDGs of *Zero Hunger, Good Health and Well Being, as well as Reduced Inequalities.*

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Enhancing food processing levels, particularly primary processing for value addition will have direct impact on farmers' incomes due to assured market and reduction in food losses. One more benefit of food processing is that the processed food can be an effective way to ensure access to nutrition. Moving up the processing value chain alone is not adequate, but what is needed is also focussing on higher value processed foods such as fruits and vegetables. While on one hand this will allow for better price realisation, on the other it will also help meet India's nutrition goals. So, just one step of enhancing processing levels will leverage towards combatting malnutrition, micronutrient deficiencies and reducing consumption nutrients of concern as well as enhancing farmers' income. Understanding the difference between food loss and food waste is important and a chapter in this section does that by differentiating between food loss and food waste and suggests enablers towards allowing more

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streamlines and transparent food donation solutions towards minimising food waste.

India's agriculture production has increased a lot, but the storage, transportation infrastructure is yet to align to the level of production, leading to losses of food grains, fruits and vegetables. Enhancing and improving the effective storage infrastructure is the only way to reduce food losses. For perishables, the focus is on integrated farm to fork cold chain infrastructure. The vision is to develop dry storage efficiency and integrated cold chain solutions which are energy and cost efficient towards better logistics connectivity of farm to fork and reducing food loss.

Producer-consumer integration using technology and digital intervention and effective use of social capital for transforming the food system will allow for more varied market linkage channels, enhance completion thus bringing in quality, and also provide for better price realisation opportunities.

The most critical stakeholder of food systems is the producer. Empowering the producer is the key to resolve problems. Focuses on imparting knowledge on optimising natural resources, allowing better terms of trade, cooperation and collectivisation of farmers, especially women, are some of the ways to empowering farming communities. It needs to be coupled with leveraging technology which will allow for solutions of a lot of farmer level issues ranging from demand led production, risk mitigation, better post-harvest technologies and efficient usage of natural resources.

Academic research is one more important component in the prosperity. It is crucial to continue to focus on research and innovation by academic institutions for enabling enhanced production in a sustainable manner.

Among the various facets of prosperity is rural livelihoods. Promoting and enabling primary processing can enhance rural incomes through value addition and reduce waste and thus can support rural livelihoods. This will also generate local employment, which is a crucial enabler towards prosperity. Developing local employment and entrepreneurial opportunities and maintaining biologically diverse landscapes for sustainable intensification of agriculture by focusing on 3 'I's - Innovations, Incentives and Institutions will help in generating local employment.

Food safety in one of the crucial part of the prosperity. Given the dominance of the informal sector in Indian foods, it is crucial to ensure that food safety is maintained in that sector. To achieve participation of street food vendors in the implementation of food safety programmes is very essential and the FSSAI is doing programmes for involvement of street food vendors in food safety. These programmes are needed to be widen considering the huge number of street food vendors and their spread across the country.

Conclusion

Thirty-two papers in the three sections show ways to reach to the food and nutrition security for the large population of the country simultaneously ensuing sustainable development of the agriculture sector during a decade ahead. Adopting the pathways suggested in the 2030 vision document will help secure the India's Food System.

The way challenges related to our food system are interrelated, so are the solutions. The actionable areas are thus interlinked with complex interdependencies, possible synergies, and likely trade-offs between them.

We sincerely believe the report will help India and other countries move in the direction of healthy diets and sustainable food production.

About

Food Future Foundation

Food Future Foundation, a non-profit organization was established in 2019. It is working towards transforming food systems in India by engaging, exciting and enabling key stakeholders to change the food system that delivers both for the people and the planet. The Foundation provides a platform of key stakeholders working towards transforming food systems in India by engaging, exciting and enabling them to change to the food system that delivers both for the people and the planet.

About CII

Confederation of Indian Industry

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering Industry, Government, and civil society through working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for Industry.

For more than 125 years, CII has been engaged in shaping India's development journey and works proactively on transforming Indian Industry's engagement in national development. The premier business association has over 9000 members, from the private as well as public sectors, and an indirect membership of over 300,000 enterprises from around 294 national and regional sectoral industry bodies.

With 62 offices, including 10 Centres of Excellence in India, and 8 overseas offices in Australia, Egypt, Germany, Indonesia, Singapore, UAE, UK, and USA, as well as institutional partnerships with 394 counterpart organizations in 133 countries, CII serves as a reference point for Indian Industry and the international business community.

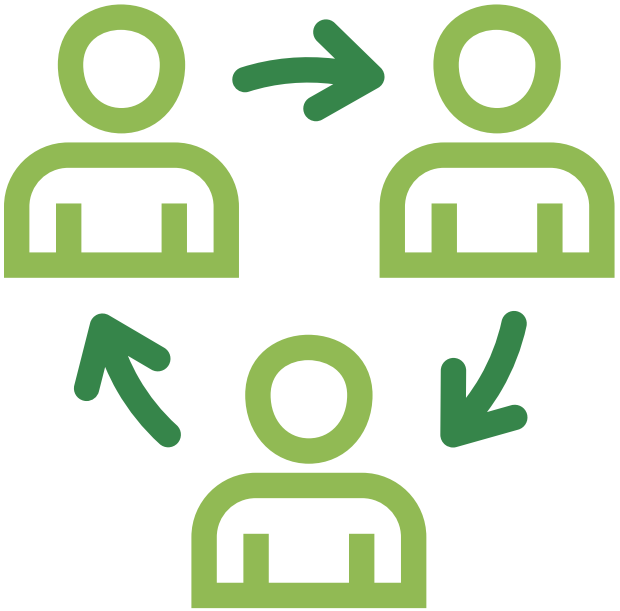
About FACE

FACE is CII's Center of Excellence dedicated to building efficiencies across the agriculture value chain from farm to fork. FACE is charged with the mission of improving competitiveness of India's agriculture and food sector by catalysing innovation, building capacity and enhancing productivity across the value chain. FACE works with farmers, companies, development institutions and the government to

- **Improve on and off-farm productivity through dissemination of best practices and technology innovation**
- **Invest in capacity building initiatives and skill development for supply chain participants across the value chain**
- **Strengthen linkages across the value chain through market access initiatives, thereby reducing losses and increasing farmer incomes**

About GIZ

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, on behalf of the German Federal Government, is a global service provider in the field of international technical cooperation for sustainable development. In India, GIZ has been working for over 60 years, jointly with partner ministries, state governments, public sector and private sector entities for sustainable economic, ecological and social development. The focal areas of the Indo-German cooperation are Energy, Environment, Climate Change and Biodiversity (including NRM, agroecology and agriculture), Sustainable Urban and Industrial Development, and Sustainable Economic Development. The German Federal Ministry for Economic Cooperation and Development (BMZ), the German Federal Ministry of the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) as well as the German Federal Ministry for Economic Affairs and Energy (BMWi) are the main commissioning parties of GIZ in India. Other clients include Indian public sector clients, the European Union and international foundations.of India's agriculture and food sector by catalysing innovation, building



SECTION 1

People

people

food future foundation

Multiple Pathways to Deliver Nutrition to All

1 Poshan Abhiyaan

Actionable Area

Focusing on strategies to scale Poshan Abhiyaan, ensuring access to safe and nutritious food for all.

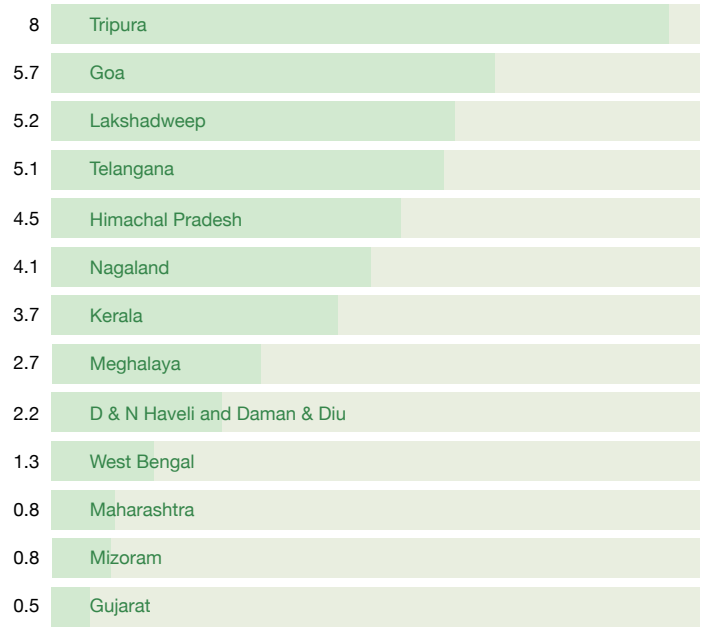
Issue

Partial results from the National Family Health Survey round 5 (NFHS-5) Phase I released for 22 states/UTs drew attention to the persistent problem of malnutrition in the country. The findings indicate a slight improvement in some of the indicators in a few states, but in several states, there is a worsening of the malnutrition situation. The percentage of children suffering from chronic child undernutrition, and childhood stunting, has increased in 13 out of 22 states, while acute undernutrition or wasting has increased in 12 out of 22 states, and underweight has also increased in 16 out of 22 states. There is also an increase in the prevalence of anaemia among young children, adolescents, pregnant women, non-pregnant women, and men in most of the states.

Moreover, the recent state-wise findings for 19 of 22 states /UTs, presented as the state Nutrition Profiles' (SNPs), showcase the variability of performance across districts in terms of nutrition outcomes, immediate and underlying determinants. Due to the widespread burden of malnutrition, it is imperative to strengthen the delivery systems of the key actions. Policy actions are required through a multisectoral system to achieve global public health targets.

Stunting* Among Children (0-5 years)

% Increase from 2015-16 to 2019-20



*low height for age

Source: National family health survey-5 (2019-20) Phase-1 report

Status

Government Initiatives

The Prime Minister launched the 'flagship' programme, PoshanAbhiyaan(theNational Nutrition Mission), in March 2018 with the ambitious goal of achieving a KuposhanMukt Bharat (malnutrition free India) to improve nutritional outcomes for children, pregnant women, and lactating mothers. The programme aims to ensure service delivery and interventions through technology, behavioural change through convergence and lays down specific targets to be achieved across different monitoring parameters over the next few years. The mission recognises that the repercussions of malnutrition are lifelong and irreversible, so that the implementation strategy would be based on intense monitoring and Convergence Action Plan right up to the grassroots level.

For the implementation of POSHAN Abhiyaan, the four-point strategy/pillars are:

- Inter-sectoral convergence for better service delivery.
- Use of technology (ICT) for real-time growth monitoring and tracking of women and children.
- Intensified health and nutrition services for the first 1000 days.
- Jan Andolan- people's movement.

NITI Aayog has played a critical role in shaping the POSHAN Abhiyaan and has been entrusted with closely monitoring the POSHAN Abhiyaan and undertaking periodic evaluations to assess the readiness/ preparedness of the readiness/preparedness the States and Union Territories to implement the Abhiyaan effectively. The Implementation Scores criteria have been used to measure the readiness of the States/UTs to implement and execute the POSHAN Abhiyaan effectively. The inputs by NitiAayogare further grouped under the following categories, which are critical for effective execution of POSHAN Abhiyaan:

- Governance and Institutional Mechanism.
- Strategy and Planning.
- Service Delivery and Capacities.
- Programme Activities and Intervention Coverage.

POSHAN Abhiyaan was earlier designed to cover all the states/UTs and districts in three phases, i.e., 315 districts in 2017-2018, 235 districts in 2018-2019 and remaining districts in 2019-2020. However, it was launched as a national programme covering all districts to bring down stunting in children (0-6 years), from 38.4% in 2016 to 25% by 2022. While POSHAN Abhiyaan has an earmarked three-year budget of Rs. 9046.17 crore commencing from 2017-18, it really is an overarching framework that seeks to leverage funds, functionaries, technical resources and IEC activities from existing programs and schemes such as the Integrated Child Development Services (ICDS)- the beneficiaries under the Scheme are children in the age group of 0-6 years, pregnant women and lactating mothers focusing on

- Improving the nutritional and health status of children in the age-group 0-6 years;
- Lay the foundation for proper psychological, physical, and social development of the child.
- Reduce the incidence of mortality, morbidity, malnutrition, and school dropout.
- Achieve effective co-ordination of policy and implementation amongst the various departments to promote child development; and
- Enhance the capability of the mother to look after the normal health and nutritional needs of the child through proper nutrition and health education.

There are several other schemes, such as the National Health Mission (NHM), which envisages achievement of universal access to equitable, affordable & quality health care services that are accountable and responsive to people's needs; Swachh Bharat Mission (SBM) to accelerate the efforts to achieve universal sanitation coverage and to put the focus on sanitation; National Rural Livelihood Mission (NRLM), National Rural Employment Guarantee Assurance (NREGA) and the Public Distribution System- PDS which is operated under the joint responsibility of the Central and the State Governments. Under the PDS, presently, wheat, rice, sugar, and kerosene are being allocated to the states/UTs for distribution. Some states/UTs also distribute additional items of mass consumption through the PDS outlets such as pulses, edible oils, iodised salt, spices, etc. The idea is to align the efforts of every stakeholder in a direction that could positively impact nutrition outcomes. Other key Nutrition strategies and interventions include IYCF (Infant and Young child feeding), Food and Nutrition, Immunization, Institutional Delivery, WASH (Water, Sanitation and Hygiene), De-worming, ORS-Zinc, Food Fortification, Dietary Diversification, Adolescent Nutrition, Maternal Health and Nutrition, ECD (Early childhood development)/ECCE (Early Childhood Care and Education), Convergence, ICT-RTM (Information and Communication. Technology-enabled Real-Time Monitoring) and Capacity Building etc.

A number of states have introduced innovative schemes towards improving the nutrition situation. States such as Chandigarh, for instance, has developed a *POSHAN Helpline*. The helpline provides remote access to the Anganwadi worker and gives the opportunity to book a home visit of the Anganwadi worker/Auxiliary Nurse Midwife. The *Rajpusht programme* in Udaipur, Rajasthan, involves a 360-degree approach that provides cash incentives to women to enhance the nutritional status of children and delivers on-ground communication on social and behavioural change. The programme targets children, pregnant and lactating women and reaches out to community members, husbands, and family members to improve dietary patterns, health-seeking behaviours, and nutritional practices. The *Mamata programme* in Odisha provides a cash benefit scheme to pregnant and lactating women to improve nutrition and promote health-seeking behaviours.

Several stakeholder Ministries have also expressed their commitment to the objective of PoshanMaah and planned activities in 2020 to bring Nutrition in focus through their verticals. Department of School Education, Ministry of Education has asked states to conduct Nutrition e-quiz and Meme making competition amongst students. Ministry of Rural Development has advised states to promote Nutri-gardens with the support of Mahatma Gandhi NREGA. Ministry of Ayush has offered to support building a healthy lifestyle by adopting Yoga and holistic nutrition. Ministry of Health and Family Welfare has also extended its cooperation for all the activities in the best possible manner.

Interventions such as the 'Eat Right India' movement by the FSSAI focuses on eating right, safe and sustainable and promoting awareness about a balanced and healthy diet. In association with POSHAN Abhiyaan, this initiative has penetrated schools, homes, and hospitals to educate on and promote quality diets, with a strong focus on well-being. Furthermore, the development of Eat Right Toolkits will further enable the goals by providing a method of digital counselling on how to improve their nutrition and diet. Additionally, FSSAI has set up the "Food Fortification Resource Centre (FFRC)" for providing technical support to various ministries of the government to fortify the five staples—rice, wheat, oil, milk and salt—and for providing assistance to the states on how these can be disseminated through PDS, Mid-Day Meals or the ICDS. Under Eat Right efforts, several food companies such as ITC, Adani, Tata, Dawat etc., for which staple food fortification is relevant, voluntarily fortify some or all of their products according to standards set by FSSAI.

Another initiative called the Impact4Nutrition was launched by a diverse network of partners, including UNICEF, Sight and Life, CSRBox, Tata Trusts and the Confederation of Indian Industries as a PPE. The input is to help governments deliver on their targets, harness the power and reach of businesses, and reduce the financial and health burdens that are linked to poor diets.

Private sector Interventions

In terms of private sector interventions, several companies like HUL, PepsiCo India, ITC Ltd etc., have developed comprehensive, public, formal commercial strategies to address issues related to the double burden of malnutrition in India. Nestlé India is working towards improving the nutrition scenario in India with its Healthy Kids Programme, which focuses on raising nutrition, health, and wellness awareness among school-going children. Additionally, ITC's "*Mission SunheraKal*" program on Mother and Child Health aligns with the Integrated Child Development Services and PoshanAbhiyan and aims to reduce infant/ maternal mortality and child malnutrition. A Memorandum of Understanding (MoU) has been signed with TATA Trusts to deploy one Swasth Bharat Preraks (SBP) across each district and with the NASSCOM Foundation for technical and administrative support for implementation and roll-out of the Abhiyanat state/UT level. A total of 270 SBPs have been deployed to date.

Vision 2030

- **Reduce Stunting from 38.4% (NFHS-4) to 25% by 2022 (Mission 25 by 2022)and end all forms of malnutrition by 2030.**
- **Empower states/ UT's, line ministries and encourage convergence.**

2 Resolve to work for protein sufficiency

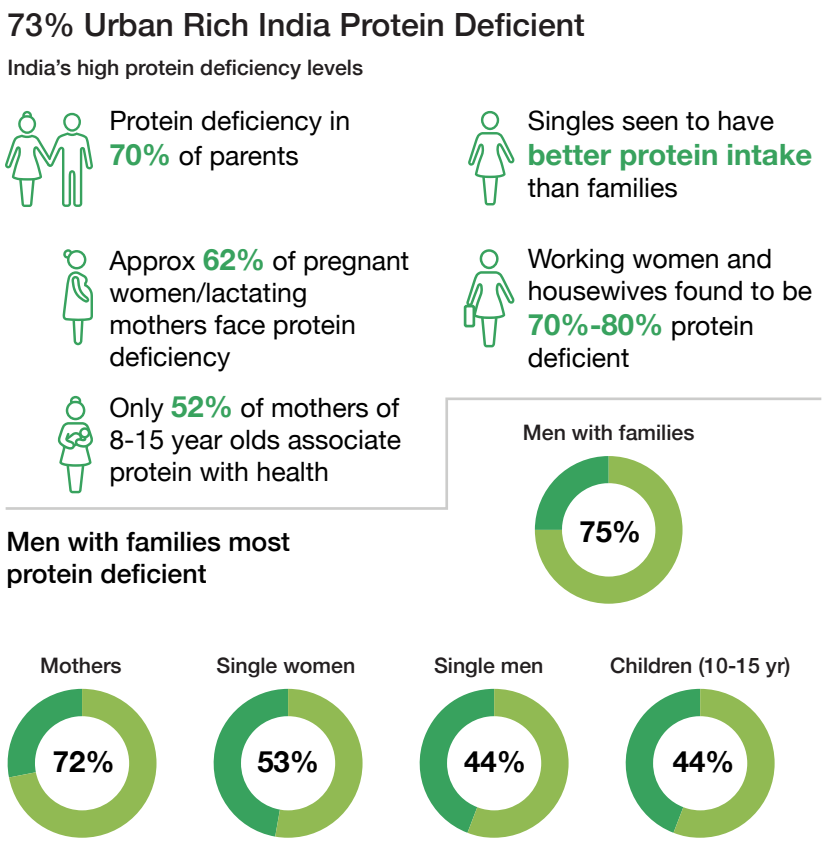
Actionable Area

Consolidating efforts for protein sufficiency to ensure that diseased burden is reduced.

Issue

The recommended dietary allowance of protein (2020 RDA)for an average Indian adult is 0.8 to 1 gm per kg body weight. However, India has the lowest average protein consumption (at 47 gm per person per day) compared to other Asian countries and developed nations. Indians lack awareness and are not consuming an adequate quantity of protein regularly. A 2017 India Market Research Bureau (IMRB) survey shows that 73% of Indians are deficient in protein while above 90% are unaware of the daily requirement of protein.

Low-quality protein intake has consequences in adult life; for example, poor protein intake is associated with sarcopenia, and undernourished men have substantially less muscle mass than well-nourished men. Functional studies, such as those measuring glutathione homeostasis, are also relevant in this context. Having less muscle mass limits an individual's mobility and is also a risk factor for diabetes because skeletal muscle is a major site for glucose disposal at rest, and insulin sensitivity is associated with reduced skeletal muscle mass and its function. From the Protein Paradox Study by Right to Protein that surveyed over 2142 mothers across 16 cities to understand the reasons why protein was ignored in an Indian household, an



insight that emerged was the misinformation surrounding protein and its consumption. Nearly 95% of Indian mothers know of protein as a macro-nutrient, but only 3% really understand its important functions and why one should consume it.

The EAT Lancet-Commission report shows that Indians consume more simple carbohydrates and less complex carbohydrates, proteins, and fruits and vegetables in their diets. The Indian Consumer Market 2020 shows high monthly expenditure on cereals, processed foods, with only one-third of the food budget being spent on protein-rich foods. India is also facing the double burden of malnutrition, with 38 per cent undernutrition (46.6 million) in children under the age of five and about 15 per cent obesity and overweight (14.4 million). There is variation in obesity prevalence across age, gender, socio-economic status, with the ICMR-INDIAB study showing that the prevalence of obesity ranges from 11.8% to 31.3% for India. With the rise in non-communicable diseases, it is important to have a balance in the quality and quantity of macronutrients. There has been a declining trend in the consumption of protective foods like pulses and milk. The inclusion of high-protein foods in a diet has been strongly associated with improving insulin response and reducing diabetes.

NITI Aayog has also highlighted the case for including protein-rich foods—both plant and animal protein—in the public distribution system, evidenced in the government's relief package for poor and vulnerable families in the wake of the pandemic. India's nutrition programmes, through the Public Distribution System (PDS), have targeted the poor by providing for subsidized food grains to be given to beneficiaries under the National Food Security Act, which includes rice, wheat, and millets. The protein supplementation through PDS averages 7.2 gm/day and 3.8 gm/day in rural and urban areas, respectively.

Status

Government Initiatives

The Government of India has various safety net programmes under the National Food Security Act for improving nutrition and food security. They include the Integrated Child Development Services (ICDS), which provides 500 kilocalories, with 12-15 gm of protein per day to children and up to 25 gm of protein for adolescent girls and the Mid-Day Meal Scheme (MDM), which provides for 300 kilocalories and 8-12 gm of protein per day. Rajiv Gandhi Scheme for Empowerment of Adolescent Girls (RGSEAG)is a centrally sponsored program of the Government of India for adolescent girls 11–18 years of age under all ICDS projects in selected 200 districts in all the states/UTs in the country. The scheme focuses on all out-of-school adolescent girls who would assemble at the Anganwadi Centre as per the schedule and frequency decided by the States/UTs.

The others, i.e., the school-going girls, would meet at the AWC at least twice a month and more frequently during vacations/holidays, where they will receive life skill education, nutrition & health education, awareness about other socio-legal issues etc.

In 2020, to protect the community from the impact of the pandemic, the government had announced an additional Rs. 22.6 billion relief packages under the 'Garib Kalyan Yojana' allow for an additional supply of 5 kg rice/wheat and 1 kg of preferred pulses per month. According to the government's National Action Plan for Egg & Poultry-2022 (NAPEP), plans to fulfil the objective of protein-enriched food requirement of the country's growing population and prevent malnutrition in one of the highest malnourished children populations in the world. As

a policy, the PDS should provide protein-rich foods at subsidized rates to make them more affordable and available. States (such as Andhra Pradesh and Telangana) that are providing pulses through PDS are considered to have better protein intake by households (NAPEP, 2022).

Private Sector Interventions

Several private sector interventions such as Danone India has sensitized Indians about the importance of Protein and created mass awareness about the role of protein in maintaining good muscle health which is compromised as we age through various public health awareness workshops in several cities, where leading nutritionists to educate people about the role of protein and other vital nutrients in building immunity. In 2018, Danone also joined the 'Eat Right India' movement launched by Food Safety and Standards Authority of India (FSSAI), to work on improving the nutritional profile of its product portfolio in India. Another intervention led by the private sector, the milk district initiative of Nestle, improved the productivity and income of small producers, in the process increasing their purchasing power to afford nutrient-dense foods. There is evidence in many cases of increase in milk consumption by small producer households, e.g. the Mulkanoor Dairy Cooperative which recorded indication of increased availability and consumption in the area of production. Interventions like 'Saanjhapan' (Create Shared Value) priorities the aspects of hygiene and quality of milk, bringing into focus the dimensions of food safety and quality in addressing undernutrition.

Towards developing a self-sustaining agri-food-nutrient ecosystem, ITC limited has also worked on integrating agri-value chain with the product development that has led to the development of value added, high protein products (through e-choupal channels etc).

Right to Protein, a nation-wide public health initiative, was announced in 2019 to educate the people in India about the importance of proteins for their general health, fitness and wellbeing. #RightToProtein campaign aspires to act as a catalyst in promoting consumption of different forms of proteins amongst Indians for better overall nutrition. The objective isto bring together institutions, academicians, professionals and individuals that can participate in on-ground activities, share knowledge and expertise to drive protein awareness in India.

Several plant-based protein start-ups have also emerged. Mister Veg which is formed with a view to provide an innovative solution for nutritious and delicious plant-based meat and sea food alternative in hygienic & cost-effective manner. GREENEST which is a plant-based foods brand created by Upstablish Food Technologies Private Limited, a food tech company working to address the fast-growing protein and nutritional needs of India.

Vision 2030

- **Increase the average intake of protein from 47 gm per person per day to recommended intake of 68 gm per person per day in line with Global protein consumption.**
- **Increase awareness among people regarding protein through public health programs engaging various stakeholders and help people to improve their diet quality by including rich protein sources on a daily basis.**

3 Anemia Mukt Bharat

Actionable Area

Consolidating efforts to tackle the malnutrition problem of iron deficiency anemia through a package of appropriate strategies and interventions.

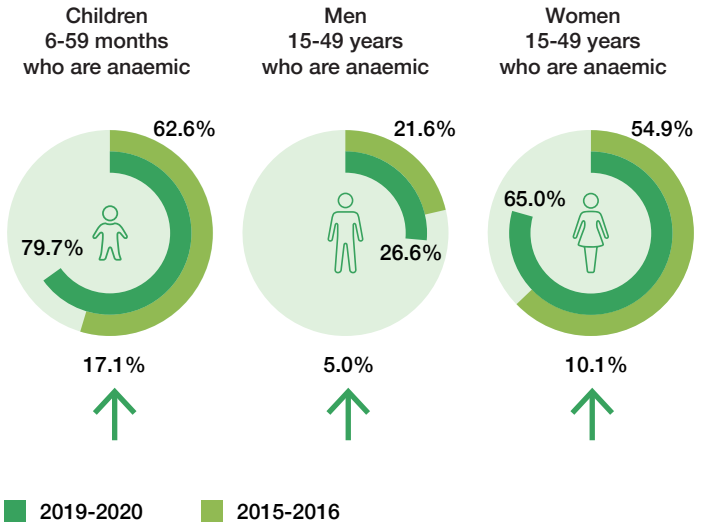
Issue

The recently published NFHS-5 report has key findings for 22 states and UTs. Compared to the fourth round of the National Family Health Survey (2015-16), evidence from the latest NFHS-5 (2019-20) reveal that anaemia prevalence rates have increased across many groups (i.e., children, pregnant and non-pregnant women, and men) in different states. Anaemia among children (aged 6-59 months) increased from 53.8% to 68.9% within the last five years, i.e., between NFHS-4 and NFHS-5. Similar jumps of 49.7% to 57.2% among adolescent women (aged 15-19 years) and 47.9% to 54.5% among non-pregnant women of reproductive age were found. There were increases in the prevalence of anaemia within the male population as well. According to the Global Nutrition Report 2020, one in two women of reproductive age is anemic.

To tackle anemia in India, the Anemia Mukt Bharat (AMB) program was launched in March 2018by the Government of India under the Prime Minister's overarching scheme for Holistic Nourishment (POSHAN) Abhiyaan. One of its targets is to reduce anemia by 3% per year to support the end of the goal of attaining a malnutrition free India by 2022. The program uses the 6x6x6 strategy - which implies six age groups, six interventions and six institutional mechanisms.

Prevalence of Anaemia Among Children, Men, and Women

Swasth report card Gujarat



Source: National family health survey-5 (2019-20) Phase-1 report

The six population groups under AMB strategy are:

- Children (6-59 months)
- Children (5-9 years)
- Adolescents girls and boys (10-19 years)
- Pregnant women
- Lactating women
- Women of Reproductive Age (WRA) group (15-49 years)

The six interventions are:

- Prophylactic Iron and Folic Acid Supplementation
- Deworming
- Intensified year-round Behavior Change Communication (BCC) Campaign and delayed cord clamping
- Testing of anemias using digital methods and point of care treatment,
- Mandatory provision of Iron and Folic Acid fortified foods in Government-funded health programmes
- Addressing non-nutritional causes of anaemia in endemic pockets, focusing on malaria, hemoglobinopathies and fluorosis and the six institutional mechanisms.

The six institutional mechanisms are:

- Inter-ministerial coordination
- National AnemiaMukt Bharat Unit
- National Centre of Excellence and Advanced research on Anemia Control
- Convergence with other ministries
- Strengthening supply chain and logistics
- AnemiaMukt Bharat Dashboard and Digital Portal- one-stop-shop for Anemia

Status

Government Initiatives

India has a long history of National Nutritional Anemia Control Program (NNACP) are modified as the National Iron Plus Initiative (NIPI) to combat anemia.

Under AMB, the IFA Supplementation Program aims to meet the challenge of high prevalence and incidence of iron deficiency anemia among age groups from 6 months to 19 years. The long-term goal of AMB is to break the intergenerational cycle of anemia, the short-term benefit is a nutritionally improved human capital, and the IFA supplementation program supports both. The program is being implemented in all States/UTs of India, aiming to reach 11.2 crore beneficiaries, including 8.4 crore school-going and 2.8 crore out-of-school children and adolescents (Weekly Iron Folic Acid Supplementation, NHM). The IFA Supplementation program— is highly impactful and cost-effective: a pilot with adolescent girls reduced anemia by 24% after one year at an average cost of just Rs.39.12 per girl treated (WIFS, NHM).

Initiatives like NDD (National Deworming Day) and IFA (Iron and Folic Acid) supplementation programs have been making key contributions towards the reduction of anemia. Launched in 2015, NDD scaled rapidly to national coverage, from treating 8.9 crore children in 2015* the now biannual program now covers 26 crore children and adolescents per round. Worm infestations interfere with nutrient uptake, can lead to anemia, malnourishment, and impaired mental and physical development, and pose a serious threat to children's health, education, and productivity.

Programs like IFA Supplementation and NDD, with their unique strategies like target setting guidance for states, extended mop-up days to include beneficiaries who missed out, scaling up to include more private schools and; community-based deworming work to support the POSHAN Abhiyaan, with the aim to leave no one behind while reiterating the message of health for all.

To fight chronic anaemia and undernutrition, the government is making plans to distribute fortified rice through the Integrated Child Development Services and Mid-Day Meal Schemes across the country from the year 2021, with a special focus on Aspirational districts and this was decided in a review meeting of an existing pilot scheme which was approved in February 2019, for a three-year period from 2019-20 onwards. With reference to the Prime Minister's announcement of 15th August 2021, one district each in 15 predominantly rice-eating states was selected. It was found that out of 15 states, only 5 — Andhra Pradesh, Gujarat, Maharashtra, Tamil Nadu and Chhattisgarh- have started the distribution of fortified rice in their identified pilot districts. The Food Corporation of India (FCI) has now also been mandated to scale up the annual supply of Fortified Rice Kernels (FRK) from the current 15,000 tonnes to at least 1.3 lakh tonnes. To cover PDS, anganwadis and mid-day meals in the 112 aspirational districts, annual supply capacity would need to be increased to about 1.3 lakh tonnes. Further, existing rice mills will be equipped with Blending Machines for mixing FRK with normal rice.

The Food Fortification Resource Centre (set up by FSSAI with support from Tata Trusts) is also supporting to overcome anemia as a resource hub that provides information and inputs on standards and food safety, technology and processes, premix and equipment procurement and manufacture, quality assurance and quality control for fortification of foods. Several international NGOs like PATH's present work on fortification centres around rice fortification, which involves manufacturing fortified rice kernels (FRKs), and blending them with regular rice kernels. PATH has operations in Gujarat and Chandigarh with the largest presence in Karnataka, where they are working in six state-level Akshaya Patra Foundation kitchens under the Midday Meal (MDM) scheme. The typical kitchen feeds between 100,000 and 150,000 children per day, six days per week.

Private Sector Interventions

- In terms of private sector interventions, several brands have successfully launched the fortified iron products across different staples such as
- ITC's Aashirvaad Chakki Atta (Wheat Flour fortified with Iron + Folic Acid + Vitamin B12),
- TATA salt plus (salt fortified with Iron + Iodine),
- Daawat Sehat Mogra (Rice fortified with Iron + Folic Acid + Vitamin B12),

- Phillsbury Chakki Fresh Atta (Wheat Flour is fortified with Iron + Folic Acid + Vitamin B12), Golden Harvest Chakki Atta (Wheat Flour is fortified with Iron + Folic Acid + Vitamin B12), Britannia Tiger Biscuits,
- Nirmal Seeds ICTP 8203 Fe Pearl Millet
- Organizations like HarvestPlus has operated in the country for nearly nine years, in close collaboration with ICAR, India's State Agricultural Universities (SAUs), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), seed companies, etc. to develop varieties like high-iron pearl millet that can stem the deleterious ripple effect of iron deficiency by significantly improving nutrition and cognitive performance.

Vision 2030

- **Reduce prevalence of anaemia by 3% per annum respectively in line with the PoshanAbhiyaan targets and end all malnutrition related adverse outcomes by 2030.**
- **Ensuring food and nutrition security by Increasing the availability, accessibility, affordability and sustainability of iron rich fortified products to consumers as well as vulnerable groups through social protection schemes and open market.**

Pathways

POLICY

Enhance sustainability and accountability by streamlining the targets and sub-targets under each flagship programme part of the AMB strategy, with special attention to further strengthening the food system.

Emphasis is to be laid towards adopting the positive lessons emerging in various states' ongoing programme intervention strategies. In this context, the key strategies and processes that led to achievements in improving the nutrition situation of the identified well-performing states should be critically studied, analysed, documented with details of processes on what worked and disseminated the findings for wider adoption of the emerging evidence by other states/UTS. Incorporation of root cause analysis and Quality Implementation Approach (QoI) to be considered crucial and incorporated with concurrent intervention assessments (behaviour change communication, deworming etc.) towards bridging gaps and maximizing outreach.

Strengthen monitoring and surveillance to track violations related to the marketing of breast milk substitutes.

Focus on Anaemia has largely been preventive; there needs to be a greater focus on treatment. There is a need to leverage the private sector, with a focus on new innovations, including the development of non-invasive technologies, deployment of mobile medical units that ensure real-time assistance and development of treatment regimens and protocols in convergence with the central and state governments.

Incentivise farmers through minimum support price and promote industry participation towards ensuring availability of Nutri-cereals and protein-based pulses for consumers.

Advocate for the formulation of policies that impact public health strategies such as upper permissible limits for food fortification and tolerable limits along with EAR/RDA that would prevent excess nutrient intake/toxicity among the targeted population.

Pathways

KNOWLEDGE AND RESEARCH

There is a need to institutionalise surveys governed by science-based standards at the national, state and district to enable periodic assessment of diet consumption patterns and nutrient intake to help create a framework for reviewing policies and developing district plans of action. The present data gap hinders the formulation of region-specific public health and nutrition policy and program design. This area needs to be urgently addressed.

Support grassroots training and augmenting front line worker capacities and conduct sensitisation training at mid / higher leadership levels to streamline the nutrition goals as a common national agenda.

For supporting effective rolling out, the POSHAN Abhiyaanstrategy through PPP undertakes district-wise mapping of NGO's and private sectors to provide area-specific support to strengthen service delivery of nutrition-specific and nutrition-sensitive services. In this context, PPP role is in the following actions could be clearly reflected in district plans of action.

Root cause analysis and the Quality Implementation Approach (QoI) needs to be incorporated with concurrent intervention assessments (behaviour change communication, deworming etc.) towards bridging gaps and maximizing outreach.

The AnemiaMukt Bharat program has a very robust tracking mechanism when it comes to IFA (Iron Folic Acid supplementation). There is a need to develop a better understanding of barriers to implementation of the program under various states and leverage positive deviation instances to implement these learnings at scale. Additionally, similar metrics are to be created and tracked for all aspects of the program, including haemoglobin testing at the district level, large scale fortification, amongst others.

Identify and escalate usage of proven platforms in delivering high-quality content/right nutrition information, including home visits, television/radio, community-based events, and posters/wall paintings etc.

Pathways

IMPLEMENTATION

Strengthen coordination and convergence between various departments, NGOs, state governments, public& private sector and other relevant groups under flagship programmes and schemes for better delivery at the district level. Map NGO's and private sectors to districts to ensure better outcomes.

Ensure commercially available foods adhere to the food laws and regulations based on safety, quality, and nutrients of concern in alignment with public health goals. Reinforce industry engagement towards the promotion of "right food and feeding" in the interest of public health.

For public health, strategies like fortification, upper permissible limits, and tolerable limits along with EAR should be considered to avoid excess nutrient intake/toxicity among targeted populations.

Leverage the private sector in addressing Protein Energy Malnutrition (PEM) by delivering protein-based foods to the community initiatives such as providing milk in tetra packs and dry cereal-nut mixes rich in protein could be a part of the strategy.

Broad base options for protein delivery under flagship schemes, including orientation towards plant-based proteins/other affordable protein sources.

Need to create greater focus on R and D investments, innovations in product formulation with plant proteins and proteins with indigenous sources towards meeting the additional protein requirements of the vulnerable population.

At the national level, ensure commercially available foods adhere to the food laws and regulations based on safety, quality, and nutrients of concern in alignment with public health goals. Work along with industry towards the promotion of "right food and feeding" in the interest of public health.

Coordination among various government departments, food industry, regulators, civil society ensuring the quality of the takes home ration or cooked meals provided into the government schemes and programmes like the ICDS, MDM, PDS and TPDS.

Pathways

Implementation (Contd)

Ensure mainstreaming of iron-rich fortified foods into publicly funded programmes like the ICDS, MDM and PDS.

Monitor iron intake to mitigate iron deficiency anemia by providing the right tools and platforms.

Promote practices like Nutri/kitchen gardens, diversified crop farming, organic foods/ millets consumption for better adequacy of macro and micronutrients at all the three levels- individual, household and community towards ensuring both food and nutrition security. The ecosystem of SHG's SRLM's and KrishiMitra, local panchayat, needs to be leveraged to cascade this to the local communities.

Expand social infrastructure for meaningful interactions around the concept and benefits of nutrient-dense diets, importance of macro/micronutrients, fortified foods etc., leveraging social media, influencers and other mass media tools including radio etc.

There is a need to create strong convergence across government, industry, community-level NGO's and Panchayati Raj institutions about harmonized messaging and communication leveraging platforms like Darpan portal and POSHAN Gyan, amongst others.

people

food future foundation

Delivering Nutrition for Children

2

Actionable Area

Promote consumption of safe and nutritious foods among children of all age groups.

Issue

Partial results from the National Family Health Survey round 5 (NFHS-5) were released to draw attention to the crisis of malnutrition in the country. There is a slight improvement in some indicators in some states, but overall, in most states, there is a worsening in indicators such as childhood stunting has increased in 13 out of 22 states, wasting has increased in 12 out of 22 states, and underweight has also increased in 16 out of 22 states. There is also an increase in the prevalence of anemia among young children. Given that the second phase of the NFHS-5 has been carried out during the pandemic and the lockdown, the situation may be even worse in the remaining states.

Also, lately, the **Triple Burden of Malnutrition** is coming into focus with micronutrient deficiencies such as iron, iodine, zinc and Vitamin A adding to the dual nutrition burden, affecting more than 40% of children in the age group of 1-4 years (MOHFW, GOI, 2019).

National Institute of Nutrition (ICMR-NIN) has been the nodal agency for recommending the dietary allowances and nutrient requirements for Indians. The report 'Nutrient Requirements for Indians' was launched last year specifying guidelines for different age groups and life stages such as for Infants & Young Children (0- 24 months) focusing on appropriate breastfeeding practices and timely introduction of complementary foods to prevent undernutrition;

According to the CNNS, 2016-18 report:

- **Stagnation or worsening of child anthropometric outcomes across several states**
  - 33% U-5 children, 35.2% are underweight
  - 35% U-5 children are stunted
  - 17% U-5 children are wasted
- **Steady increase in the number of overweight/obese children with an increasing trend in lifestyle-related disorders like diabetes (10%)**
- **Anaemia, the most common form of micronutrient deficiency itself takes account into 50-60% population especially preschoolers and women**
  - 40.6% pre-school children
  - 23.5% school-aged children
  - 28.4% adolescents

Promoting a balanced diet and healthy meals ensuring adequate intake of macro and micronutrients among children. Additionally, when it comes to policy or strategic planning, the focus has largely been placed around nutrition-specific interventions during the 1000-day period from conception till two years of age. With the impact of the intergenerational cycle on nutrition outcomes, it is very important to understand the investments across multiple life periods to address the underlying determinants. Therefore, an attempt is required to look at the issue comprehensively and holistically to deliver nutrition on an ongoing basis. Interventions may work directly through the biological pathways (mother-child) or indirectly through the socioeconomic system.

Status

Government Initiatives

Several initiatives like the Midday Meal Scheme is a school meal program in India designed to better the nutritional standing of school-age children nationwide. The program supplies free lunches on working days for children in primary and upper primary classes in government, government-aided, local body, Education Guarantee Scheme, and alternate innovative education centers, Madarsa and Maqtabs supported under Sarva Shiksha Abhiyan, and National Child Labour Project schools run by the ministry of labour. 11.59 Crore children are enrolled under the Mid-Day Meals scheme & 25.95 lakh Cook cum Helpers have been engaged to provide MDM meals to children; it is the largest of its kind in the world (GoI, 2021). In support to MDM, findings from secondary data analysis on national representative datasets of mothers and children from 1993-2016 assessing intergenerational nutrition benefits of India's national school feeding program revealed that supplementary nutrition programs as school meals programs are linked to better growth outcomes in children, with greater height-for-age z-score (HAZ) among children born to mothers with full MDM exposure compared to the children born to non-exposed mothers, indicating the need to include these programs in the global agenda addressing stunting in children (IFPRI, 2021).

Salient Features of MDM Rules, 2015 includes each child from class 1-8 within the age group of six to fourteen years is eligible for a cooked nutritious meal every day except school holidays; with the following nutritional requirements, For Primary school children, the Calories Intake is Energy of 450 Calories, Protein of 12 g & food intake of food grains 100 g, pulses 20 g, vegetable 50 g, oil & fats 5g. For upper primary children, the calorie intake is Energy of 700 Calories, proteins of 20 g& food intake of food grains 150 g, pulses 30 g, vegetables -75 g, oils & fats 7.5 g.

The Akshaya Patra Foundation, which was successfully implementing its school lunch program in Karnataka since 2000, was called in to give testimonies for verifying the efficacy of the scheme, following which the mandate to implement Mid-Day Meal Scheme was passed. To successfully carry out this mandate, each State Government started its own Mid-Day Meal Program, with Akshara Dasoha being initiated by the Government of Karnataka in 2002. This pioneering move by the Government of Karnataka to make NGOs the implementing arm of the Government has been one of the major reasons for its success in reaching the program's goals. The achievements of several private-public partnerships have even influenced the Central Government. By setting up and encouraging private-public partnerships, the Government is successfully leveraging the skills and resources of the private sector for the greater good. The mid-Day meals

scheme has considerable opportunity for social entrepreneurs and public-private partnerships to include large corporates and ensure the quality of food is maintained during the distribution.

Apart from MDM, interventions such as the Eat Right India movement were also launched by the FSSAI, focusing on eating right, safe and sustainable and promoting awareness about a balanced and healthy diet. The Eat Right School program under the ERI movement was launched in September 2016 as Safe and Nutritious Food (SNF) at School program, with the objective to create awareness about 'Eating Healthy', 'Eating Safe', and 'Eating Sustainably' among school children and through them in the community at large. Under this, the school will run the program through Health and Wellness Ambassadors and teams who will conduct both curricular and co-curricular activities. As part of the progress, 53,043 schools have registered, and 48,058 school activities have been completed across different schools.

Several activities like the Eat Right Creativity Challenge in the form of poster making and photography competitions have been organized under the Eat Right India movement to encourage the creative talent of school children with rewards and appreciation enabling them to develop healthy eating patterns and consumption of nutritious meals on a daily basis.

To adopt a comprehensive program aiming to convert school campus into ‘Eat Right Campus’ promoting safe food and balanced diets amongst children, the FSSAI has also issued gazette notification regarding restriction of food marketing, advertisement and selling of unhealthy foods products high in saturated fat/trans-fat/added sugar/sodium in and around school campus (within fifty meters from the school gate in any direction), ensuring food safety by regular inspection and monitoring.

Private sector Interventions

Under the ‘The Eat Right India Movement’ launched by FSSAI to improve nutrition scenarios in India and combat malnutrition and lifestyle-related disorders, food businesses are being encouraged to reformulate their products by providing appropriate nutritional information to consumers and making investments towards healthy food items. As part of the initiative, twenty companies from the food industry had signed up with voluntary commitments to reduce fat, salt and sugar in their products to address issues related to the triple burden of malnutrition in India. FSSAI has also capped the amount of trans fatty acids (TFA) in oils and fats to 3% for 2021, and 2% by 2022 from the current permissible limit of 5% through an amendment to the Food Safety and Standards (Prohibition and Restriction on Sales) Regulations as trans fats are associated with increased risk of heart attacks and death from coronary heart disease.

Several companies like Infosys have been the flag-bearer of improving education standards in the country. The dropout rates in primary schools are very high as children from low-income families need to earn to feed themselves. Infosys foundation collaborated with Sri Ramakrishna Vidya Kendra in the Bannerghatta Forest area in Bengaluru to provide free meals to children belonging to BPL (Below Poverty Line) families and hence promote education among them.

Another instance includes PepsiCo India that has successfully adopted FSSAI’s Eat Right School (Safe and Nutritious Food, at School) program, in line with the company’s commitment towards creating awareness about safe food, healthy and sustainable diets. The adopted modules were rolled out in leading home science colleges across the country where

volunteering students were trained as “Safe and Nutritious Food (SNF) Fellows”. These SNF fellows later implemented the program across schools in Delhi, Gurugram and Mumbai. In 2018-2019, the SNF Fellows facilitated informative sessions on Iron Deficiency Anemia across schools impacting over 4.5 lakh children.

There are several other examples of private sector collaboration to strengthen the ecosystem.

Vision 2030

- Reduce underweight from 33.4% (0-4 years), 35.2% (5–9 years) and 24.1% (10-19 years)- Comprehensive National Nutrition Survey (CNNS), 2016-18 in line with the Global targets and end-all malnutrition-related adverse outcomes by 2030 towards meeting the SDG of Zero Hunger and Good Health and Well-being
- Reduce Stunting from 38.4% (NFHS-4) to 25% by 2022 (Mission 25 by 2022) and end all forms of malnutrition by 2030
- Reduce overweight/obesity prevalence among children from 3.7% (5-9 years) and 4.8% (10-19 years)- MOHFW, GOI, 2019, in line with the global targets and Track 3 of the SDG ensuring good health and wellbeing.

Pathways

There is a need to recognize that nutrition needs a life cycle approach, going beyond specific targeted vulnerable age groups.

In line with the vision, the overall aim is to work on the health and wellbeing of children by providing a health-promoting, safe environment to every child, ensuring adequacy in their nutritional status as well as access to safe food by children both at household as well as at the community level.

Ensure convergence of multiple government programs and schemes and strengthen coordination between various departments, NGOs and other groups to avoid redundancy and increase efficacy. Create the necessary institutional mechanisms by setting up a Nutrition Authority to strengthen the delivery of nutrition with a strong implementation and monitoring framework. This will require a participatory framework and could be done in a public-private partnership model

Revisit the mid-day meal design principles that are calorie and protein-centric, to include diversity and guidelines around fat and sugar, to ensure there is no compromise on the nutritional quality of the meals provided.

Ensure taste and texture considerations are addressed as part of the design to ensure that there is the consumption of the meals provided

The transition from cereals as the predominant source of calories to include greater diversity Distribution of food as part of supplementary feeding under ICDS/MDM and dry ration under PDS needs reformulation ensuring protein adequacy and diet diversity at both household and community level.

Pathways

Research, Action & Policy Framework (Contd)

Create a provision for breakfast and /snacks to meet caloric and nutritional requirements.

Create the ecosystem for delivering nutrition to children by promoting fortified staples and distributing nutritious/fortified foods through PDS/TPDS.

Development/Innovation of Nutritious Food Menu items as a part of supplementary nutrition feeding in ICDS and MDM, covering aspects of Food Safety, Hygiene, Nutrition, Fortified Products, Regional food choices including “Eat Right Movement” initiated by FSSAI promoting healthy eating approach and address nutrients of concern by reducing the intake of High Fat, Salt and Sugar in the foods making right food choices.

Integrate food safety and hygiene as integral parts of the MDM program, given their impact on nutrient absorption and gut health over time. Ensure compliance to all regulatory norms by MDM kitchen facilities with FSSAI. Inspection & Monitoring by State Food Safety officers on MDM Kitchens must be done at regular intervals. There needs to be guidance for MDM Kitchens to obtain third party certification on Food Safety Management System.

Nutrition intervention and supplementation programs need to be implemented throughout the year, including vacations/break time towards ensuring continuous nutrition delivery minimizing the reversal in the nutritional status post the vacation period.

Cultural and regional aspects of malnutrition must be taken into consideration towards ensuring maximum outreach and nutrition quality delivery.

Ensure access to quality, timely healthcare with monitoring of physical activity and morbidity profile as part of the assessment of the nutritional status of the children.

To get children to aspire to good nutrition, it is important that nutrition campaigning and communication targeted to children include aspirational health and nutrition influencers/celebrities as role models/icons they could relate with.

Pathways

Research, Action & Policy Framework (Contd)

INFRASTRUCTURE AND DELIVERY

Encourage Educational Institutions (EIs), School Management Committees and Parent-Teacher Associations (PTAs) to ensure the provision of healthy/balanced food options in canteens and mess through:

Appointing a school level "Nutrition and Health Committee" trained on principles of healthy diets and closely monitors healthy eating among the students.

Introducing "Nutrition Report Cards" in tune with the Hon'ble Prime Minister's suggestions to help track the nutritional status of children from time to time and opening possibilities of addressing specific nutritional concerns and enabling targeted actions.

Curriculum to have all aspects of nutrition & healthy diets with practical training on planning & preparing healthy diets (basics) and even on development of kitchen/balcony/terrace gardens wherever possible.

Introduce Societies/ Committees in a school, Students' Nutrition Clubs such as "Sehat Club" of Eat Right School Program run by FSSAI may be formed in each school to conduct various activities related to promoting "Balanced and Healthy Diets".

Scale-up programs and build the infrastructure for meaningful interactions leveraging the delivery mechanism of the model of large-scale kitchens, decentralised self-help groups to maximise local community participation, and ensure delivery of high-quality, safe food to all. Pilot innovative distribution models to test efficacy, reduce variability and delivery solutions.

Encourage local women by integrating SHGs who can work towards the provision of "Easy to deliver" nutritious meals to nearby schools/AWCs as a long-term commitment ensuring good nutrition delivery to children with better outreach.

Address the gaps existing at a systems level in terms of pooling well-equipped and non-equipped schools- sharing resources, building communication etc. to be done wisely to narrow down the existing gaps among different social classes

Strengthen Capacity Building and Infrastructure on Food Safety, Good Hygiene Practices, Good Storage Practices, Good Manufacturing Practices, Integrated Pest Management, Food Nutrition at regular intervals.

Pathways

Infrastructure and Delivery (Contd)

Co-opt children in building awareness and knowledge dissemination of nutrition Leverage technology to create training aids that can be leveraged for education and amplification of messaging.

Leverage the private sector to strengthen the supply of services and invest in R and D and product formulations to meet nutritional requirements in compliance with defined nutritional guidelines.

Create open collaboration formats where demonstrations and pilots have done through public-private sector partnerships can be taken to scale by the government

Amplify public health and nutrition messaging /communication leveraging private sector –collateral /messages need to be common and agreed to ensure responsible communication.

MEASUREMENT SYSTEMS

In addition to key innovations and models, measurement is another key component in the form of Periodic diet and nutritional assessment, using formats like school health cards and growth monitoring cards at block/community level to track the actual progress vs the present status redirect better policies and decisions.

Leverage data analytics to customize nutrition interventions needed in schools.

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Safe Food for All

3

Actionable Area

More effective implementation of food safety programmes on a national scale for access to safe and nutritious food for all.

Issue

- Unsafe foods containing pathogenic microorganisms and toxic chemicals are responsible for more than 200 diseases - from diarrhoea to cancer. Food and waterborne diarrheal diseases are linked to the deaths of an estimated 2 million people annually worldwide, including many children. In India, the full burden of foodborne illnesses is unknown; most foodborne illnesses go unreported.

- Indiscriminate use of pesticides and fertilisers leads to persistent residues of these chemicals. They contaminate food, disperse in the environment and find their way into the food chain. India is struggling with the age-old problem of poor environmental sanitation, lack of access to safe water, and disease surveillance. These hazards are in addition to the menace of food adulteration.

- Economic growth, rising incomes, and urbanisation have influenced Indians' eating habits. There is increased demand for greater variety in food choices, and Indians are becoming more concerned about food quality and safety. Given these issues, India must transform its approach to food safety comprehensively.

- Inadequate water, sanitation and hygiene (WASH) services in India's health facilities contribute to the high neonatal mortality rate, currently 24 deaths per 1000 live births. Sepsis – mostly spread in health facilities – contributes to 15% of the overall neonatal mortality and 11% of maternal deaths. Lack of toilets adds to the risks.

Foodborne diseases in India lead to

120,000 deaths each year

A burden of over 8 million **disability adjusted life years**

Children under 5 are at **40% more risk** with around **30000 deaths** each year

Source: Kristkova, Z.S., Grace, D. and Kuiper, M. 2017. The economics of food safety in India – a rapid assessment. Amsterdam, Netherlands: Wageningen University & Research.

- Food can be rendered unsafe by pathogenic organisms or chemicals. Hazards are often classified as Biological for bacteria, fungi, viruses and other parasites, Chemical for heavy metals, pesticides, veterinary drug residues and other substances coming into food from equipment or packaging, and Physical for fragments of metal, glass, plastic, bone, etc. Many foodborne diseases are zoonotic - transmissible between animals and people. Some are also new and emerging diseases: novel diseases or diseases changing in their hosts, geography, or impacts. Emerging diseases have the potential to cause pandemics or widespread diseases affecting a large number of people. Other food safety related issues include food allergies and intolerances, food adulteration and food fraud, and bioterrorism.

Status

Government Initiatives

- The levels of pesticide residues in food commodities and environmental samples are measured in the "Monitoring of Pesticide Residues at National Level" scheme. From 2008 to 2018, a total of 181,656 samples of the various food commodities and environmental samples like soil and water were analysed. Of which 3,844 (2.1%) samples were found above Maximum Residue Limits (MRL) prescribed by the Food Safety Standard Authority of India (FSSAI).

- The Food Safety and Standards Act (FSSA) 2006 was designed to improve the overall food safety and the food trade within and outside the country. The FSSA consolidated responsibility for food safety to FSSAI. Since it was set up in 2008, FSSAI has been working to create a regulatory environment different from other countries yet fit India's nuances as compromised quality, growing adulteration trend, and instances of product integrity issues pose serious challenges to food safety. They also can cause irreparable damage to the reputation of brands.

- FSSAI has been conducting following activities to ensure food safety and nutritious food to all -

a. Through its enforcement mechanism, it conducts the surveillance of foods to ensure access to affordable, nutritious foods for all. It has notified 263 primary food testing labs across the country, and state food testing labs under a Central Sector Scheme, including Mobile Food Testing Labs (SoFTeL), thus strengthening the food testing system in the country.

b. It has also released a booklet, 'Detect Adulteration with Rapid Test (DART)', describing over 50 common quick tests conducted by the people themselves at home to detect food adulterants.

c. It has introduced a policy to adopt Rapid Analytical Food Testing (RAFT) Kit/Equipment/Method for regulatory purposes.

d. Lays down science-based standards for food articles and regulates their manufacture, storage, distribution, sale and import to ensure the availability of safe and wholesome food.

e. Enforces the provisions of the FSS Act, 2006, Rules and Regulations made thereunder through states/UTs.

f. Trains Food Safety Supervisor FoSTaC (Food Safety Training and Certification scheme) for every 25 food handlers in each premise across the food value chain.

g. Initiated the Food Safety Training & Certification (FoSTaC) for food business operators across the food chain towards capacity building, thus ensuring training of food handlers on food safety.

- There are training programmes under the Ministry of Food Processing Industries (MoFPI) on processing, packaging, storage commodity-specific training under the National Horticulture Board on product protocols and under the Ministry of Integrated Development of Horticulture (MIDH) for storage and marketing. MoFPI has initiated schemes and grants to aid the food processing industry in adopting food safety & quality assurance mechanisms such as TQM, including ISO 9000, ISO 22000, HACCP, GMP, and GHP.

- Ministry of Agriculture and Farmers Welfare conducts specific advisory and awareness programmes through State Agricultural Universities and the Department of Agriculture/ Horticulture of States to manage chemical residues in primary production.

- The Directorate of Plant Protection, Quarantine and Storage under the Ministry publishes a list of pesticides banned in India from time to time due to their harmful properties to ecology, soil, plant and human health.

Private sector interventions

- The private sector partners working in an effective food safety system are primarily responsible for ensuring food safety. To be most effective in this task, the private sector has been working closely with its stakeholders like the consumers, supply chain and regulator.

- Voluntary FSSAI Schemes like Hygiene rating, applicable to food businesses supplying food directly to consumers, allows FBOs to showcase their level of compliance and excellent food hygiene quality and enable consumers to make informed choices about the foods and the places where they would like to eat.

- As part of the public-private partnerships, state of the art, world-class laboratory for skill development of food analysts and other research was developed by Merck and FSSAI through the launch of the centre for Microbiological Analysis Training (C-MAT). Thermo Fisher Scientific India Ltd. has developed the Food Safety Solution Centre at FSSAIs premises at Ghaziabad to further research and provide demonstration and training in food safety. The International Training Center for Food Safety and Applied Nutrition (ITC-FSAN) was launched in Mumbai. It is a state-of-the-art training facility established through a public-private alliance between FSSAI and EIC and the Global Food Safety Partnership of the World Bank.

- Industry initiatives in partnership with FSSAI like CHIFSS (Capability Harnessing Initiative on Food Safety Sciences) was established to drive activities related to science-based food safety in the country in high-risk areas like meat, poultry, novel foods and additives, allergens on microbiological risk assessment, sampling and others to strengthen protection of consumers and create an innovative environment for the industry.

- With the aim of enhancing the Food Safety Excellence culture in the country, the food chain in India has seen a paradigm shift through the CII Food Safety Awards Program. The program comprehensively covers training and development of food safety professionals and assessment of the unique 'Food Safety Maturity' annually. It aims to enhance competitiveness through excellence, benchmarking to world-class standards, and identifying role models in the food chain. This voluntary award program is aimed at an ongoing capacity building of the Indian Food Chain Industry which has seen significant growth over the past 12 years ever since its inception in 2010.

- All stakeholders must play a pivotal role in building a community that shares common goals and responsibilities to achieve food safety. This partnership should encompass consumer and school education, science and research, agriculture and fishery, tourism, trade, the industry, and regulatory authorities. One of the biggest challenges facing food industries seeking to conform to food safety regulations is the lack of appropriate awareness and communication. To address this challenge, FSSAI's FoSTaC (Food Safety Training and Certification Scheme) is playing a key role in sensitizing, training and updating Food Business Operators, especially in the MSME Sector, in regional languages, as well, through an effective ecosystem of countrywide approved training partners, national resource persons and training of trainers involving the regulator and relevant domain experts.

Vision 2030

- **Achieve a one-third reduction in premature mortality from non-communicable diseases.**

- **Reduce the number of foodborne illness cases and related deaths from an estimated 100 million and 120,000 respectively to less than 50 million illness cases and less than 40,000 related deaths respectively by 2030.**

- **Reduce non-compliance of MRLs in fresh produce from 2.1% in 2018 to less than 1% by 2030.**

The India Picture

61%
of the deaths in India are from non-communicable diseases

58.17 lakh
Total number of NCD deaths in India

23%
Indians are at risk of premature death from NCDs

Cancer, diabetes and heart diseases account for 55% of the premature mortality in India in the age group of 30-69 years

Pathways

IMPLEMENTATION

Significantly improve surveillance and monitoring mechanisms for foodborne illness and augment capabilities for managing food safety risks. To comprehensively cover all stakeholders through structured risk alerts and communication systems, this will play an important role in sharing objective and factual information about food safety risks.

Promote the use of approved and validated rapid test kits for both FBOs and the surveillance process.

Develop Train-the-Trainers (TOT) programs and conducting state-level training programs on food safety risk assessment and risk communications throughout the country.

Target enforcement efforts better precede them by surveillance efforts to identify hotspots and problem areas.

Launch capacity building initiatives and food safety management systems for micro, small and medium scale Food Business Operators on regulations and standards.

Develop approaches for bringing all stakeholders together in applying new technologies and approaches thus, increasing knowledge.

Enhance consumer awareness on better labelling, safety and traceability.

Pathways

POLICY

Expand availability and accessibility of food labs, augmenting these in regions that need strengthening and develop schemes to utilise private food testing labs.

Undertake an initiative to build a team of 100 food safety experts of global repute in view of the paucity of talented specialists and experts in food safety.

Develop mechanisms to ensure wider engagement of relevant institutional and human resources needed to monitor food safety more effectively.

Include food safety & hygiene concepts in school & college curriculum and involve academic institutions in food safety.

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Safe Drinking Water for All

4

Actionable Area

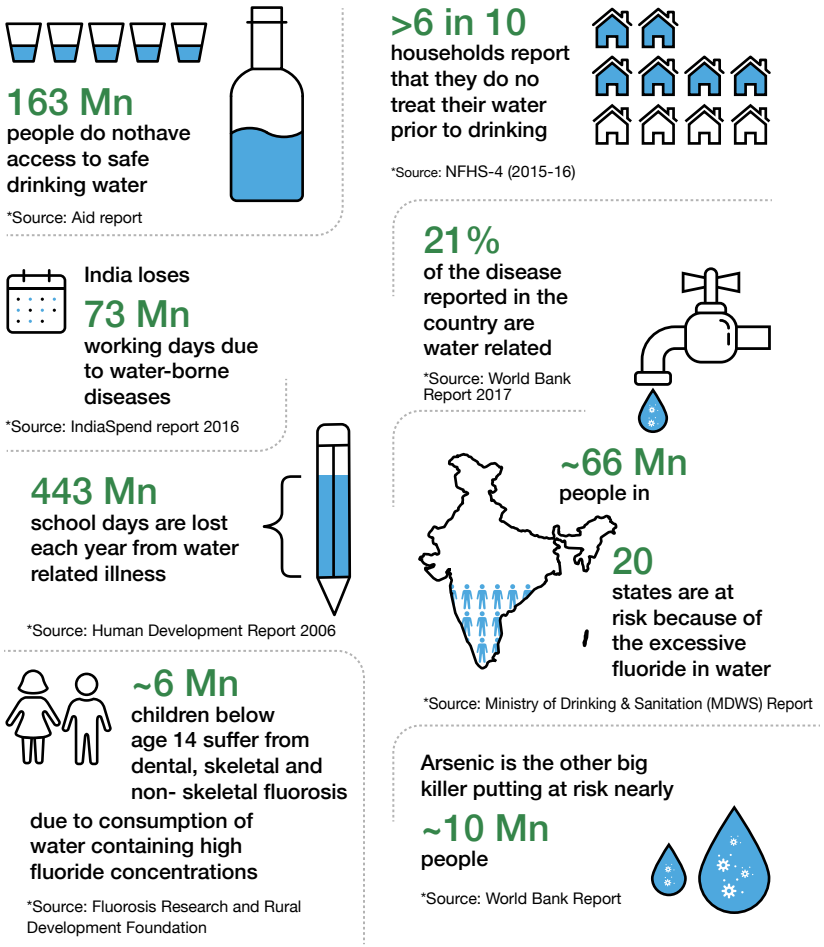
Implementing a safe drinking water programme on a very large scale provides access to clean and safe water to all.

Issue

- A safe water supply is the backbone of a healthy economy. It is estimated that waterborne diseases have an economic burden of approximately US$ 600 million a year in India as annually about 37.7 million Indians are affected by waterborne diseases, 1.5 million children die of diarrhoea, and 73 million working days are lost. Waterborne diseases have caused 10,738 deaths since 2017. The problem is more serious in drought- and flood-prone areas, which affected a third of the nation's area in the past couple of years.

- Less than 50% of the population in India has access to safely managed drinking water. Government records show that access to safe and usable water in rural areas has increased from 1% population in 1980 To only 30% population by 2013. Chemical contamination of water, mainly through fluoride and arsenic, is present in 1.96 million dwellings. Excess fluoride in India is affecting tens of millions of people across 19 states. Equally worryingly is excess arsenic. Central Ground Water Board (CGWB)'s monitoring data indicates the occurrence of contaminants such as Fluoride, Arsenic, Nitrate, Iron, and Heavy Metals beyond permissible limits for human consumption in isolated pockets.

8 Facts on India's drinking water challenge



- Moreover, two-thirds of India's 718 districts are affected by extreme water depletion. The fast rate of groundwater depletion is a major challenge. India is known as the world's highest user of groundwater sources due to the proliferation of drilling over the past few decades. Groundwater from over 30 million access points supplies 85 per cent of drinking water in rural areas and 48 per cent of water requirements in urban areas.

- Rampant pollution, dumping of sewage waste, and abuse of the rivers have led to large sections of important rivers becoming unfit for use. The rivers (surface drinking water sources) are found to be contaminated with heavy metals such as lead, arsenic, copper, cadmium, mercury, and nickel that are toxic and carcinogenic beyond standards. Pit latrines may cause possible contamination of groundwater with pathogens and nitrate. The current lack of planning for water safety and security is a major concern.

- Water being a State subject, initiatives on water management, including taking corrective action related to groundwater quality in the country, are primarily the states' responsibility.

- Unfortunately, millions of Indians are not equipped with facilities to test whether the water they consume and use is safe enough or not.

- Often women and children are burdened with the responsibility of bringing water from the source to the home. This results in a fall in school attendance as children are made to spend hours collecting water. School drop rate is increased by 22% in drought-affected states. Close to 54 per cent of rural women – and some adolescent girls - spend an estimated 35 minutes getting water every day, equivalent to the loss of 27 days' wages over a year.

The scale of need in India is immense, making India the concentrated centre of the global water and sanitation crisis.

- Use of untreated wastewater or poor quality water in agriculture, which is a common practice, can aggravate health risks and deteriorate soil health. The challenge is to identify the reuse options for agriculture and other sectors with proper utilisation of its nutrients. Wastewater is an important resource that requires appropriate treatment for its safe utilisation.

Status

Government Initiatives

- In 2019, the Ministry of Drinking Water and Sanitation (MDWS) mandate became one of two pillars under a new ministry named Jal Shakti (meaning "power of water"). The Swajal programme empowers communities to plan, design, implement and monitor single village drinking water supply schemes and organise community ownership for operation and maintenance. Focus areas are conservation and rainwater harvesting, renovation of traditional and other water bodies/tanks, reuse and recharge water structures, watershed development, and intensive afforestation. This programme has helped prioritise integrated water safety planning, behaviour change and community participation in most deprived aspirational districts, and Water Quality Monitoring (WQM). This has contributed to 18.6 million people gaining access to safe drinking water.

- The Ministry of Drinking Water and Sanitation is also working on policy planning, funding, and coordination of the program known as, National Rural Drinking Water Programme (NRDWP), which aims at assisting states in providing adequate and safe drinking water to the rural population in the country. In 2018-19, the scheme was allocated Rs 7,000 crore, accounting for 31% of the Ministry's finances.

- Every rural household must be provided with piped potable water by 2024 under the Jal Jeevan Mission.

- In all, 7.56 Crore rural households across the country have been provided with tap water supply since the start of the mission.

- In habitations adversely affected by Arsenic/ Fluoride contamination, States are advised to plan and install Community Water Purification Plant (CWPP) on priority, as an interim measure to provide 8-10 LPCD (litres per capita per day) potable water for cooking and drinking purposes. To involve and empower the community at the grass-roots level for monitoring the quality of water in their respective habitations, Field Testing Kits (FTKs) are being distributed, and five women from every village are being trained for using these kits. This will facilitate early detection and identification of water-borne risks. So far, 4.7 Lakh women in 1.25 Lakh villages have been trained for water testing.

- Central Pollution Control Board (CPCB), in association with State Pollution Control Boards/Pollution Control Committees (SPCBs/PCCs), is implementing the provisions of The Water (Prevention & Control) Act, 1974 & The Environment (Protection) Act, 1986 to prevent and control pollution. The Act does not define the level of wholesomeness to be maintained or restored in different water bodies of the country. The Central Pollution Control Board (CPCB) has tried to define the wholesomeness in terms of protection of human uses, and thus, taken human uses of water as base for identification of water quality objectives for different water bodies in the country.

Private sector initiative

- Understanding the drivers and key risks for the private sector is critical in their engagement in owning, operating, and managing safe water supply through Small Water Enterprises(SWE). The general idea is to attract private sector investment for small water enterprises in the country as complementary safe drinking water solutions to piped water. In addition, public-private partnerships can play a major role in providing safe drinking water to water-stressed or quality-affected communities.

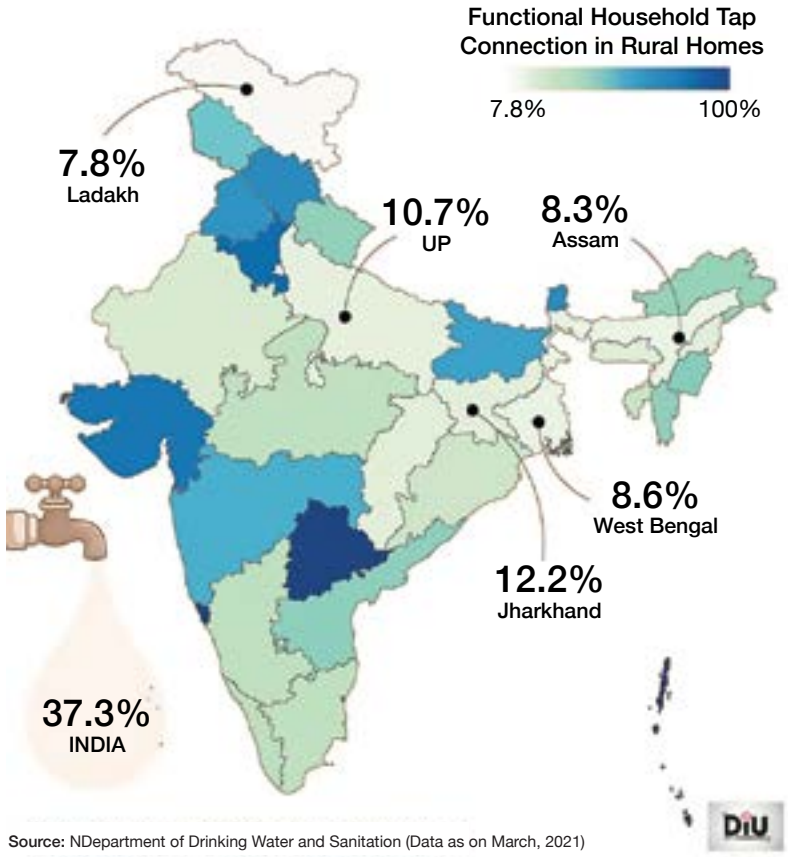
- The Industry has been found to accord high priority on self-regulation through the implementation of voluntary Food Safety Management system standards like ISO 22000 and GFSI benchmark schemes which make it mandatory to use safe potable water in cleaning & sanitation of food items and food contact surfaces and production processes thus requiring industries to set up water treatment facilities towards adequate access to potable water wherever required.

Vision 2030

- Aim to achieve equitable access to safe and affordable drinking water for all.
- Reduce the loss of 73 million working days to below 25 million working days by 2030
- Reduce the death by diarrhoea of children below five years to below three lakhs by 2030
- Achieve more than 90% treatment of wastewater and substantially increasing recycling and safe reuse to improve water quality.
- Reduce pollution, eliminate dumping and arrest release of hazardous chemicals and materials in water bodies.
- Aim to substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.
- Reduce extreme water depleted districts from the current 478 to less than 100.

Tap connections in rural india

Assam & west bengal villages have low rural household tap water access



Source: NDepartment of Drinking Water and Sanitation (Data as on March, 2021)

Pathways

POLICY

Expand public-private partnerships and co-operation as well as capacity-building support in water- and sanitation-related activities and programmes.

Support and strengthen the participation of local communities in data generation, monitoring, and continued surveillance, conservation.

Improve the efficiency of the urban and rural water supply system and the development of block and district level water conservation plans.

Promote mandatory water audits for drinking water purposes by all states.

Install more Community Water Purification Plant (CWPP) in areas that are adversely affected by Arsenic/ Fluoride contamination.

IMPLEMENTATION

Substantially increase the number of accredited water quality testing laboratories in India.

Renovation and cleanliness of traditional and other water bodies/tanks are necessary to improve potable water quality.

Provide guidelines/standards to farmers prescribing the permissible limits of physical, chemical, biological parameters in water for potable and irrigation use, judicious use of approved pesticides and fertilisers.

Promote and Setting up desalination plants along with the coastal areas.

Empower local people and enable them to save water for usage and promote locally owned and managed to drinking water security plans which are simple and can be used, monitored, and managed by people and local governments.

Pathways

TECHNOLOGY

Develop suitable technologies for the treatment of drinking water and non-drinking purposes, considering the nature and extent of contaminations and availability of infrastructure.

Provide low cost-solutions or technologies to improve water quality. Provide home water-treatment capability using filters, solar disinfection, or flocculants to make drinking water safe and promotion of Bureau of Indian Standards-compliant products.

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Strengthen Traceability

5

Actionable Area

Develop and implement a food tracing system in normal circumstances too for consumers to know the origin of the food product.

Issue

- Today's health & wellness-conscious consumers demand information on food freshness, storage & transportation conditions, food additives, etc. This puts an added responsibility on food businesses to provide easy access to trusted product information to consumers.

- Consumers' concerns about the methods of food production (organic, inorganic, genetically modified) have also increased now, which is primarily motivated by foodborne disease outbreaks and chemical contaminants. Hence, implementing 'farm to fork' traceability is an essential requirement under food safety. This is also mandated by FSS (Food Recall Procedure) Regulation 2017 for food businesses in India.

- Worldwide, the role of traceability as a means of enabling food safety is being increasingly acknowledged by industry and regulatory bodies. Vendor-neutral technologies & open standards that allow track & trace across food supply chains must be adopted by food businesses.

- A comprehensive study in India revealed that most businesses don't have an effective traceability system across their food supply chains. This could be attributed to the perceived cost of the infrastructure requirement, inadequate knowledge/awareness, and general apathy towards food safety. At best, most FBOs had only implemented a track & trace system up to one level down in their supply chain. Beyond this, no credible system existed till the food was sold/consumed.

According to a food regulator analyses during the year 2018-19

$30 billion - $40 billion
is annual estimated cost of food fraud

106,459
samples across India were tested out of which,

- **15.8%** food samples were sub-standard
- **3.7%** were unsafe,
- **9%** were mislabeled

Source: Report by Authentication Solution Providers' Association (ASPA) in 2020

- Supply chains today are incredibly complex and have evolved into worldwide inter-connected supply-and-demand networks with profound interdependencies. This leads to problems concerning food safety and quality, including food spoilage and wastage.

- A modern, coordinated approach to traceability reduces foodborne illness, builds consumer trust, and avoids overly broad recalls. Well-functioning traceability systems allow both public and private sector actors to verify that products meet market and/or regulatory requirements and to respond swiftly in the event of food safety breaches.

- Traceability technologies are essential for smallholder farmers, where they will help deliver the missing personalised farm advisory services based on farm input purchase and use. Tracing farm inputs from the factory floor to the farm will help reduce the chemical footprint in food production and antibiotic use in livestock.

- New technologies, such as blockchain and satellite imaging can strengthen traceability programmes and lead to better transparency and value across the supply chain. The application of such technologies comes with risks if common protocols and policies are not put in place.

- Traceability helps make much of what is currently “invisible” within our food systems “visible.” It could potentially facilitate comprehensive tracking of the environmental, economic, health, and social consequences of different agricultural production processes, even making it possible to calculate the “true cost of food.”

Status

- In recent years the Indian government has started engaging with private entities, state, and central government agencies like Food Safety and Standards Authority of India (FSSAI), Agricultural and Processed Food Products Export Development Authority (APEDA), Spices Board, GS1 India, ITC’s e-Chaupal, and Reliance industry, etc. for developing the traceability system within the Indian food supply chain. The GS1 standards facilitate unique and universal identification, capture, and share information on products and services, from point-of-origin to point-of-sale or dispensation. These standards are used in the barcoding of consumer items.

- APEDA had initiated the new electronics traceability system for Agro-food safety and emphasized applying the information technology in the traceability system for various farm produces. But currently, it is not mandatory for all farmers unless there is a requirement from export countries. APEDA provides laboratory testing and certification for export and helps track and trace information through its internet-based traceability software system. The e-Spice Bazaar is a unique project of the Spices Board to ensure traceability of Indian spice farmers in international markets and determine the quality and price of their products for export purposes. Traceability Project seeks to incorporate all commercial spices grown in the country, bring spice farmers in the global supply chain with identification of traceability at source, and generate direct linkage with exports to get a premium price. Started in the Prakasam and Guntur districts of Andhra Pradesh and Warangal and Khammam districts in Telangana, the project currently (2021) covers 52,000 chilli and turmeric farmers in these four districts.

Private Sector Initiatives

- Backward food traceability is useful in identifying suppliers and processes that have contributed to producing a particular product. The private sector is the main driver of traceability, and investments are typically motivated by consumer demands, risk mitigation, standards compliance, efficiency gains, or some combination of these incentives.

- TC has initiated Integrated Agri Extension Platform (IAEP) interventions for chilli in Andhra Pradesh. The intervention included digital crop and post-harvest advisory to farmers, technology intervention, and a market linkage for chilli. This has resulted in a 13% increase in chilli productivity, 8% improvement in grade out turns, thus, an additional realisation of Rs 23000/acre. OlamAgro traceability intervention in rice value chain in Haryana done for 500farmers. This has increased farmers' income by 12-15%, reducing cost by 15%, and increasing yield by 10%. In India, the food traceability market is increasing with the growing understanding of food safety among consumers and government authorities.

Vision 2030

- **A multipronged approach focused on applying emerging technology platforms on traceability across food-system & integration is needed to support transformation.**

- **Harmonised standards, ongoing technological development to drive down costs, a continued focus on robust economic models, and effective communication and training programmes are fundamental to scaling traceability.**

- **Introduce & scale-up of Technology-Driven Traceability system and supply chain transparency which would reduce food loss by 1-4%.**

Pathways

POLICY

Leveraging Farmer Producer Organisations (FPOs) to build incentives around training through policy and legislation to enable implementation.

Incentivise traceability and support adoption through policy incentives.

IMPLEMENTATION

Helping small-scale farmers/producers/primary producers at the farm side and Mandis to make the appropriate operational changes for complying with traceability requirements.

Retailers should ensure that their suppliers have systems and software in place for forward and backward tracing.

Align traceability system to real-time food safety & quality parameters.

Value-chain players will need to align on standards, including what data needs to be collected, how it must be collected, how it will be governed, and how it will be shared.

Conduct consumer education programmes on labelling & awareness programmes on traceability for all stakeholders.

Pathways

TECHNOLOGY

Integrate efforts like technology development/digitisation at farm level regarding digital infrastructure, data collection methodology, Internet of Things (IoT), Block-Chain, and others with initiatives of Ministry of Agriculture, which is working on the architecture of a national digital agristack.

Find solutions to overcome infrastructure gaps like electricity, internet facilities, etc. Simple mobile phones are much more widespread, and solutions adapting to this type of technology could be instrumental in overcoming near-term gaps.

Technology companies should develop clear, consistent, and globally harmonised standards for data collection, governance. Sharing them can potentially develop the transformative traceability technologies needed to reduce costs, improve delivery and maximise efficacy.

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Large-scale Food Fortification

Actionable Area

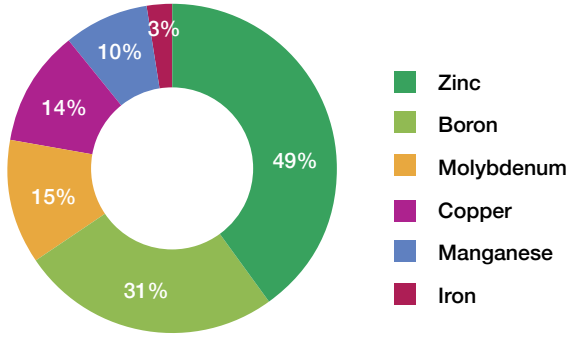
Implementing and scaling up food fortification programme to ensure access to safe and nutritious food for all.

Issue

- The deficiency of various micro-nutrients, leading to malnutrition, anaemia, stunting, and mortality, is a major persistent problem of India as child malnutrition rates are unacceptably high. Over 70% of the Indian population consumes less than half the daily Recommended Dietary Allowance (RDA) of micronutrients a day. World Health Organization (WHO) estimates that more than two billion people suffer from micronutrient deficiency globally, and one-third of them are in India. This number is likely to grow amidst the COVID-19 pandemic.

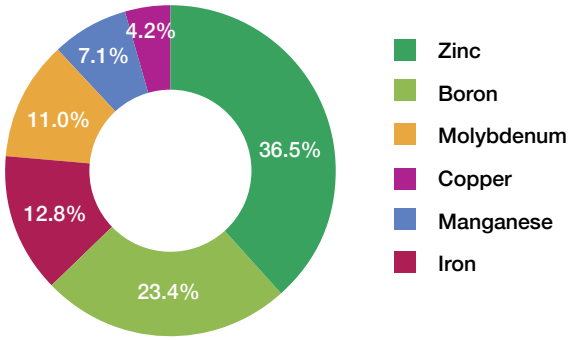
- One solution to overcome this problem is staple food fortification. It is one of the most cost-effective large-scale programs to combat malnutrition as micronutrients such as zinc, iodine, folate, and iron are added to rice, wheat, cooking oil, and other staple foods people consume daily. It is done without changing taste, smell and looks. It can yield significant results in a short period of time.

Global micronutrient deficiency status



Source: ICAR - Central Institute of Post-Harvest Engineering & Technology, Annual Report 2018-19

Micronutrient deficiency in Indian soil



Source: Indian Journal of Fertilisers, 2018 and PwC analysis

Status

Government Initiatives

- Food fortification began in the 1950s with vegetable oil fortification and salt iodisation. Then after a 60-year gap, the government introduced in the 2000s the fortification of other commodities such as rice and wheat. When the Food Safety and Standards Authority of India (FSSAI) established standards for fortification of rice, wheat flour, edible oil, double fortified salt (DFS), and milk in 2016, the momentum for fortification accelerated and in 2018fortification regulations were are also in place. Now, food fortification is on the national agenda and is likely to take centre stage, given persistently poor health statistics year after year. With fortified staples- wheat flour (with Iron, folic acid and B12), oil (with vitamin A & D), salt (with Iron and iodine), problems of iron deficiency anaemia, neural tube defects, iodine deficiency disorders and deficiencies related to vitamin A, D and B12 can be addressed effectively. The FSSAI established the Food Fortification Resource Centre (FFRC) and developed the '+F' logo to identify fortified foods.

- Moreover, the FSSAI, after staple fortification, issued gazetted notification for standards of mandatory fortification of processed foods such as breakfast cereals, buns, rusk, pasta, noodles, buns and fruit juices with permissible levels of micronutrients (15-30 % of the Indian adult RDA) Also, products that are high in fat, salt and sugar (HFSS) will be "excluded" from the fortified processed foods category as per Food Safety and Standards (Fortification of Foods) Regulations, 2018.

- In 2011, the Ministry of Women and Child Welfare (MWCD) and Ministry of Human Resource Development (MHRD), Government of India, initiated the proposal of making mandatory use of fortified foods. Through its communications dated 10th July 2017 and 2nd August 2017, the mandate has been established to use fortified oil, fortified wheat flour, and double fortified salt in Mid-day meals (MDM) and Integrated Child Development Services (ICDS) programmes.

- Department of Food and Public Distribution, Government of India, through its letters dated 3rd November 2014, 22nd December 2016, and 18th September 2018, asked all states which distribute 'atta' through PDS to supply fortified 'atta' and pass on the cost to the consumers. A pilot scheme was approved in February 2019 for three years from 2019-20 onwards, wherein one aspirational district in each of the 15 predominantly rice-eating states was selected for the provision of fortified rice. Initially, Andhra Pradesh, Gujarat, Maharashtra, Tamil Nadu, and Chhattisgarh had started the distribution of fortified rice in their identified pilot aspirational district at the time of review. It has now been expanded to 112 specially identified aspirational districts of the country. The food ministry has decided to scale up the distribution of fortified rice under the ICDS and MDM, covering all their centres across the country from April 2021.

- The Food Corporation of India (FCI) has also been mandated to scale up the annual supply of Fortified Rice Kernels (FRK) from the current 15,000 tonnes to at least 1.3 lakh tonnes to meet country-specific needs (2021-2022). If done through PDS, then 350 lakh tonnes of rice needs to be fortified, ensuring an uninterrupted supply pipeline of FRK for which existing rice mills (28,000 in the year 2020) need to be equipped with blending infrastructure for the production of fortified rice.

  India's 10th, 11th, 12th Five-Year-Plans, POSHAN Abhiyan (National Nutrition Mission) and Anaemia-Mukt Bharat Mission recommend food fortification as an important strategy to tackle micronutrients malnutrition. In his Independence-Day speech on 15th August 2021, Hon'ble Prime Minister Narendra Modi announced that fortified rice would be distributed through various food schemes to combat malnourishment among the poor. Be it the rice available at ration shops or the rice provided to children in their mid-day meals, the rice available through every scheme will be fortified by the year 2024. Various states have adopted fortification of several commodities across the government safety net programmes (SNP).

Private sector initiatives

- Presently, 157 brands of five fortified staples are available in the open market with a pan India presence. There has been tremendous traction in the oil and milk industry. As per recent estimates, 69% (7.94 million tonnes/annum edible oil) of packaged edible oil sold across India is fortified. More than 40% of the organised milk industry fortifies its products as per FSSAI standards.

Civil Society Initiatives

- Several development partners have been working in coordination with the Food Fortification Resource Centre (FFRC) at FSSAI to coordinate the scale-up of staple food fortification across the country through open market and social protection schemes. Detailed roadmaps for scaling up fortified edible oil, milk, wheat flour, rice and double fortified salt were drawn up by POSHTIK Network partners.

- In addition to the scale-up universal adoption of fortified staples by social protection schemes and through the open market, there is increasing emphasis on ensuring that the fortified staples available to the population comply to national fortification standards and are of good quality. This will be achieved through strengthening regulatory monitoring at the production and market levels, further strengthening the capacity of food laboratories to accurately test for micronutrients and ensuring that data is available transparently across the value chains. These efforts require coordinated action from the government, food industries, citizens supported by development agencies, civil society organizations and academia.

Vision 2030

- Leverage fortification and biofortification as complementary strategies to prevent and control micronutrient deficiencies. End all forms of malnutrition-related adverse outcomes and ensure a nutritionally secure generation by 2030.
- Universalise fortification of edible oil, milk, and other relevant staples.
- Ensure food and nutrition security by emphasising sustainable ways of increasing the availability, accessibility, affordability, and consumption of fortified products by consumers and vulnerable groups through social protection schemes and open market.

Anaemia in India

Rs 1.5 lakh crore in GDP lost in 2016

Due to Anaemia, as per an IndiaSpend report.

41%

of pre-schoolers, 24 per cent of school-age children and 28 per cent of adolescents were anaemic, with the greater prevalence among children below two years of age. According to the CNS report 2019.

40%

Female adolescents had more than twice the prevalence of anaemia, than that of male adolescents (18%).

Pathways

IMPLEMENTATION

Coordinate efforts of different sectors: various government departments, food Industry, regulators, civil society to ensure mainstreaming of fortified staples (wheat flour, oil, and salt) into the government schemes and programmes like the ICDS, MDM, PDS and TPDS, as has been done for rice.

Encourage fortification of the staple to be done at the source to minimise logistics and other related costs.

Address supply-side constraints and catalyse investment through better market signalling, such as provisioning of longer-term procurement contracts.

Provide technical assistance to the food industry, especially the small business enterprises, SMEs/MSMEs, to adopt fortification and encourage the setting up of more food fortification plants in the private sector.

Create an eco-system enabling long term engagement of local micronutrient producers and organisations to build momentum around fortification.

Launch mass movement on the lines of Jan Andolan for creating community awareness. Agricultural and home science colleges to be engaged for disseminating knowledge to the community.

Promote the +F logo devised by FSSAI for consumer awareness and identification of fortified products.

Pathways

POLICY

A comprehensive framework needs to be created to integrate biofortification and fortification to address micronutrient deficiencies as they play a complementary role.

Strengthen regulatory monitoring to ensure the quality and efficacy of fortified foods. This can be achieved by strengthening the referral laboratories for quality checks and building the capacity of already existing laboratories.

Create differential incentives to ensure price parity /competitiveness of fortified staples. GST rates need to be rationalised for packaged and branded fortified foods vis a vis unbranded products.

Expand social infrastructure for meaningful interactions and interventions focussing on mass awareness of nutrient density of foods among people at all three levels- individual, household and community.

KNOWLEDGE AND RESEARCH

Institutionalise a diet study/survey of consumption patterns and nutrient intake at regular periodicity representing the national/regional sample. This will create the foundation for data /science-based standards and a framework for periodic assessment and review of standards and regulations from a public health standpoint.

Institutionalise a monitoring framework addressing safety and technical aspects of adding nutrients to the food in terms of the anticipated consumption of the food to be fortified the physiological availability (bioavailability) of the added nutrients, the likely impact of fortification on overall nutrient(s) intake as well as the associated risk with excessive intake among the specified population.

Run educational, consumer marketing campaigns to build awareness around the concept and benefits of nutrient-rich /fortified foods leveraging social media, influencers and other mass media tools, including radio etc.

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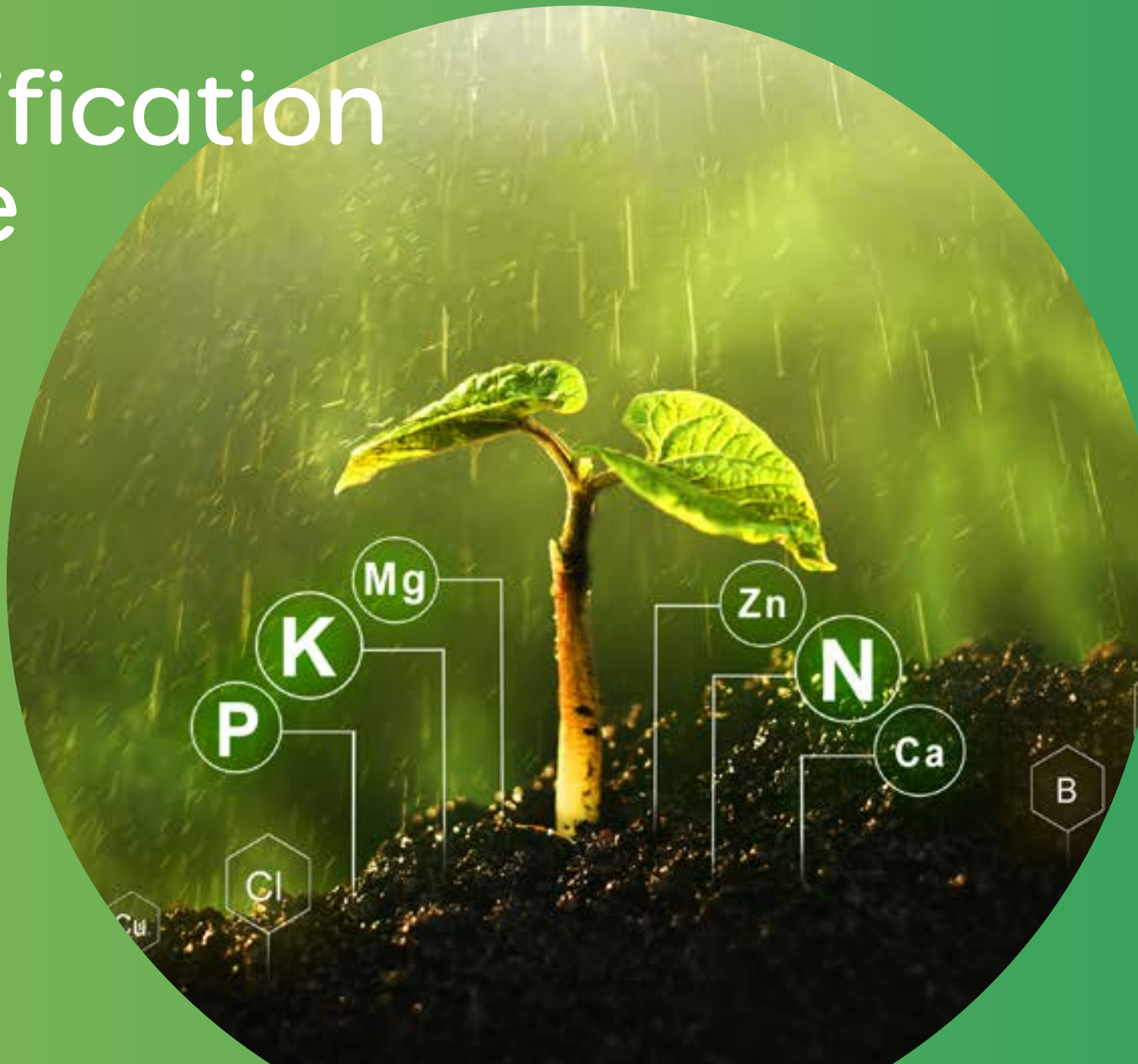
Bio-fortification at Scale



Actionable Area

Mainstreaming biofortification in the staple food system to achieve zero hunger and access to safe and nutritious food for all.

Issues

- Hunger and deficiency in various micro-nutrients, which leads to malnutrition, anaemia, stunting and mortality, are major and persistent problems in India. It is home to the highest number of malnourished children, and the child malnutrition rate is unacceptably high. One-third of the people suffering from micronutrient deficiency globally are in India. Micronutrients are required in small quantities and are responsible for vital functions of the human body. The daily intake of micronutrients is far from satisfactory, which costs the country 1% of its GDP.

- More than 6,000 children below five years die each year in India, and over half of them are due to malnutrition caused by lack of Vitamin A, iron, iodine, zinc and folic acid. About 57% of pre-schoolers and their mothers have subclinical Vitamin A deficiency. An estimated 30% of adult males, 45% of adult females, 80% of pregnant females, and 60% of children in India are iron deficient. Due to iron deficiency, India suffers from the highest prevalence of anaemia globally, affecting 40% of the population. According to the Comprehensive National Nutrition Survey (CNNS) of the Union Ministry of Health and Family Welfare in 2019, Folate deficiency was prevalent among 23% of pre-school children and 37% of adolescents. The prevalence of deficiencies of Vitamin B12, Vitamin A and Vitamin D also hover between

Target crops for biofortification: Indian Scenario

Base line and targets

Traits	Parameters	Rice (polished)	Wheat	Maize	Pearl millet
Fe:	Retention after process (%)		90		
(30% EAR)	Bioavailability (%)	10		5	
	Base line (ppm)	2	30	30	47
	Target (ppm) (dry wt.)	15	59	60	88
Zn:	Retention after process (%)		90		
(40% EAR)	Bioavailability (%)		25		
	Base line (ppm)	16	25	25	47
	Target (ppm) (dry wt.)	28	38	38	66
ProA:	Retention after process (%)		50		
(50% EAR)	Bioavailability (%)		12.1		
	Base line (ppm)		0		
	Target (ppm) (dry wt.)	17	17	23	17

Adult women: Fe: 1460 ppm, Zn: 1860 ppm, ProA: 500RE per day
4-6 yrs child: Fe: 500 ppm, Zn: 830 ppm, ProA: 275RE per day
Source: Bouis & Welch, 2010

14% and 31% for pre-school children to adolescents. Zinc deficiency was found among 19% of pre-school children and 32% of adolescents. Indians lose about 2.8 million disability-adjusted life years (DALYs) every year due to zinc deficiency.

- Biofortification can change the situation and hence, warrants its promotion and further scaling up. Biofortification differs from conventional fortification. Biofortification increases micronutrient levels in the edible parts of the crops (seeds, tubers, grains etc.) in plant growth rather than through post-harvest processing of agricultural production. Biofortification improves the nutritional quality of food crops through agronomic practices, conventional plant breeding, or modern biotechnology.

- Biofortification leads to a more nutritionally resilient staple food system. It is a foundation on which to layer industrial food fortification for the remaining nutrients of public health concern un addressed through biofortification. Empirical studies have established that when consumed daily in normal quantities, biofortified crops deliver measurable positive impacts to human health, including non-communicable diseases and nutritional status.

- The Copenhagen Consensus ranked interventions that reduce micronutrient deficiencies, including biofortification, among the highest value-for-money investments for economic development. For every dollar invested in biofortification, as much as $17 of benefits may be gained.

Status

Government Initiatives

- The government of India is a leading advocate for reducing malnutrition by increasing the production and consumption of nutrient-enriched staple foods, particularly biofortified zinc wheat, zinc rice, and iron pearl millet (IPM). 2018 is declared as the "Year of Millets". Farmers were incentivised to grow crops such as 'Nutri-cereals,' which the government recognises as being important to improve both food and nutrition security. That same year, the Indian Council of Agriculture Research (ICAR) took a decisive step by establishing minimum levels of iron and zinc to be bred into all national varieties of pearl millet.

- Since 2006, ICAR-All India Coordinated Research Projects (AICRP) began breeding programs on pearl millet for micronutrients alongside higher yields. Following that,10 iron pearl millet varieties and 9 zinc wheat varieties have been released to farmers to promote their growth and production in India. In August 2020, ICAR took a bold step to help scale up the production and consumption of nutritious biofortified crops in the country. It was announced that 10% of ICAR's Frontline Demonstrations (FLDs) of crops would now include zinc-biofortified wheat and rice varieties. ICAR, Indian agricultural universities and research institutes have developed five varieties of wheat biofortified with zinc.

- Biofortification is also being championed at the highest levels of the government. Recently, Hon'ble Prime Minister of India, Mr Narendra Modi, strongly endorsed staple crop biofortification as a sustainable and cost-effective solution to alleviate malnutrition. In October 2020, he dedicated 17 biofortified varieties of 8 crops to the nation.

- Government of Bihar, India's third most populous state with the lowest per capita income and the highest rate of stunting, committed in 2020 to scale up the production of zinc wheat seeds through public seed companies. The Bihar government also inaugurated in 2020 a "nutritional village" that will cultivate only biofortified crops using organic methods to promote these nutrient-rich varieties.

- Cropsfor biofortification include:

  a. **Ironbiofortification -** rice, beans, sweet potato, cassava and legumes, cowpeas, lentils

  b. **Zincbiofortification -** wheat, rice, beans, sweet potato, and maize

  c. **Provitamin A carotenoidbiofortification -** sweet potato, maize, and cassava; and

  d. **Amino acid and proteinbiofortification -** sorghum and cassava

Civil Society &Commercial Initiatives

- Global Alliance for Improved Nutrition (GAIN) and HarvestPlus collaborate to support the commercialisation of biofortified iron pearl millet in Rajasthan, Maharashtra and Karnataka, and zinc wheat in Uttar Pradesh, Bihar, and Punjab. On one end, the project ensures that biofortified seeds are adequately multiplied and adopted/cultivated by farmers through farmer outreach activities and establishing relations with farmer groups and associations. On the other, it engages with the food processors and key-value chain actors to adopt biofortified grains for existing products and develop innovative food products that are nutritious and appealing to the consumers. The project collaborates with state and national governments to encourage the distribution of biofortified varieties within the social protection schemes.

- The project is also piloting a digital agri-platform for providing end-to-end solutions to the farming community and food processors to commercialise biofortified foods in Rajasthan and Bihar. The platform would be deployed to enable supply chain participants to share information (e.g. inventory data, demand forecasts), communicate and collaborate more effectively. It would be a learning for designing more efficient supply chain structures.

Vision 2030

Leveraging biofortification towards ‘Kuposhan Mukt Bharat’ (Malnutrition free India) by improving access and production of biofortified food products while increasing its outreach to populations through government-sponsored food programs and open markets.

Pathways

POLICY

Create a comprehensive framework integrating biofortification and fortification to address the issues of micronutrient deficiency across the population since they play a complementary role to address malnutrition.

Build a framework for public-private partnerships in research and development, focused on new varieties and seeds. This will require better coordination and collaboration among various subject specialists, namely breeders, biotechnologists, biochemists, seed technologists, agronomists, and post-harvest technologists across various public and private organizations.

Set up a dedicated biofortification department within the Ministry of Agriculture.

Create a clear framework for transgenic biofortification and address ambiguities related to GM policy in India.

Include biofortified products in government-sponsored schemes such as National Food Security Mission, Rashtriya Krishi Vikas Yojana, Public Distribution System, as well as nutrition intervention programmes like Integrated Child Development Services scheme, ‘Mid-day meal’ and Nutrition Education and Training through Community Food and Nutrition Extension Units for mass outreach.

Ensure alignment of biofortification and fortification as a complementary strategy to address micronutrient malnutrition by engaging different stakeholders.

Pathways

IMPLEMENTATION

Improve consumer awareness and include participatory breeding techniques to address the needs and preferences of all farmers, male and female and consumers by addressing the key issues like taste/yield/processing traits in accordance with the existing commercially grown crops in the market.

Introduce nutritional traits like minerals and vitamins into the mainstream to ensure the required levels in crop varieties to be developed in the future. Leverage region-specific nutrient-rich crops such as fruits in the North-Eastern part of India.

Establish strong linkages with the Agri food-processing industry for the dissemination of biofortified crops. Undertake strong promotional extension activities to improve awareness on biofortified crops among the farmers, industry and consumers.

Initiatives like awarding remunerative prices for biofortified grains in the market to encourage the farmers and value chain actors to adopt biofortified crops at scale. Adoption of the 'seed village' model for the cultivation of the biofortified crops by the entire farming community of the village.

Strengthen the seed chain to produce and supply good quality seeds to popularize biofortified varieties of crops for rapid dissemination of nutritionally improved cultivars among the farmers.

Provide technical assistance to Food Industry, especially the small business enterprises, SMEs/MSMEs, to adopt bio-fortification; encourage investments in the private sector for effective production of biofortified staples and establish long-term sustainable markets for biofortified crops.

Expand social infrastructure for interactions and interventions focused on mass awareness of nutrient density of foods at all the three levels- individual, household and community.

Streamlinemessaging around 'nutrition in foods' among consumers for improved impact and understanding.

Develop crop value chain specific communication strategies to encourage adoption of biofortified crops and foods.

Consumer-focused marketing campaigns to build awareness, and hence demand, around the concept and benefits of nutrient-dense bio-fortified foods leveraging digital & social media, influencers, and other mass media tools.

Pathways

KNOWLEDGE & RESEARCH

Institutionalise research by conducting large-scale trials to help in generating data and thus help in the dissemination of biofortified varieties.

A dashboard can be created along with ICAR to have dynamic data available on the scaling up and outreach of the biofortified crops. This can be done at the state level.

Develop or integrate global standards for biofortified crops - seed and grain - and create an eco-system to accelerate and amplify biofortified varieties among the food processing industry.

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Changing Consumer Behaviour

8

Actionable Area

Strengthen 'Eat Right India' movement to bring in behavioural change and enable access to safe and nutritious food.

Issue

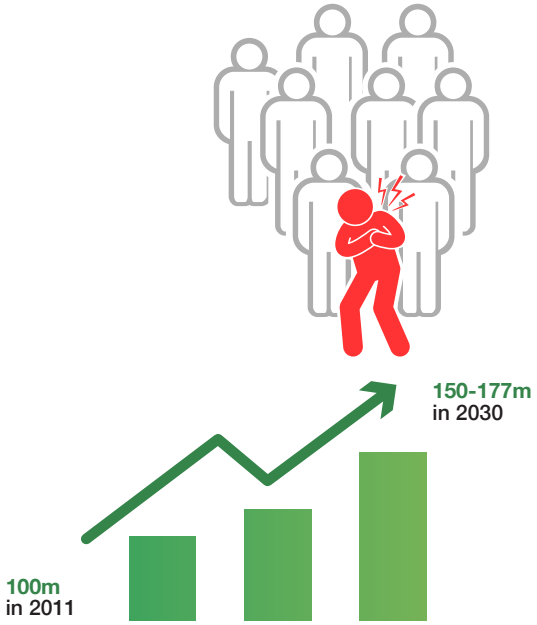
- A range of food safety hazards and unhealthy diets contribute to malnutrition and several non-communicable diseases (NCDs). Unsafe food also makes the vicious cycle of disease and malnutrition worse. Foodborne diseases (FBDs) obstruct socioeconomic development by straining health care systems and harming national economies, tourism, and trade. Thus, safe and nutritious food plays a key role in public health and nutrition, and it has environmental impacts too.

- With changing lifestyles, food habits are increasingly driven by convenience and impulse; food is becoming a method of instant gratification rather than a means of nourishment and good health. A diet rich in saturated fat and added salt & sugar can significantly increase the risk of chronic conditions, such as obesity, heart disease, and diabetes.

- Today, nutrient deficiencies and toxicity from unsafe and poor dietary habits are linked to nearly all modern health conditions. The burden of undernutrition coupled with the increasing incidence of obesity among children is a particular concern. Nearly 62% of deaths in India are caused by diet-related non-communicable diseases like diabetes, hypertension, and cardiovascular disease. Unsafe food costs India as much as US$15 billion annually—a very high economic burden caused by foodborne diseases.

The Rising Burden of FBDs

By 2030 1/9 people will fall sick due to food-borne diseases, up from 1/12 in 2011 (globally).



Number of foodborne disease cases in India

Source: WHO, 2019; Wageningen University & Research and ILRI, 2017

Status

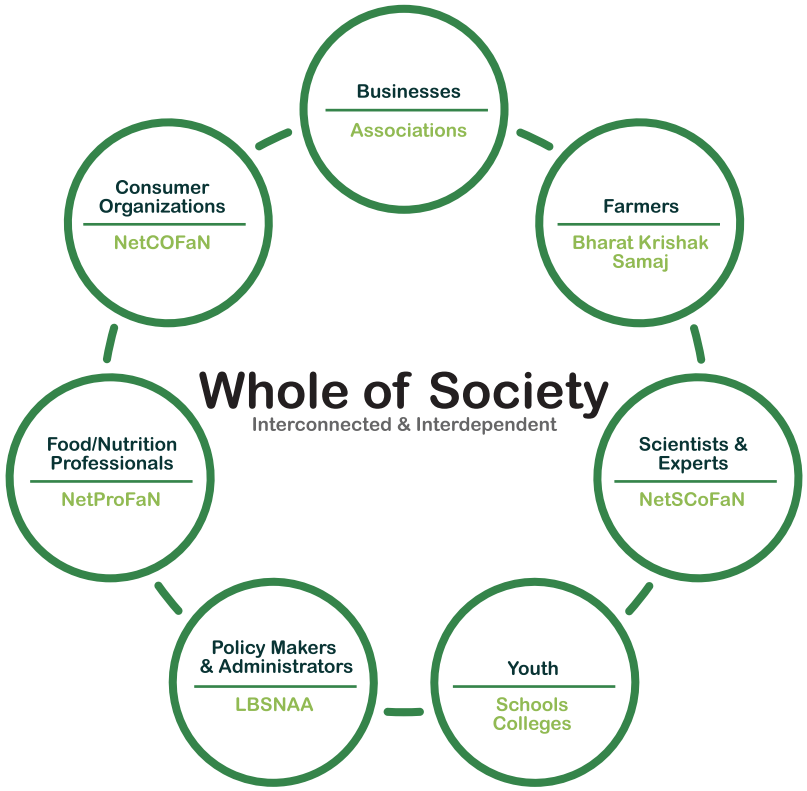
Government Initiatives

- Inspired by an emphasis on preventative healthcare in the National Health Policy of 2017, as well as flagship programs including Ayushman Bharat, POSHAN Abhiyaan, and the Swachh Bharat Mission, the Food Safety and Standards Authority of India (FSSAI) launched the "Eat Right India" programme on 10th July 2018. It is an effort started on a large scale to overhaul the country's food system to provide people with safe, healthy, and sustainable food. Eat Safe, Eat Healthy, and Eat Sustainable are the three fundamental themes/pillars of the 'Eat Right India' movement.

  Eat Safe: Ensuring personal and environmental hygiene, hygienic and sanitary practices throughout the food supply chain, fight adulteration, prevent/reduce toxins and pollutants in food to acceptable levels, and prevent food hazards in processing and manufacturing operations.

  Eat Healthy: Supporting dietary diversity and balance, eliminating hazardous industrial trans-fats from food, reducing salt, sugar, and saturated fat intake, and promoting large-scale fortification of staples to address micronutrient deficiencies.

  Eat Sustainable: Promoting locally grown, processed, and seasonal foods, preventing/ reducing food loss and waste, conserving water in food value chains, limiting chemical usage in food preparation & presentation within acceptable levels, and utilising safe and sustainable food packaging.



- Eat Right India encompasses a wide range of initiatives and programmes aimed to promote both the demand for and the supply of safe and healthy food in a sustainable way. While the supply-side interventions aim to build capacities of food businesses to promote self-compliance, the demand-side initiatives motivate consumers to demand safe and healthy food. The initiatives for the production and consumption of food in a sustainable way aim to promote environment-friendly food practices and habits.

- To augment the capacity of the private sector on the supply-side, FSSAI has initiated Food Safety Training and Certification (FoSTaC) – a unique program to ensure a trained and certified Food Safety Supervisor (FSS) on each food business premise. As of 9th July 2021, a total of 5,26,059 FSS has been trained by 262 training partners and 2,133 trainers under the FoSTaC Ecosystem.

- Several benchmarking and certification schemes to improve food safety and hygiene standards are in place. Clean Street Food Hub, Clean and Fresh Fruit, and Vegetable Markets Eat Right Station and BHOG (Blissful Hygienic Offering to God) for Places of Worship targeted to clusters of vendors. The Hygiene Rating scheme for Restaurants and Catering Establishments, Bakeries, Sweet and Meat Shops has been put in place for individual foodservice establishments.130 campuses have been awarded EAT Right campus recognition, 99 are in the pipeline, and 484 applications have been received. Under the Clean Street Food Initiative- 28 street food hubs have been certified,23 are under process, and 20 states are engaged.

- The three major focus areas are Building Consumer Awareness, Addressing Adulteration, and Enabling Healthy Choices. To build consumer awareness, a settings-based approach has been adopted with programmes like Eat Right Campus and Eat Right School that target individuals in workplaces, colleges, universities, institutes, hospitals, tea estates, jails, and school children in schools. As of December 2021, under Eat Right School initiative, 63,804 schools, 6,923 Health & Wellness Ambassadors have been registered, and 48,058 school activities completed.

- The Eat Right Toolkit has been launched to reach communities at the grassroots level by training frontlines health workers on messages on eating right. To address adulteration, the Detect Adulteration with Rapid Test (DART) Book to test food adulterants at home with simple tests has been developed. The Food Safety Magic Box has been created to test adulterants in a school laboratory setting. A mobile food testing van called Food Safety on Wheels has been launched to reach remote areas and conduct training and awareness activities as well.

- To enable healthy choices, FSSAI has launched mass awareness campaigns to reduce salt, fat and sugar in the diet; “Aaj Se ThodaKam” and Trans-Fat Free India@75 to eliminate trans fats by 2022. Food fortification is also being promoted on a large scale to address micronutrient deficiencies across the country. Several companies have come forward to voluntarily sign pledges on Reducing High Fat and High Sugar, High Salt as an outcome of these efforts.

- To encourage and support responsible production and consumption of food to protect the environment, FSSAI is spearheading initiatives such as Jaivik Bharat to promote authentic organic food; Save Food, Share Food to reduce food waste and promote food donation; Safe and Sustainable Packaging in Food and Beverage Sector to reduce the use of plastics, and Repurpose Used Cooking Oil (RUCO) for safe and healthy use of cooking oil and repurposing used cooking oil to make biodiesel, soap or other useful products.

- FSSAI launched a national campaign, "Swasth Bharat Yatra," on 16th October 2018 on the occasion of World Food Day. 'Swasth Bharat Yatra' was a pan-India Cyclothon, held across 350 locations across the country for connecting 1.33 billion people to promote the message of safe and wholesome food in the country. Over 7,500 cyclists participated in over 18,000 km relay cycle rally travelling across six tracks through almost every state and UT for over 100 days to propagate a powerful message, 'Eat Right India.'

- The Food Fortification Resource Centre (FFRC) was set up to provide information to the various Ministries of the government to fortify the five staples—rice, wheat, oil, milk, and salt—and provide assistance to the states on how these can be disseminated through Public Distribution System, Mid-Day Meals or the ICDS and under the Eat Right India.

- At present, the contribution of milk cooperatives to the fortifiable milk quantity is approximately 220 Lakh Litres per Day (LLPD), while the private sector contributes approximately 196 LLPD. The total quantity can potentially benefit almost 275 million people. Out of this 416 LLPD milk produced, about 150 LLPD gets actually fortified currently, reaching about 100 million people.

- FSSAI has an online food concern redressal system, namely 'Food Safety Connect,' part of the existing online Food Licensing and Registration System (FLRS). This online platform helps consumers register their complaints and feedback about food safety issues related to adulterated food, unsafe food, substandard food, labelling defects in food, and misleading claims & advertisements related to various food products.

- NetProFaN is envisaged as a platform hosted by the FSSAI to leverage the collective strengths of the professional associations and bodies in food and nutrition to foster innovations. This network will leverage its members' resources, skills, expertise, and knowledge to support the national efforts in improving food and nutrition indicators.

Private sector initiative

- FSSAI's efforts in setting standards for fortified staples have created an enabling environment. They have resulted in the inavailability of 157 brands of five fortified staples in the open market with a pan India presence and regional preferences. There has been tremendous traction in Oil and Milk industry, with 47% of the vegetable oil produced by top players in the refined packaged oil market is being fortified. 36.6% of milk is currently being fortified. In all 19 states and 5 union territories have adopted fortification of several commodities under the government safety net programmes (SNP), mainly ICDS, MDM & PDS.

- Global Alliance for Improved Nutrition (GAIN) and Tata Trusts and Food Fortification Resource Centre (FFRC)-FSSAI has been working together with the dairy industry to step up their capacity to produce the quality assured milk fortified with vitamins A and D. On the product folio side, major food companies have voluntarily pledged to reformulate packaged foods to reduce the level of fat, sugar, and salt. Also, major food retail players, e-commerce players have pledged to promote healthier options & responsible retail practices.

- For Transfat-free India @75 by 2022, voluntary commitment has been made by Bakery Associations, Halwai Associations, professional associations like Nutrition Society of India, Indian Dietetic Associations (IDA), Association of Food Scientists and Technologists (India).

- The schemes like Clean Street Food Hub, clean and fresh fruit and vegetable markets, Eat Right Station, and BHOG (Blissful Hygienic Offering to God) for places of worship provide opportunities to the private sector and support these activities through their Corporate Social Responsibility Projects. Several private sector organisations have supported street food hubs in Gujarat and other states successfully.

Vision 2030

- **Reduce mortality rate due to non-communicable diseases by making balanced diet, physical exercises and mental health an integral part of the people's life.**

- **Develop an informed society fully aware of sustainable eating and lifestyles in harmony with nature.**

- **Strengthen scientific and technological capacity to move towards more sustainable patterns of consumption.**

- **Ensure a healthier, better nourished India through enhanced Public-Private Partnership involving all stakeholders.**

Pathways

IMPLEMENTATION

Adopt Triple E (Engage, Excite, Enable) strategy to incentivize consumers and food handlers for safe, healthy, and sustainable diets.

Continuemass campaigns for promoting informed food choices. Foreg.repository of content to be created with relevant messages in audio and video.

Promote food culture associated with good nutrition by supporting and protecting processed and traditional foods with a nutrition focus, providing information about traditional dishes.

Improve people's awareness about and provide them easy access to food testing facilities/ FSSAI to help authorities expose food frauds.

Promote and strengthen the Indian Food Sharing Alliance – Save Food, Share Food, Share Joy, a social initiative by the FSSAI to help solve India's food waste and hunger crisis by integrating various partner organisations, Food Recovery Agencies, and NGO's.

Handhold and build capacity of the small scale and unorganised sector in lowering the fat, sugar, and salt content of food being produced. Encourage the large and medium scale FBOs to develop and share technology with the small-scale sector.

Strengthen the testing laboratories and ensure a rigorous surveillance plan to detect food contaminants and adulterants.

Increase the outreach of the mobile food testing units to reach far-flung areas to monitor food quality and safety.

Pathways

POLICY

Promote public-private partnership networks and collaborations activities.

Encourage private organizations to mass scale the home food safety test kits, approved by FSSAI, to make them easily available.

Encourage and motivate corporates to utilise their Corporate Social Responsibility (CSR) Funds for farmer producer organisations and social projects related to Eat Right India and adopt them successfully as part of public service.

Make social protection programmes more nutrition-sensitive by augmenting and adapting existing programmes to enable nutritionally vulnerable households to afford and access a healthier diet, provide essential nutrition-related services to vulnerable groups, and stimulate food systems to supply more nutritious foods.

Monitor programs and initiatives and their progress to ensure better implementation and achievement of goals.

KNOWLEDGE AND RESEARCH

Create a repository of traditional nutritious foods and local nutrient-rich produce (fruits, vegetables, grains, legumes, seeds) of all the regions for ready reference.

Identify and promote local, traditional nutritious foods. Develop new low-cost nutritious products on the basis of research.

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Workforce Nutrition

Actionable Area

Ensuring nutrition security for the current working population and children who will enter the workforce in the future. The focus is to build strong human capital that act as a driving force to move away from low-skilled jobs to a knowledge-based economy.

Issue

- With 66% of the population under working age, India has a huge potential to achieve economic growth faster than the largest global economies. This requires a focus on building a strong human capital which further needs to ensure nutrition security.

- Malnutrition has consequences beyond an individual's health and wellbeing. A study in 19 countries estimated that "$8–38 billion per year [are lost] from reduced worker productivity due to employees being underweight, and $4–27 billion per year due to obesity." Child malnutrition alone is responsible for approximately 15% of the total disease burden in India, which costs India around 3% of its gross domestic product (GDP) every year, i.e., about $46 billion, and up to 8% of its productivity. Poor and vulnerable sections of the population have minimal access to diverse foods and are more negatively impacted during public health crises.

- Improving investments in human capital through improved workforce nutrition interventions is one way to influence both national economies and global public health. 'Workforce Nutrition' as defined by the

Cost of Malnutrition

$8–38 billion
per year are lost from reduced worker productivity due to employees being underweight.

$4–27 billion
per year are lost from reduced worker productivity due to employees being obese.

Around $46 billion
are lost every year due to child malnutrition in India. Costing up to 8% of the country's productivity.

Global Alliance for Improved Nutrition (GAIN), refers to a set of interventions that work through the existing structures of the workplace to address fundamental aspects of nutrition amongst employees and/or supply chain workers. These programmes aim to create improved access to and demand safe and nutritious food. Breastfeeding support programmes are included in this definition.

- Given that most working-age people will eat at least one meal a day at work, businesses can play a catalytic role in sustaining a healthy and thriving workforce. Access to nutritious food in work settings is often inadequate – a missed opportunity given the strong connection between health, nutrition, and productivity. There is a strong business case for corporates, employers, and governments to introduce effective workforce nutrition programmes. A recent World Bank analysis estimates that every $1 invested in interventions to meet the World Health Assembly nutrition targets would yield an economic return between $4 and $35.

- A simple workforce nutrition initiative reduces the risk of non-communicable diseases and provides enough energy and nutrients to perform tasks. This can result in reduced rates of accidents and absenteeism, increases productivity, and reduces mistakes.

Status

Government Initiatives

- The nutrition policies and programmes of the government of India are targeted at the population in general and not specifically at the working age. This is particularly true for workers in the unorganised sector, who constitute more than 90% of India's 450 million-strong workforces. The existing laws and regulations for workers provide for occupational health and safety, labour welfare, and work conditions. But nutrition is overlooked in these policies.

- The national initiatives on maternal and child nutrition such as the Integrated Child Development Services (ICDS), Mid-Day Meal, and the recent flagship programme POSHAN Abhiyaan (Nutrition Mission) have had moderate success in decreasing the number of children who are stunted, wasted, and anemic. These interventions are critical to developing a nutritionally secure workforce for tomorrow.

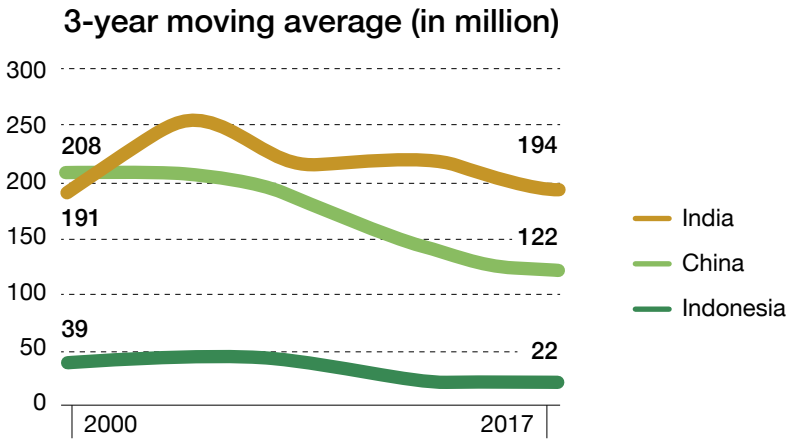
- The National Food Security Act (NFSA) guaranteed access to staple foods at very subsidised rates. However, the affordability of other important sources of nutrition such as fresh fruits, vegetables, dairy products, and other important food groups is still a challenge for many. For the past 40 years, food policies have largely focused on providing calorie-dense diets and reducing absolute hunger;

however, concentrated efforts to reduce hidden hunger or micronutrient deficiency need to be additionally prioritised with urgency.

Private Sector Initiatives

A very recent development towards workforce nutrition in the private sector is the corporate wellness programmes, which include nutrition-related services such as diet counselling, weight management, and physical exercises. But very few Indian businesses have introduced these wellness programmes. They benefit only about 10% of employees, primarily from the formal sector.

India is home to the highest number of undernourished people in the world, a title China used to hold until the early 2000s.



Source: FAO, NFHS

Vision 2030

- Reimagine nutrition security for a healthy and productive Indian workforce through the involvement of both public and private sector stakeholders.
- Workplaces can be leveraged as an optimal point of nutrition intervention, and Nutrition Education programmes for the workers should be introduced.
- Change the food environment at workplaces.
- Concerted efforts to create healthy and safe working spaces for women.
- Businesses should step up their workforce nutrition interventions to tackle the increasing disease burden along with the government.

Pathways

POLICY

Government should introduce a workforce nutrition policy and programme and augment investments in nutrition programmes by a much stronger commitment and involvement of the private sector.

Industries should explore innovative ways to introduce nutrition policies and programmes for their workforce.

Involve businesses, corporates, and other stakeholders in the governmental efforts and make nutrition a part of their business strategy.

Introduce family-friendly policies at workplaces of which breastfeeding support should be a crucial part.

Make workforce nutrition an integral part of a company's policy.

IMPLEMENTATION

Employers should influence the behaviour of workers by providing a supportive and enabling environment.

Employers should introduce Healthy Food at Work by focusing on increasing employees' access to healthy and safe foods at work, either for free, with a subsidy, or at full cost to the employees.

Bring corporate canteens on board for this initiative as these are outsourced to a food vendor.

Form health and wellbeing committees at workplaces to work together with the food vendors to develop nutritious food menus and monitor and evaluate the impact of the programme.

Provide to working mothers creches and lactation stations at workplaces.

Businesses should introduce nutrition-focused health check-ups as part of the workforce nutrition intervention, coupled with counselling.

The private sector should evaluate and monitor such nutritional programmes to measure their financial impact on their businesses.

Pathways

KNOWLEDGE & RESEARCH

Leverage existing infrastructure to bridge the knowledge gap on nutrition and improve access to nutritious diets for the workforce.

Support the employees in tracking progress on nutrition-related goals, increasing their knowledge about health and nutrition.

Article by:
Tarun Vij who leads the India Country Program of GAIN.

With inputs from:
Mr. Basant Kar; Mr. Saroj Kumar Mohanta(Ecociate), Mr. Pratyush Panda (ACC Cements); Mr. K K Upadhyay (independent expert); Mr. Kirti P Mishra (Ecociate); Mr. Rajeev Ahal (GIZ), Mr. Manish Mishra (Ministry of Skills and Entrepreneurship Development), Ms. Komal Ganotra (GAIN); Mr. Avilash Dwiwed (Tata Projects), Aishwarya Choubey (GAIN); Bhuvaneswari Balasubramanian (GAIN), Biju Mushahary (GAIN); and Ms. Neha Khara (GIZ).

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Preventing Anti-Microbial Resistance (AMR)

10

Actionable Area

Adopt One Health (OH) Approach to prevent the spread of antimicrobial resistance and unregulated use of antibiotics.

Issue

- India is currently facing many health threats such as antimicrobial resistance, environmental health hazards, food safety risks, and most importantly, zoonotic diseases such as Nipah, Avian Influenza, Scrub Typhus, Congo fever, Kyasanur forest disease, COVID-19, and Leptospirosis that grossly impact country's economy. The recent pandemics have exposed the gaps in public health policy, and the government is prepared to commit to the One Health Approach and invest more in public health infrastructure. Further, as challenges have increased in recent years, the experts advocated the One Health Approach not only to cope with the pandemic but also to manage the infodemic by promoting the timely dissemination of accurate information. Thus, the healthcare sector is coming under increasing pressure calling for urgent attention.

- Scientists have observed that more than 1.7 million viruses are circulating in wildlife, and many of them are likely to be zoonotic. This implies that unless there is timely detection, India risks facing more pandemics in times to come. "Anthropozoonotic" infections get transferred from humans to animals. The transboundary impact of viral outbreaks in recent years such as the Nipah virus, Ebola, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and Avian Influenza has further reinforced the need for us to consistently document the linkages between the environment, animals, and human health.

Zoonotic diseases are responsible for an estimated 2.5 billion cases of illness and 2.7 million deaths worldwide each year.

Source: UNDP

- AMR (Antimicrobial Resistance) is a complex, multifaceted problem that threatens human and animal health, the global economy, and national and global security that demands an integrated and holistic multi-sectoral One Health(OH)approach. The rates of AMR have been rising disproportionately in the past few decades. India holds the fourth position in the world when it comes to antibiotic consumption by food animals, accounting for 3% of the global consumption. Adopting an integrated approach to food safety throughout the food chain "from farm to fork" is critical to prevent foodborne diseases and other safety hazards. With the implementation of the Food Safety and Standards Act, 2006, India was able to lay down science-based standards for foods to ensure the availability of safe and wholesome food for human consumption. The areas for OH intervention for preventing food safety hazards include outbreak investigation of foodborne illness, laboratory network for pathogen identification, joint research and surveillance of the foodborne pathogen, and improving animal health to help minimise food contamination infectious pathogens, training, and demonstration programs on food safety measures.

- The field of climate change represents an excellent opportunity for researchers to work across disciplines to integrate diverse data sources, develop cross-cutting methodologies, and answer questions about the broader effects of environmental health on human health and animal welfare. The control of the vector-borne disease cannot be addressed without considering the impact of natural and man-made environmental changes on patterns of disease vector proliferation.

- To prevent the spread of new animal-borne diseases and save people from becoming victims, the OH system must be implemented. It refers to a system in which different sectors collaborate and communicate to improve public health results. "It is impossible to preserve human health without taking into account the effects of human activities that disturb ecosystems, intrude on habitats, and accelerate climate change. Pollution, vast deforestation, intense cattle production, antibiotic overuse, and present systems of growing, consuming, and exchanging food are all examples of these activities.

- The Wildlife Conservation Society (WCS) introduced the term "One World-One Health" in 2007 along with 12 recommendations (the Manhattan Principles) that focused on establishing a more holistic approach to preventing epidemic disease and maintaining ecosystem integrity.

- To achieve the 'One Health' vision, challenges on veterinary manpower shortages, restricted/improper disease reporting, the lack of information sharing between human and animal health institutions, and inadequate coordination on food safety at slaughter, distribution, and retail facilities, and others must be addressed.

- While there is an increased focus on preventing and predicting diseases in human health, the animal health sector lacks proper disease prevention, reporting, surveillance, forecasting, and laboratory diagnosis. Another major challenge is setting up surveillance programs, and there is a lack of support from partners. Milder zoonotic diseases that pose a low and medium risk which when not addressed can convert into the major problem are not monitored. There is a lack of awareness. Wild zoonosis is a domain that lacks proper attention. One main challenge is that the collaboration and coordination among the stakeholders are not sufficient to adopt a standard One Health protocol.

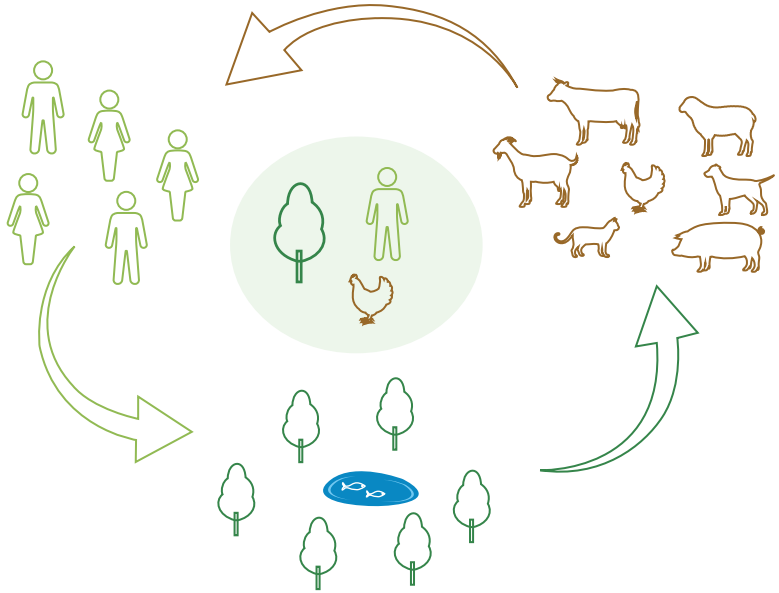
Status

Government Initiatives

- Although the OH approach is in an early stage in India, there are many cross-cutting policies and regulatory measures that are operating and conducive for further development of the approach. Owing to the public health importance of zoonotic diseases in India, a National Standing Committee on Zoonosis was formed in 2007. The Food Safety and Standards Act, India, stipulates the limits for contaminants, naturally occurring toxic materials, antibiotic residues, pesticides, heavy metals, veterinary drug residues, etc. Government-initiated control programs for zoonotic and highly communicable diseases such as rabies, brucellosis, and food-and-mouth disease are also available. The Centre of Zoonosis, National Centre for Disease Control, India, has published a manual for handling zoonotic diseases.

- The Department of Animal Husbandry and Dairying (DAHD) has launched several schemes to mitigate the prevalence of animal diseases. Additionally, the government is working on revamping programmes that focus on capacity building for veterinarians and upgrading the animal health diagnostic system, such as Assistance to States for Control of Animal Diseases (ASCAD). India's National Action Plan (NAP) against AMR marks a significant step in terms of the government's convergent effort to tackle AMR issues. Recently, funds were sanctioned for setting up a 'Centre for One Health' at Nagpur.

Human health, animal health and ecosystems are **inextricably linked**



Human health
At least 60% of all human diseases have their origin in animals

Animal health
Diseases in food producing animals globally amount to a loss of 20% in production

Ecosystem
Any emerging disease in the last 30 or 40 years results from encroachment into wild lands and changes in demography (Peter Daszak, EcoHealth Alliance)

- The Indian Council of Medical Research (ICMR) initiated an Antimicrobial Resistance Surveillance and Research Network (AMRSN) in 2013 to generate relevant evidence on the extent of drug resistance, and nationally representative reliable data on AMR was not existent in India. The main goal of the AMRSN is to monitor the trends in susceptibility profiles of clinically important and pathogenic organisms of human health by including comprehensive molecular studies, creating data management systems and dissemination of information to stakeholders, and promoting intervention to reduce the AMR. In addition to the above, the Ministry of Health and Family Welfare, Government of India, initiated the Antimicrobial stewardship (AMSP) activities. As a part of this and in order to promote rational use of antibiotics among the healthcare providers, a series of sensitisation and training workshops have been organised in different healthcare facilities in the country for the benefit of the practicing clinicians. Standard treatment guidelines developed by NCDC for rational use of antibiotics have been made available to clinicians across the country.

- The Pashu Aadhaar system, also known as the Information Network for Animal Productivity and Health (INAPH), developed by the National Dairy Development Board (NDDB), was introduced in August 2019. The INAPH assigns a Unique Identification Number (UID) to each animal and keeps a record of all the necessary information about the bovines. This helps the government manage the country's vast numbers of livestock; now Government of India has tagged 14.62 crore livestock with a unique ID Number.

- The National Health Policy 2017 identifies antimicrobial resistance as a problem and calls for effective action to address it. National Action Plan on Anti-Microbial Resistance (NAP – AMR) 2017-2021 was issued by the Government of India. ICAR, in collaboration with FAO, established "Indian Network of Fishery and Animal Antimicrobial Resistance (INFAAR)" for AMR surveillance in pathogens from fish, livestock, and poultry. Presently 21 laboratories (18 from ICAR and 3 from universities) are partners of this program. It is proposed to expand the network gradually, thus making INFAAR a pan-India network to meet the national needs. Manual on Veterinary Drug Residue Analysis including antibiotics, 2018 was released by FSSAI.

- Kerala was the first state in the country to have ramped up efforts to control AMR, and this plan was guided by WHO and was launched in October 2018. It is called Kerala AMR Strategic Action Plan (KARSAP) and has been operationalised through a One Health response. Madhya Pradesh is the second state to have a plan for antimicrobial resistance. The Madhya Pradesh State Action Plan for Containment of Antimicrobial Resistance (MP-SAPCAR) focuses on a 'One Health' approach to contain AMR through six key strategic priority areas and multi-sectorial involvement.

- Recently a multi-disciplinary and multi-country collaborative research project had been sanctioned by the United Kingdom Research & Innovation (UKRI) under the Global Challenges Research Fund (GCRF), namely GCRF One Health Poultry Hub. It is for a period of five years for five intuitions in India, Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Chennai and Anand Agricultural University (AAU), Gujarat, along with medical partners Christian Medical College, Vellore, and Gujarat Biotechnology Research Centre (GBRC), Ahmedabad and Jawaharlal Nehru University (JNU), New Delhi.

Private sector initiatives

- Many private players have adopted good practices in poultry and livestock management, creating a healthy environment under the complete supervision of veterinarians. The farmers are being trained in good practices, provided technical support, engaged in skill-building activities, and supported to increase their farm and off-farm productivity, yield, and incomes.

- Many Quick Service Restaurants (QSR's) source poultry from certified partners who follow strict safety measures, rear their chickens/meat products in bio-secure farms, and implement health & safety checks at every stage of the poultry rearing process. Every batch of chicken/meat sourced comes with a health certificate that details their health history through the entire rearing phase. Every single bird is inspected by a trained husbandry quality controller before it is butchered to ensure that the bird is healthy and disease-free. Additionally, there are also efforts being made by industry bodies such as the Confederation of Indian Industry and Industry partners who are building the capacity of food business operators on prevention and control of Avian Influenza.

Vision 2030

- **Adopt One Health Approach for preventing fatalities among humans arising out of antimicrobial resistance and unregulated use of antibiotics.**

- **Prevent Human Health fatalities by strengthening capacity towards early prediction, detection, and diagnosis of zoonotic pathogens in wildlife, livestock, and human populations and data capture aligned to the One Health Approach. Ensure sustainable growth of workforce development and emergency response systems based on Scientific Research, Technology, and Infrastructure.**

Pathways

IMPLEMENTATION

Enhance holistic partnership for sustainable development, complemented by multi-stakeholder partnership across ministries, industry, non-government organisations, communities, society including pharma, poultry and meat sector, dairy sector, veterinary community wildlife experts, epidemiologists, research institutions, and testing labs in animal and human health, consumers and others to mobilise, share knowledge, expertise, technology, and financial resources.

Implement Strategic priorities under National Action Plan - Anti Microbial Resistance including, improving awareness and understanding of AMR through effective communication, education, and training, strengthening knowledge and evidence through surveillance, reducing the incidence of infection through effective infection prevention and control, optimising the use of antimicrobial agents in health, animals, and food

Strengthen India's leadership on AMR.

Consolidate Disease Surveillance mechanism for animal health & monitoring disease surveillance systems and information systems for animal productivity & animal disease reporting system. Strengthen the work on alternatives to antibiotics like herbal preparations, competitive non-pathogenic organisms (Lactobacillus & Saccharomyces), antimicrobial peptides, etc.

Strengthen human resource development, including Public Health Veterinarians, food microbiologists, environmentalists, fish microbiologists, and Medical Professionals for quality research, risk assessment, measures to combat AMR, quality slaughterhouse byproducts, quality food products, etc.

Pathways

POLICY

Strengthen early warning systems on global health risks through early detection, diagnosis, mitigation, and monitoring of the effectiveness of actions on Zoonotic and Anthropozoonosis diseases. Establish a single agency or framework that embraces all inter-disciplinary sectorial players under a single umbrella to carry forward the 'One Health Cycle.'

Standardise guidelines regarding antibiotic use, limiting the use of antibiotics as over-the-counter medications, banning or restricting the use of antibiotics as growth promoters in animal livestock, and pharmacovigilance including prescription audits inclusive of antibiotic usage – in the hospital and community.

Strengthen regulations on the usage of antibiotics in animal health, plant health & human health and ensure harmonisation with each other. Leverage development and implementation of Antibiotic Stewardship programs.

Develop the economic case of sustainable investment that takes into account the needs of all countries and increases investment in new medicines, diagnostic tools, vaccines, and other interventions.

KNOWLEDGE AND RESEARCH

Enhance scientific research and upgrade technological capabilities of resources and infrastructure related to AMR, Zoonotic Disease control, Hygiene, and Biosecurity Measures by encouraging innovation in these areas through public and private research and increasing development spending.

Develop & disseminate guidelines on best practices for slaughterhouses & informal market operations and create mechanisms to operate 'One Health' at every stage down to all levels.

Increase the awareness of farmers, livestock managers, and environmentalists regarding the One Health approach and zoonotic diseases.

Promote research and study on risk assessment on the use of animal origin products as agricultural inputs.

Institutionalise a national disease registry of zoonotic diseases.

Ensure increased use of technology to improve the living environment of animals and monitor and treatment of diseases. Organize prevention through increased vaccination coverage.

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Health Supplements and Nutraceuticals

Actionable Area

Supplement and retain nutrition through health supplements and nutraceuticals.

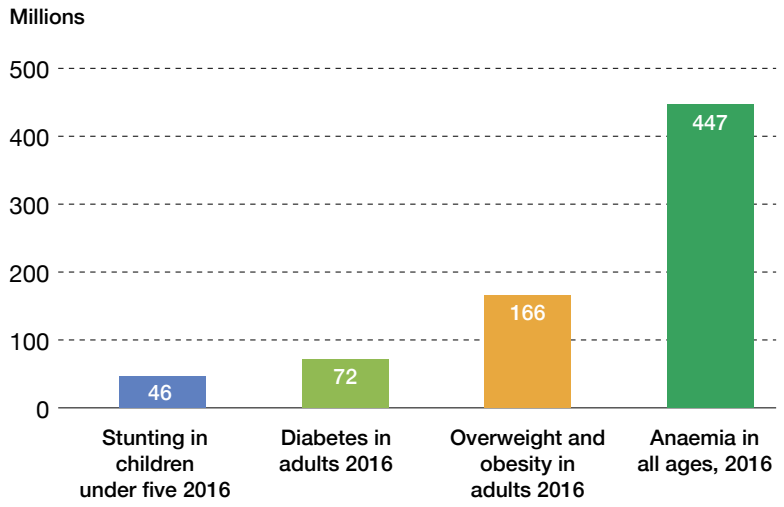
Issue

- Recent National level surveys have shown the lack of vital micronutrients in the Indian diet. This is no longer limited to any particular geographical area, socio-economic section, gender, or age group. The daily, diversified, balanced diet is required to provide appropriate macro & micronutrients and critical non-nutritive components as phytochemicals, antioxidants to enable healthy growth & development of individuals. The changing lifestyles, especially during the pandemic, has resulted in poor eating habits and thus impacted the overall intake of vitamins and minerals essential for a healthy life. With the growing need for convenient foods, it is becoming essential to include certain specialised products that can take care of the missed nutrients and important ingredients to achieve a healthy lifestyle and avoid long term deficiencies and disorders.

- Dietary and nutritional approaches are of paramount importance in managing non-communicable diseases (NCDs), especially diet-related NCDs. A diet lacking in micronutrients is a key risk factor for NCDs.

- ICMR's Hyderabad-based National Institute of Nutrition (NIN) conducted a study in 2017 on ‘Diet and Nutritional Status of the urban population in India and prevalence of obesity, hypertension, diabetes and hyperlipidaemia in urban men and women.'

The burden of malnutrition among children and adults in India (presented in millions)



Source: Stunting - Joint Child Malnutrition Estimates, 2019; Diabetes - IDF DIABETES ATLAS, Eighth edition, 2017; Overweight and obesity - Global Health Observatory (GHO) data, 2018; Anaemia -. The Global Burden of Anaemia, 2016 and Global Burden of Disease Study, 2013.

It concluded that:

a. In the Indian urban population, the average intake of micronutrients like iron, thiamine and niacin were observed to be below Recommended Dietary Allowance (RDA), whereas the intake of vitamin A and Riboflavin are grossly inadequate and Vitamin C and total folate were meeting the RDAs.

b. The proportion of pre-school children and pregnant women consuming less than 50% of RDA of vitamins and minerals was very high.

- RDA is the average daily dietary intake level that suffices to meet the nutrient requirements of nearly all (97–98%) healthy persons of a specific sex, age, life stage, or physiological condition (such as pregnancy or lactation). ICMR has devised new RDAs 2020 as per the Indian Population.

- However, the nutrient requirement of individuals can vary considerably. In this regard, to derive a single value for the requirement, ICMR has also defined Estimated Average Requirement (EAR), which is the nutrient requirement used in public health nutrition to evaluate the nutrient intakes of a population. Also, sometimes nutrients can be ingested at high dosages. Hence, the Tolerable Upper Limits (TUL) for every nutrient is also defined.

- In addition to the consumption of a balanced nutritious diet, vitamins and minerals deficiency can be addressed successfully in a holistic manner through supplementation. Health supplements, nutraceuticals, probiotics provide essential vitamins and minerals in the right dosage in accordance with the RDA requirements and address the concerns of low nutrition. They can become a part of our daily health regime and help to achieve better nutrition and improved immunity. Also, vitamins and minerals show potential benefits in viral infections by showing immune-modulatory effects and playing a role in preventive healthcare.

- Effective implementation of supplementation programs largely depends on appropriate interventions based on public-private partnerships. Additionally, supported by a conducive regulatory framework and strengthening of the supply chain to bridge gaps on accessibility and availability of quality food to the population at large and specifically to the targeted groups.

Status

Government Initiatives

- To regulate the increasing demand of consumers for healthy foods like health supplements and nutraceuticals, the government brought in regulations on such products as the FSS (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food and Novel Food) Regulations, 2016.

- These foods, besides containing vitamins and minerals, also contain ingredients traditionally used as medicines. The functionality of healthy foods can be linked to the ingredients present or with the whole product formulated. Their benefit is beyond basic nutrition and plays a role in reducing the risk of certain diseases & other health conditions.

- The regulation defines the dosage format, formulation specifications, safety, and efficacy parameters that need to be considered for the delivery of these products.

- Collaboration of professionals in the field of nutrition and health can provide a credible source of evidence-based knowledge and influences policies and programmes in the food value chain.

- In alignment with the National Health Policy 2017, Eat Right India programme was launched with its focus on preventive and promotive healthcare.

- Under the National Health Mission, The Ministry of Health and Family Welfare has launched the 'Weekly Iron and Folic Acid Supplementation (WIFS)' Programme to meet the challenge of high prevalence and incidence of anaemia amongst adolescent girls and boys through supervised weekly ingestion of IFA supplementation and biannual helminthic control. Its long-term goal is to break the intergenerational cycle of anaemia whereas, the short-term benefit is of nutritionally improved human capital.

Private Sector Initiatives

- Several initiatives have been undertaken by the private sector, in partnership with FSSAI, under the EAT right initiative to spread awareness about daily nutritional requirements.

- There is a great focus on health solutions and innovations focused on heart health, gut health, eye health, brain health, immunity and mobility, which are all growing concerns, especially in the context of a growing and ageing world population by a company like DSM.

- Companies are also focused on sustainable agriculture through a strong emphasis on innovative health and wellness solutions based on organic ingredients. Companies like Herbalife are also diving into the vast knowledge of Ayurveda with a focus on blending the goodness of Ayurveda and modern science. Amway engages with over 520+ farmers and their families ploughing in 1500+ acres of farm spread in the states of Karnataka, Gujarat, Maharashtra, Kerala & Madhya Pradesh. ITC has invested in around 100 acres of demo farms for medicinal and aromatic plants in Madhya Pradesh and is doing crop development through a cluster development approach and educating farmers in at least 500 villages on the cultivation of these important (Ayurvedic valued) medicinal plants. They have partnered with NITI AYOG under the aspirational district's program to train 2.5 million farmers in 27 backward districts in India.

- Extensive work is also being undertaken by the Resource Centre on Health Supplements and Nutraceuticals (RECHAN) that works on strengthening science and the ecosystem. Under this training and capacity building of point of sale personnel at pharmacies, direct selling agents and sellers on e-commerce platforms are underway. Companies such as Amway conducted 25,000 digital training programs spanning over 20 lakh direct sellers and their consumers. In addition, other companies like Abbot, Danone are also actively involved in various sustainable and nutrition initiatives.

Vision 2030

Strengthen immunity of the population as a 'preventive health care' mechanism. Reduce the death threat of non-communicable diseases.

Pathways

KNOWLEDGE AND RESEARCH

Training and capacity building by working collectively with an integrated and proactive approach across all government departments, agencies, public bodies, educational institutions, private sector etc., in a supplemented diet consisting of health supplements, prebiotics or foods rich in vitamins and minerals as part of a healthy regime.

Enable a streamlined plan to develop the full value chain involved in the development of these supplements, i.e., from raw material to final products. This can support a more holistic agri-product ecosystem.

Institutionalise surveys on consumption /dietary patterns to assess nutrient intake versus RDAs.

Collate data on absorption and potential losses of nutrients in the Gastrointestinal tract and also, for improving gut health by appropriate absorption and retention of nutrients, the focus should be on supplements herbal in nature.

Conduct impact analysis studies to develop mechanisms at each step to assess whether the interventional strategies are working or not, what dosage format is best suitable, and the consumption rate. These mechanisms should follow up at intervals of five to 10 years to make necessary changes in the current programmes and devise future strategies.

Pathways

POLICY

Strengthen the regulatory framework on dietary supplements.

Establish appropriate administrative controls to monitor the progress.

Programs must be based on a regionalised approach by Identifying the regions where the requirement of supplementation is high.

IMPLEMENTATION

Develop institutional mechanisms/programs to create awareness about diet diversity and supplementation with emphasis on the consumption of nutrients to meet daily RDA requirements.

Develop and Integrate supplementation programmes with public health policies to manage non-communicable diseases.

Experts like nutritionists/ dieticians should be approached for guiding consumers to focus on the quality of food instead of quantity and prioritising proteins, seasonal vegetables as a part of a balanced nutritious diet.

Develop credible websites to guide consumers to choose the right foods under the guidance of nutritionists/ dieticians.

Industries CSR projects can be initiated in line with the state, national government and the local panchayat policies so that these projects can get absorbed into the government plans.

Identify underlying causes of micronutrient malnutrition across age groups and specifically in early childhood and adolescents.

SECTION 2

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Ecological Footprints of Food Systems

Actionable Area

Realign India's public food system to the principles of decentralisation, diversification, and agroecology to reduce its negative ecological and economic footprints, potentially inducing economic growth with diversity.

Issues

- India's public food system played an important role in the historical evolution of its agriculture, the support systems around it, and the food grain consumption patterns across the country.
- The government of India spends Rs. 1,15,240 crores (2019-20), about 4% of its annual budget on the 'food security programs; this has increased from Rs. 63,844 crore rupees spent in 2010-11. Food subsidy is the largest component of expenditure of the Food and Public Distribution Department accounting for 95% of this budget. The National Food Security Act (NFSA) (2013) mandates coverage of 75% of the population in rural areas and 50% in urban areas under the targeted public distribution systems; currently, 81 crore people in the country, i.e., 59% of the population are covered.
- Current Challenges of Public Distribution System (Economic and Ecological Footprints)

Displacement of Rainfed Food Systems

a. Over 60% of the food grains procured at MSP comprises Paddy and Wheat. Millets, renamed recently as Nutri-cereals, constitute only 0.38% of the annual allocation of food grains for various food, nutrition, and relief schemes by the Government of India.

Public Food Systems in India

Production of food grains

Farmers do produce food grains and sell them at MSP

Procurement

Agencies like FCI, NAFED and state level agencies procure the food grains at MSP and store it as and when needed

Distribution

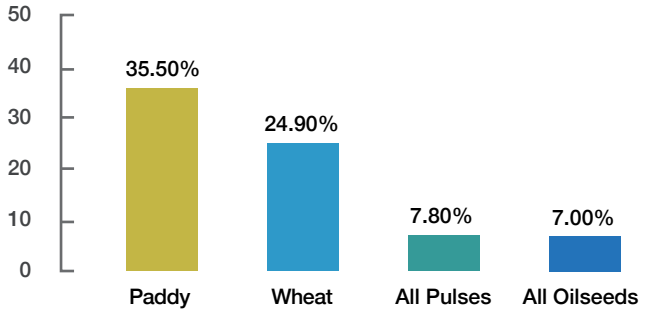
Government through fair price shops, Aaganbadies etc. distribute the food grains through schemes like

- Antodaya yojana
- Targeted public distribution system
- Take home ration
- Mid day meal

Beneficiaries

Ensuring food security of the vulnerable sections of the society

Percent of crop production procured at MSP (2016-17)



About 48% and 33% of the annual production of rice and wheat, respectively, were allocated for various food distribution programs in contrast to a meagre allocation of 0.74% for millets. The nutrition-rich Millets did not find any place in the state nutrition programs – despite the serious malnutrition across several areas in the country and despite their availability in the central pool.

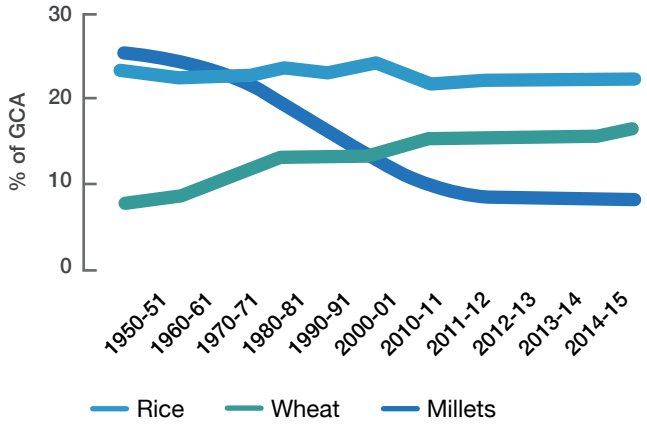
Changing Food Habits, Shrinking food diversity

a. The diverse crop-systems mix that used to include cereals, millets, pulses, and oilseeds adapted to the local agroecology has largely shifted to cultivating paddy and wheat. Monocropping of these crops over the last couple of decades has led to devastating effects in some areas, such as acute groundwater scarcity, pesticide poisoning, and low net returns even after propping up with all subsidies. Concentrated production in a few areas, procurement, transport, milling, storage, and distribution through the PDS – has a very large ecological footprint.

Reduced Agri-Biodiversity leading to monocropping

a. The multi-crop systems used to cover soil for longer periods are replaced by single-crop systems that leave soil barren from October-November, exposing the soil to high temperatures and desiccation of whatever soil organic matter is left! The varietal diversity in food systems also collapsed with the public seed systems established to ensure the proliferation of few High Yielding Varieties.

Trends in crop area (All India)



b. The Public Food Systems architecture – brilliantly conceived to meet specific policy objectives has altered the country's food landscape – shifted the food geography from rainfed areas to irrigated areas, and created an eternal dependency on irrigation, chemicals, and energy, MSP, and subsidies. This has also altered the 'food economy- skewing the benefits of public investments/ expenditure and markets heavily favoring irrigated areas, leaving the rainfed areas to misery, poverty, and distress arising out of climate vulnerabilities.

Rice and Wheat are consuming a large chunk of food and fertilizers subsidy

a. Rice and wheat consume about 53% of the total fertiliser consumption in India; of this, these crops under irrigation consume 42% of the fertilisers.

b. The two crops are great guzzlers of subsidies. Together with food subsidies, they consume 72% to 85% of the total subsidies in agriculture.

Investment in irrigation and electricity subsidy too benefited the Rice-Wheat cropping system

a. Groundwater-based irrigation using tube wells surpassed the percentage of irrigation by gravity (canals). Electricity for groundwater extraction is subsidised in several states.

b. Investments in expanding irrigation largely benefitted wheat and rice. Much of the produce of these crops go into public procurement for distribution under food security programs.

Massive subsidisation of soil pollution

a. The per hectare use of fertilisers increased from 1.99 kg in 1960 to 135.33 kg in 2009–10 and furthermore in later years. The average crop response to fertiliser use declined drastically from 25 kg grain per kg of complex fertilizers (NPK) during 1960s to only 6 kg grain per kg NPK fertiliser during the 11th Plan (2007–2012) as the diminishing returns set in. The poor and declining trends in soil carbon across the key food ecosystems in the country are worrisome. Experts call the flood of excess nitrogen one of the most severe pollution threats facing humanity today.

b. Considering that only about one-third of fertilisers employed is used by crops, the country is incentivising pollution of groundwater and soils with nitrogen compounds by spending Rs.44,649 crore rupees annually (2021). This amount is almost at par with 40 years of government expenditure on watershed development in India till 2017-18 which stands at Rs. 47,229 Crore.

Failing aquifers

a. Groundwater as a source of irrigation provided by deep tube wells has become the single largest source of irrigation. It is estimated that over the last four decades, around 84% of total addition to the net irrigated area has come from groundwater; with this trend, the energy footprint of irrigation has expanded substantially. There is a growing evidence of steady decline in water tables and water quality. At least 60% of India's districts are either facing a problem of over-exploitation or severe contamination of groundwater. Ironically much of the rice and wheat produced with such ecological footprint languishes in the FCI godowns with stocks many folds higher than the required buffer stocks.

Carbonfootprints in supply chain

a. The public distribution supply chain requires the transportation of 40 million metric tonnes of food grains from the FCI stock point to the different states. 85% of this is done by rail, covering an estimated 1,500 km each year, and the rest by road and ferries; the transport requirements of the centralised procurement till the stock reaches FCI stock points are additional. The hidden environmental costs of this long and voluminous supply chain have not yet been calculated.

b. The current footprints of GHG emissions of food grain are 1212, 15.65, and 45.51 million metric tons of CO2, N2O, and CH4 respectively which are projected to increase by 1.8%, 23.92% and 2.35%, respectively if production increases in the current structure to meet the NFSA requirements.

Vision 2030

Establish a public food system that integrates the principles of decentralisation &diversity and promotes remunerative and resilient agroecology-based practices for food and nutrition security and natural resources conservation at the household and national level.

Pathways

POLICY

Decentralise choices and decision making on the food-menus in all the state nutrition programmes including PDS with norms of compliance with nutritional standards laid out, 'achieving local food security as against or in addition to the 'national food security'. Procurement at the Local level – as much as possible – most preferably at the present last-mile Stock Points from where the stocks are supplied to various food and nutrition programs.

Mandate the Department of Agriculture to promote adequate area under chosen crop systems to meet the estimates on procurement.

Insistence and incentivising grains production to be procured with organic or non-chemical methods, following good agricultural practices such as water use efficiency, etc., can promote de-chemicalisation of the food system.

A major game-changing policy could be 'processing at the last mile'. Processing can also be promoted under public distribution systems through appropriate policy measures.

IMPLEMENTATION

Embed food-menus into local agroecology, food cultures, and traditions. The synergy between what food is used/ promoted locally and with the local agroecosystem ensures 'healthy souls and soils'.

Set up systems, processes, and redefined (decentralised) hierarchies to institute the 'decentralisation decisions' on the composition of PDS supplies (and others). Anganwadis can potentially induce nutritive and ecologically sensitive food cultures among the new generation.

Link-up with the Farmers' Producer Organisations for local production and supply of the chosen commodities; organise procurement around the last-mile stock points from where the supplies to fair price shops, Anganwadis, and others are presently organised. The catchment of these stock points can be the lowest planning unit. It does not entail any major changes in the organisation of the present system.

District and state-level procurement can be planned for the central pool stocks required to buffer the food system for the three purposes mentioned earlier.

Pathways

KNOWLEDGE AND RESEARCH

Estimate demand for various commodities based on the chosen food menus required for various state nutrition programs at the last leg of decentralisation i.e., 'Stock Points' or Blocks.

Arrive at appropriate pricing mechanisms indexed to central MSP to promote and incentivise the local production.

Written by:
Mr. Ravindra Adusumilli, Founder of WASSAN.

With inputs from:
Mr. Srinivasan Iyer (Ford Foundation), Mr. Tapan Gope (GIZ, SENU Project), Ms. Aruna Rangachar (IFHD), Mr. Rohini Kumar Sahoo (Palladium Group), Mr. Basant Kar (Nutrition expert), Mr. Rajkishor Mishra (Expert), Mr. N M Prusty (Human Aid International), Professor Sambhu Prasad (IRMA), Mr. Rajeev Ahal (GIZ), Mr. Ashirbad Das (GIZ), Ms. Neha Khara (GIZ), Mr. Kirti Prasanna Mishra (ECOCIATE).

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Climate-Resilient Food Production Systems

2

Actionable Area

Appreciate food systems' distinct systemic landscape, and take an integrated view and make a comprehensive and holistic assessment to identify strengths in climate resilience of each system and their contribution in ensuring food and nutritional security of the country as a whole.

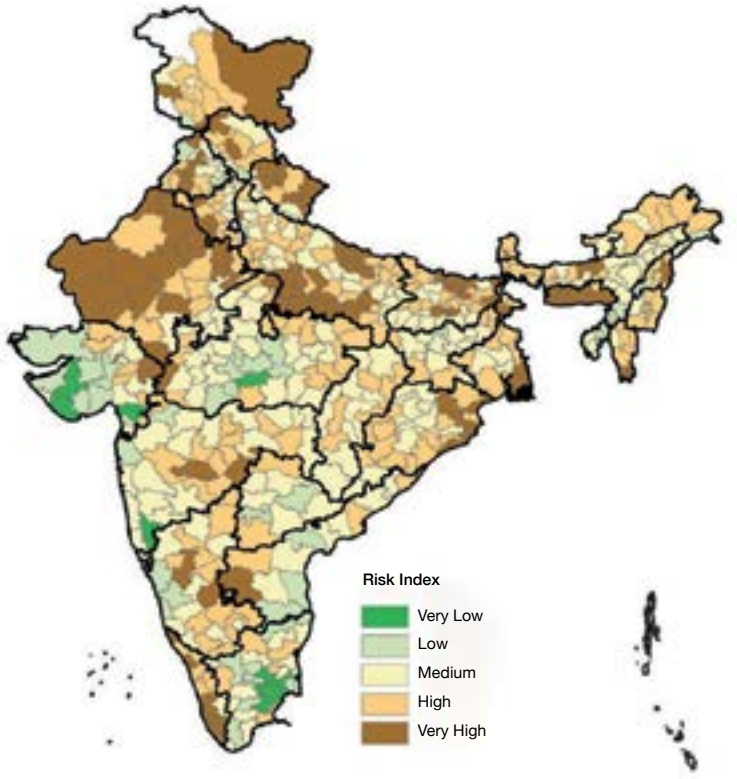
Issues

- The Coupled Model Intercomparison Project-5 estimates that for India, the average climate is likely to be warmer by 1.7 to 2.0°C for 2030 and the precipitation is likely to increase by 5-6%. Climate changes will have a direct and snowballing impact on production and the livelihood of people dependent on it.

- The composite climate change risk in the ICAR study of all 576 rural districts has found 109 districts with very high risk and 201 with increased risk due to climate change in reference to agriculture in the country.

- Post green revolution agriculture food system in the country has hovered around two major cereal crops: wheat and paddy. The research and technological development too have been led by these two crops. That has resulted in a decline in agro-biodiversity, both in plant species and varieties, contributing to increased vulnerability to climate risks at the farm level.

Risk due to Climate Change (2020-2049) in Agriculture

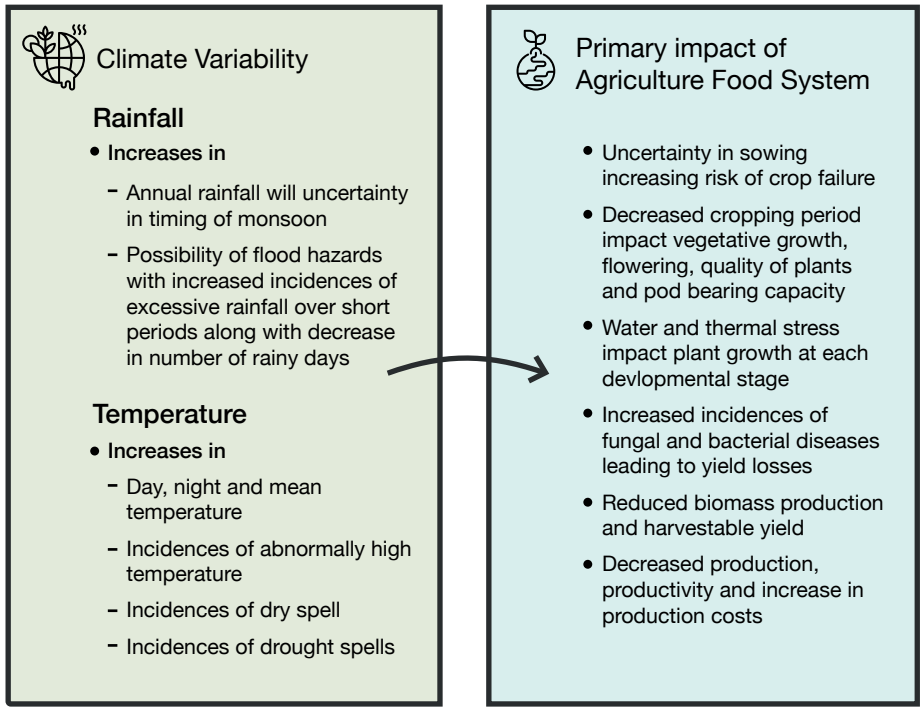


- Industrial methods that focus on production as the sole arbiter of performance have moved the food production system away from the farmer and farm to a pre-defined package of practices. The long-term impact on the increased (and often irrational) dosage of agro-chemicals on the farm has led to decreased fertility of lands, destruction of farm biodiversity, and increased risks in maintaining production and ensuring food and nutritional security.

- The issue of food insecurity and under-nutrition co-exist with the regime of increased production, which is sought to be addressed through distributive policies based on central procurements and subsidies for consumption. In a country where 85% of the farms are less than 2 ha in size, where 45% of the net area sown is operated by small and marginal farmers, and where 358 districts have more than 80% farmers as small and marginal farmers, the exposure to climatic stresses is high and widespread especially due to the movement towards a culture of mono-cropping and limitations of crop-specific packages of practices.

- Another factor that has impacted the sustainability of the present agri-based food system is its overreliance on groundwater for irrigation which is the most significant factor for yield stabilization.

- Agriculture is a biological production process and is directly impacted by climatic variations. These changes impact both the sustainability of the system and the livelihoods of people depending on it. The data suggest that rising temperature and declining rainfall will adversely affect agriculture productivity.



Vision 2030

Ensure that the nation continues to be self-reliant and ecologically sustainable by integrating diversity in all forms through collective, collaborative, and integrated actions by communities, Government, civil societies, consumers, and changemakers. The diversity is integrated by local climate-resilient food and nutritional security systems.

Pathways

POLICY

Bring a paradigm shift in policies governing the agriculture production system from the yield-oriented production-centric perspective to the system-oriented perspective that accounts for the productivity of water, soil, and other components of the ecological system. It will allow accounting for the water and carbon footprints of different crops and will thus enable to focus on crops that are more nutritious, less water-guzzling, and do not have a negative impact on soil.

Create farm and farmer-centric policies to allow spaces for multiple realities and vulnerabilities faced by farmers. Recognise the promotion of crop diversity not only on the count of being remunerative but also as a major risk minimiser for the producers.

Formulate suitable policies to recognise women's role in agriculture as producers and change markers by encouraging their land ownership, decision-making, and access to schemes.

Adopt climate as a major policy plan to promote climate resilience in agri-food systems

a. Consider multiple vulnerabilities faced by farmers and institute economic, fiscal, technical, and institutional measures that explore and develop climate adaptive practices in different geo-ecological conditions.

b. Integrate the State Action Plans for Climate Change with agriculture and allied activities to make them relevant and effective at local and regional levels.

Pathways

IMPLEMENTATION

Develop demonstrations of climate adaptive practices for different micro-ecosystems to improve soil health to reduce risks arising from climate variations. Integrate plans for sustainability in water availability as a measure to reduce crop failure on account of climatic variations.

a. Utilise experiences in incremental adaptation from varietal breeding and management practices to strengthen such efforts and to deepen such experiences.

Promote agro-ecological practices that are based on recognition of ecological resource endowment at the farm level as adaptive practices in reference to region specific climate vulnerability.

a. Invest on knowledge acquisition and transfer to extension systems.

b. Promote technologies and farm implements that encourage and incentivize sustainable agriculture practices.

Develop climate resilient aquaculture practices as aquaculture is an important source of livelihoods and nutrition to communities.

Develop Voluntary Carbon Market (VCM) projects which are expected to grow by almost 15 folds in this decade due to increasing net zero or climate neutral targets taken by companies globally.

Democratise information and knowledge by bringing localized wisdom and harnessing the social capital and collective power of the community with a specific focus on women and producers as disseminators of experience and knowledge.

Apply farm-based and farm and farmer-centric research by integrating lab to land models of extension through the institutional mechanisms and practices of farmer schools to enable early adaptation through customized solutions.

Undertake local, crop, and variety-specific climate vulnerability studies in wider geographical areas to map vulnerabilities among different categories of farmers and to assess climate deficits amongst them.

Written by:
Mr. Amod Khanna, Founder of Towards Learning and Action (TAAL).

With inputs from:
Madhuri Mewale (Expert NRM), Ms. Swati (RySS), Dr. Pankaj Tiwari (Aarohi), Mr Ashok Kumar Singha (CTran Consulting), Mr M P Vasimalai (Dhan Foundation), Dr. Jagdish Purohit (GIZ), Mr. Navin Twarakavi (IBM Weather company), Mr. Rajeev Ahal (GIZ), Mr. Ashirwad Das (GIZ), Mr. Kirti Prasanna Mishra (Ecociate), Mr. Kundal Burnwal (GIZ), Ms. Neha Khara (GIZ).

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Integrated Farming Systems

3

Actionable Area

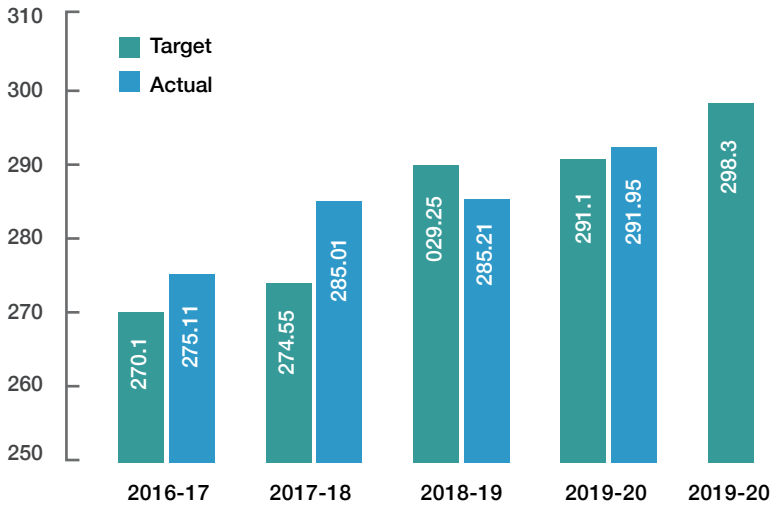
Shifting farmers' focus from individual components of household's basic needs for food (cereal, pulses, oilseeds, milk, fruit, honey, meat, etc.), feed, fodder, fibre, etc., to Integrated Farming System (IFS) approach.

Issues

- The majority of the farmers have been farming for a long time, but their focus has been on individual components and not in an integrated manner. At the Indian council of agriculture research ICAR and State Agricultural Universities level, a lot of efforts have been made aiming at increasing the productivity of different individual components of the farming system such as crop, dairy, livestock, poultry, piggery, goat keeping, duckery, apiculture, sericulture, horticulture, mushroom cultivation, etc. but lacking in their integration by following an integrated farming system approach. The integration is made so that the product of one component becomes the input for other enterprises with a high degree of complementary effects on each other. Preliminary research investigations advocated the benefits of productivity improvement by 30-50% depending upon the number and kind of enterprises and their management.

- The growth rate of agriculture in the recent past has been very slow despite rapid economic growth in India. According to the Economic Survey of India, 2008, the growth rate of food grain production decelerated to 1.2% during 1990-2007, lower than the population growth of 1.9%. In the subsequent years, the growth rate of food production has significantly fluctuated while always growing at a lesser

Food grains output
(million tonne)



Source: Second advance estimate, GOI

or an equal rate than the population growth rate. It is projected that India's population will touch 1.37 billion by 2030 and 1.6 billion by 2050. To meet the growing population of the country, India must produce 289 and 349 MT of food grains during the respective periods. The current scenario in the country indicates that the area under cultivation may further dwindle, and more than 20% of the current cultivable area will be converted for non-agricultural purposes by 2030.

- The operational farm holding in India is declining, and over 85 million out of 105 million holdings are below the size of 1 ha. Due to the ever-increasing population and decline in per capita availability of land in the country, practically, there is no scope for horizontal expansion of land for agriculture. Only vertical expansion is possible by integrating farming components requiring lesser space and time and ensuring reasonable returns to farm families. Therefore, the Integrated Farming Systems (IFS) assumes greater importance for sound management of farm resources to enhance farm productivity and reduce environmental degradation, improve the quality of life of the poor farmers, and maintain sustainability.

- The four primary goals of IFS are:

  a. Maximisation of the yield of all component enterprises to provide steady and stable income.

  b. Rejuvenation/ amelioration of system's productivity and achieving agro-ecological equilibrium.

  c. Avoid the build-up of insect-pests, diseases, and weed population through natural cropping system management and keep them at a low level of intensity.

  d. Reducing the use of chemicals (fertilisers and pesticides) to provide chemical-free healthy produce and environment to the society.

- Important elements like (i) Watershed, (ii) Farm ponds, (iii) Bio-pesticides, (iv) Bio-fertilisers, (v) Plant products as pesticides, (vi) Biogas, (vii) Solar energy, (viii) Compost making (Vermi, improved, etc.), (ix) Green manuring, and (x) Rainwater harvesting, may be included in IFS demonstrations depending upon the individual farmer's resources, interest, and opportunities.

Status

Government Initiatives

- To strengthen all aspects of cropping systems research, the 'Project Directorate for Cropping Systems Research (PDCSR)' was established at Modipuram (Meerut) in March 1989, with 'AICRP on Cropping Systems' as one of the constituent schemes of the Directorate. The earlier two components, namely 'On–Station Research' and 'On-Farm Research', remained intact.

- To promote IFS, in the year 2009-10, the government renamed PDCSR to Project Directorate for Farming Systems Research (PDFSR)'. It was further renamed as ICAR-Indian Institute of Farming Systems Research (IIFSR) in November 2014, and the mandate was redefined further as:

  a. Research in integrated farming systems on production technologies for improving productivity and resource use efficiencies.

  b. Developing efficient, economically viable, and environmentally sustainable integrated farming system models for different farming situations.

  c. On-farm testing, verification, and refinement of system-based farm production technologies.

  d. Coordinating and monitoring integrated farming systems research in the country.

Vision 2030

An inclusive and integrated farming system contributes to a food system and ensures nutritional security for communities and consumers for better human and environmental health.

India's achievement under the Rainfed Area Development website of the NMSA in 2019-20 were 52,079 hectares under various IFS activities.

These include horticulture-based farming, livestock-based farming, agroforestry-based farming systems, water-harvesting and management, and green manuring.

Pathways

POLICY

Prepare a policy draft for the consideration of planners to promote IFS models at a large scale with nominal financial assistance either through short, medium, or long-term loans or other promotional advantages.

Initiate a policy dialogue at the national and state level balancing food and nutrition security, self-sufficiency, and sustainability to influence the policy around IFS.

Establish a single-window service provision for farmers at the Panchayat/ Block level to avail the schemes related to IFS. Currently, one has to move within the departments for financing the different components of IFS as the governmental system is not yet synced with the IFS approach.

Explore the option of integrating different components of IFS with the Kisan Credit Card (KCC) and accordingly set the credit limits, as availability and convenience of services are a major concern.

Promote incentives for Gram Panchayat in IFS at a landscape level, on lines of Maharashtra government's statewide 'Swachata Mission' competitions and integrate IFS plans in the Gram Panchayat development plan(GPDP) to implement measures at a grass-root level and create evidence for further policy directions.

Explore the convergence of IFS with MGNREGA at the Gram Panchayat level since it would be instrumental in wider adoption. Use part of the fund spent on subsidising the cost of fertilisers etc., to financially support farmers for agroecological/ IFS practices.

Bring policymakers together by highlighting associated risks and benefits.

Pathways

IMPLEMENTATION

Assess and refine technologies developed at the research station to make these more participatory and feedback-centric for greater adoption in the cultivators' field.

Improve the planning capacity of the farmer by understanding what resources are available, their needs, and challenges and accordingly design and implement the IFS component and approaches.

Creating remunerative markets or strengthening existing ones as markets for commodities coming from the sustainable cropping systems is a major concern.

Back the certification of sustainable and environmentally friendly systems in order to create a market booster.

Mandate the government’s agricultural extension systems to promote IFS and create IFS missions at the state and national level to ensure its design and implementation. Further, collaborating with civil society organisations (CSOs) and community-based organizations (CBOs) to scale integrated farming.

Prepare contingent planning to counteract the weather vagaries and climate threats under different farming situations.

Promote agroforestry models which combine different types of trees, meeting the varying requirements for food, fodder, fuel, control soil erosion, etc., to ensure year-round income with reduced risk from one system. Such models diversify both farmers’ income and risk during a time of crop failures or extreme climatic events.

Place climate-resilient indigenous varieties carefully in the overall IFS approach and ensure the availability of seeds at the village or cluster level for farmers through seed production and establishing seed banks. Similarly, intercropping and food crop diversification is key to effectively addressing weather vagaries and increasing dietary diversity.

Include local agro-advisory services in the local language, including the weather forecast, in the planning process.

Pathways

KNOWLEDGE AND RESEARCH

Implementation (Contd)

Introduce a monitoring & evaluation system for assessing adoption and taking corrective measures.

Look at IFS as an approach for a better and optimised utilisation of resources at the landscape level for different IFS enterprises. IFS at the landscape level may be much more suitable than at the household/individual (farm) level – carefully tread it forward. Further, demonstrate the feasibility of economics notwithstanding ecological security to pave the path for consolidation and further expansion.

Look at the overall IFS from three lenses viz. Social (addressing vulnerabilities in terms of capacity, risk mitigation, health, and nutritional security), Environmental (climate change risks recorded in food systems document), and Institutional (national missions and flagship programs).

Create a comprehensive 'database on farming system' concerning the type of farming system, infrastructure, economics, sustainability, etc., under different farming situations.

Record traditional IFS models and challenges/opportunities across agro-ecological zones and determine a separate set of indicators to measure the productivity of the agro-ecological approach.

Look at the success matrix of IFS to transform the food systems from a systems point of view and concerning the benefits accrued from it.

Digitise farms to understand the demographic and cropping profile of the farmers and accordingly devise the mechanism for extension and other services.

Build traceability systems to measure the success of various interventions at the farm for transparency and trustworthiness.

Pathways

Knowledge and Research (Contd)

Enhance peer leanings by developing best practices at farm levels and promoting them among other farmers (Positive evidence).

Create global research partnerships to develop evidence and solutions around IFS and agro-ecology-based farming and encourage global and regional exchanges.

Develop research modules of farming systems under different holding sizes with varying economically viable and socially acceptable systems; state agriculture universities (SAUs) may develop the education modules around IFS.

Move from a prescriptive model in farming to a systems-based approach wherein collaboration and co-creation are focused and exercised. Further, list out farmers as resource persons and trainers in the form of a digital map to acknowledge that knowledge exists beyond universities.

Develop master trainers to ensure the last mile reach of extension services and develop integrated modules which build the capacity of various kinds of community resource persons (CRPs) around IFS (NRLM is an example). Revise or re-design the training modules based on the principles of IFS or agroecology.

Develop a course curriculum in University Grant Commission (UGC) and other academics around agroecological-based farming systems to further the research agenda.

Since behaviour change is key to changing practices, introduce social behavior change-based approaches, e.g., experiential learning, participatory learning, action, etc.

Explore social media to promote knowledge. For example, create a YouTube Channel to promote IFS topics. Also, where possible, have success stories promoted by role model farmers.

Written by:
Mr. Ashwini Chandak, Director and Practice Head, Ecosystem Integration and Knowledge Dissemination at Ecociate Consultants Private Limited.

With inputs from:
Mr. Yogesh Sawant (BAIF), Mr. Pramod Pradhan (SWISSAID), Mr. Kundan (FAO, India), Ms. Madhuri Mewale (Independent), Mr Ashuman Das (WHH), Mr Ravindra (WASSAN), Dr. Chadag V Mohan (World Fish), Mr. Rajeev Ahal (GIZ).

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Natural Farming

Actionable Area

The transformation of our food system must centre around the socio-cultural context, focusing primarily on women and small, marginal, and landless farmers. The shift must also acknowledge local indigenous knowledge systems and agro-ecosystem complexes.

Issues

Agriculture is a resource-intensive exercise. While conventional agriculture has led to approximately doubling the buffer stocking norms of the Public Distribution System (PDS) and ensured calorie sufficiency, the efficiency of the food system to deliver nutritious food sustainably and with little waste has declined. Notably, most of the benefits of this distributed crisis are harvested by medium and large farmers, leaving the majority of small and marginal rainfed farmers at risk.

Natural farming is a landscape-level agro-ecological approach to sustainably manage natural resources of local, distinct agro-ecosystems while eliminating the usage of synthetic agrochemicals. Natural farming or broader agro-ecology is not a mere change of agricultural practices but a transformative approach to the relationship between us humans, our food production and consumption, and the larger natural ecosystem. This characteristic feature of natural farming suggests that it is not only a technological transition but a paradigmatic shift.

6,52,000 ha
of area under natural farming across Andhra Pradesh, as of November 2020[1]

6,377 ha
area under natural farming in Himachal Pradesh as of March 2021[2]

6,00,000 Farmers
enrolled in the Andhra Pradesh state programme for natural farming, as of November 2020[3]

1,16,700 Farmers
are practising natural farming under the Himachal Pradesh's Prakritik Kheti Khushhal Kisan Yojna as March 2021[4]

Small, marginal, landless, tribal Farmers
are predominantly adopting natural farming

All types of crops
cereals, millets, and cotton to fruits, vegetables, and spices, are cultivated under natural farming

Source: Lok Sabha 2019; Ministry of Agriculture & Farmers Welfare 2019, RYSS Andhra Pradesh; Khadse et al. 2017

[1] Rythu sadhikara samstha, Andhra Pradesh.
[2] Stakeholder Consultation, SNPF, Prakritik Kheti Khushhal Kisan Yojna, Himachal Pradesh.
[3] Rythu sadhika samstha, Andhra Pradesh.
[4] Stakeholder Consultation, SNPF, Prakritik Kheti Khushhal Kisan Yojna, Himachal Pradesh.

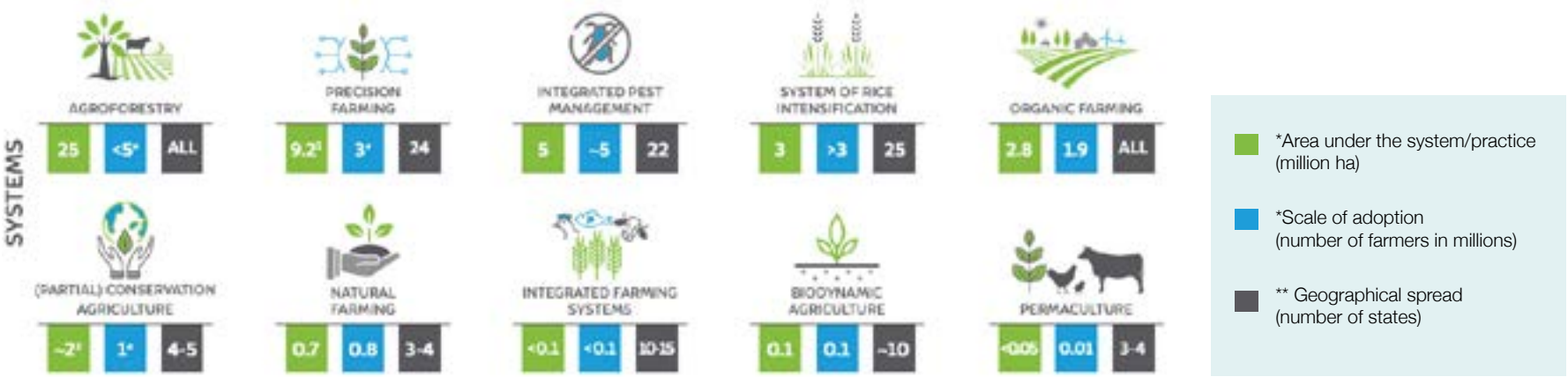
Status

A recent report by the Council on Energy, Environment, and Water (CEEW) on the Status of Sustainable Agriculture in India captures the current scenario of different systems and practices in the domain. A large-scale survey by the National Coalition for Natural Farming suggests that as of 2021, 164 Organisations in 88 districts of India are working with 94,000 farmers to scale natural farming in India. The Himachal Pradesh government indicates the adoption of natural farming by 56,620 farmers and the Andhra Pradesh government of 6 million farmers.

Government and private sector initiatives

Formulated in 2014-15, the National Mission for Sustainable Agriculture (NMSA) is the Indian Government's flagship policy committed to promulgating sustainable agriculture across the country. Besides NMSA, the Pradhan Mantri Krishi Sinchai Yojana focuses on improving water use efficiency and extending irrigation cover. The Integrated Watershed Management Programme aids in restoring ecological balance by harnessing, conserving, and developing degraded natural resources. In addition to the mentioned policy interventions, numerous civil society organisations (CSOs) are at the forefront of accelerating the efforts of scaling natural farming across the nation by promoting agro-ecological practices.

Sustainable agriculture practices and systems in India (2021) - Key statistics



Vision 2030

- **Transform the current food production systems based on agro-ecological principles in at least 10% of the country's agricultural area within the next decade.**

- **Adopt a coordinated, comprehensive landscape-level approach that builds the social and natural capital while linking institutions to create a holistic circular bio-economy with communities and existing knowledge systems at the centre.**

The National Bureau of Soil Survey & Land Use Planning (NBSSLUP) has divided the country into 20 agro-ecological regions (Sehgal et al. 1992). These 20 agro-ecological regions (AERs) are further sub-divided into 60 sub-regions (AESRs) (Velayutham et al. 1999).

The 20 agro-ecological regions include-

1. Western Himalaya (Cold Arid);
2. Western Plain, Kutch and Part of Kathiwar Peninsula (Hot Arid);
3. Deccan Plateau (400-500 mm rainfall);
4. Northern Plains and Central Highlands including Aravallis;
5. Central Highlands (Malwa), Gujarat Plains and Kathiwar Peninsula;
6. Deccan Plateau (600-1000 mm rainfall);
7. Deccan Plateau (Telangana) and Eastern Ghats;
8. Eastern Ghats, TN Uplands and Deccan Plateau;
9. Northern Plains;
10. Central Highlands (Malwa, Bundelkhand and Eastern Satpura);
11. Eastern Plateau (Chattisgarh);
12. Eastern (Chhota Nagpur) Plateau and Eastern Ghats;
13. Eastern Plain;
14. Western Himalayas;
15. Bengal and Assam Plains;
16. Eastern Himalaya;
17. North Eastern Hills (Purvanchal);
18. Eastern Coastal Plain;
19. Western Ghats and Coastal Plains;
20. Islands of Andaman-Nicobar and Lakshadweep

Natural Farming in Practice

11
States practicing natural farming

6.5
Area Covered (Lakh Ha)

Source: https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1705191

Pathways

POLICY

Include natural farming produce in schemes like Mid-Day meal, relief rations, and state-subsidized food.

Mandate a percentage for procurement under the PDS systems and rationing natural farming products to incentivise the consumer for a switch from homogenised food.

Amplify the availability of natural products and reduce the price gap between natural and conventional produce by localized production and consumption.

Encourage individual and collective production of bio-inputs through public policies, improving the availability and affordability and incentivizing their application.

Revamp the fertiliser responsive seed breeding programme to support indigenous, open-pollinated, and locally resilient farmer's varieties.

Expand and diversify the basket of public procurement to include more crops as it can help farmers and regions to implement crop diversity and achieve better nutrition.

Set standards for agro-industries on the pricing of natural produce, preservatives, shelf life, and farm-to-shelve processes.

Evolve standard valuation, certification and payment mechanisms for ecosystem services to prompt farmers towards sustainable and natural farming.

Pathways

IMPLEMENTATION

Promote custom hiring centres to ensure the timely availability of farm equipment for smallholders.

Promote traditional varieties besides tree-based crops, roots, and tubers for diversification.

Supplement promulgation of diversification by technological innovation.

Revise the indicators for agriculture productivity beyond yield to move towards total system productivity against total factor productivity.

Evolve systematic frameworks for advisory services across the value chain stages.

Give graded certification for farmers for practices, input, fertility, etc., over existing certification model.

Support and strengthen start-ups in the organic and natural domain for broadcasting the benefits.

Create public awareness, incentivise consumption of natural farm produce.

KNOWLEDGE AND RESEARCH

Public authorities prioritise mainstreaming agro-ecological principles in research and extension by realigning the funding and research agenda and increasing Natural Farming's evidence base through consistent monitoring and documentation.

Review the current quality standards and regulations around bio-inputs, educating farmers, and documenting the best practices.

Re-skill farmers, supplement the indigenous systems, and develop a comprehensive capacity building.

Portray natural farming food as desirable to align with the need for better and healthy products.

Map consumers not merely by calorie consumption but by micro and macronutrients in food.

Contributors:
Mr. Minhaj Ameen, Mr. Srajesh Gupta, Ms. Lakshmi Priyanka, and Mr. Sital Kumar of the National Coalition for Natural Farming.

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Forest-dependent Food Systems

5

Actionable Area

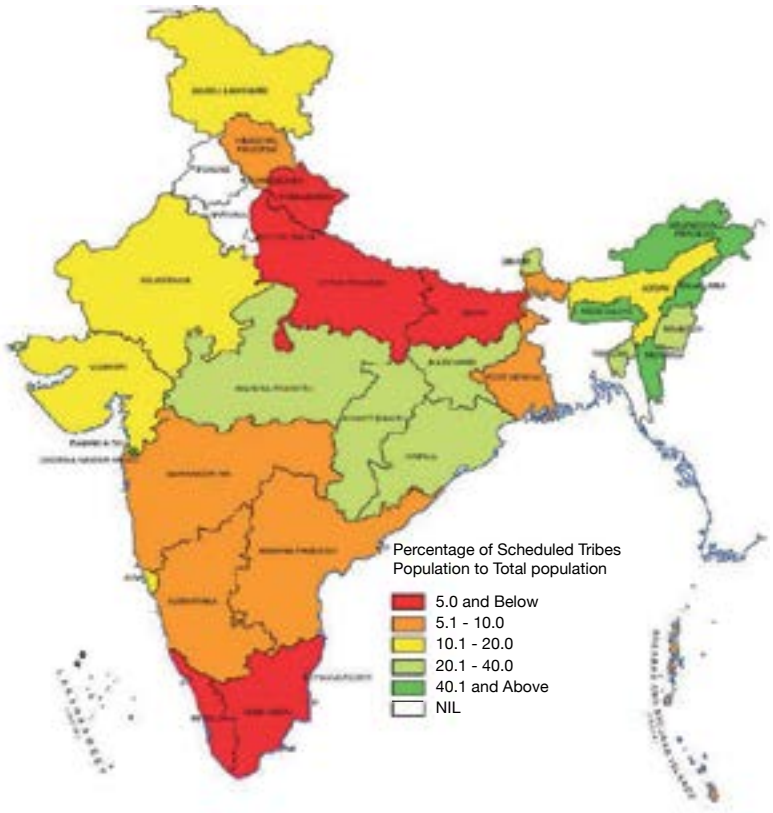
Redesigning the food systems to deliver a nutritious and affordable diet for all, particularly tribals. Policymakers, researchers, and the agriculture sector should work jointly to systematically solve the nutrition divide for a sustainable food system for tribal people.

Issue

- India's 105 million tribal population from about 705 distinct Scheduled Tribes (STs), representing 8.6% of the total population, are hardest hit by the menace of hunger and malnutrition. They are living with multiple forms of marginalisation, co-morbidities, and struggling to survive and thrive.

- About 40% of under-five tribal children are stunted, and 16% of them are severely stunted. Most of the tribal population stays in far-flung and hilly areas. This population used to be self-dependent on their daily food intake. However, changes in food habits have made them dependent on external supplies from the urban locations during recent years.

Census of India 2011- percentage of scheduled tribe population



Status

- The tribal food system depends on forest, land-common property, water resources, and biodiversity (so-called catch and collect). The Panchayat (Extension to the Scheduled Areas) Act, 1996, which was meant to expand local self-governance and tribal self-rule, has not been fully implemented. The Forest Rights Act (FRA), 2006, that recognises the rights of the forest-dwelling tribal communities embroiled with unnecessary bureaucratic and many other implementation hurdles.

- The National Food Security Act (NFSA), 2013, which controls three food and nutrition entitlements like Targeted Public Distribution System (TPDS), Integrated Child Development Services (ICDS), and Mid-Day Meal (MDM), has numerous governance and program delivery issues.

- India was host to multi-variety millets, a popular staple of the tribal community. But, over the past decades, this miracle crop got lost by relegating its status to a 'coarse grain' for the poor. Recently there has been a growing interest in nutri-cereals, specifically millets. The Government of India declared 2018 as the Year of Millets and launched a campaign to promote nutri-cereals. In 2020, the Prime Minister dedicated 17 biofortified varieties of eight crops, including nutri-cereals, and also endorsed the year 2023 to be observed as the International Year of Millets.

- There are several government initiatives and regulations to enable food safety and nutritional security. Still, there are serious issues of the tribal diets due to problems related to availability, accessibility, affordability, or nutrition governance. Hence, the government initiatives are not in a position to achieve the desire outcomes.

Vision 2030

- **Priorities programmes to nourish the undernourished tribal people, achieve zero hunger, and develop a sustainable food system. Align the vision and strategic directions with the vision of Poshan Abhiyaan 2.0 and UN Sustainable Development Goal (UNSDG) II emphasising agriculture, food security, and nutrition together.**

- **Enable a community-led caring, resilient, just, equitable & accountable, and transformative local food systems for forest-dependent communities based on responsive, efficient, and sustainable natural ecosystems.**

The U.N. General Assembly recently adopted a resolution, sponsored by India and supported by more than 70 countries, declaring 2023 as the **International Year of Millets.**

Pathways

POLICY

Develop and promote the new food systems for tribal that will address all forms of hunger and malnutrition with prioritised actions in the first 1000 days of life- “Windows of Opportunity.”

Develop a comprehensive framework for bringing awareness and behavior change towards social safety schemes- access and utilisation among landowners and forest-based communities.

Minimise the need for displacement, as it has a direct impact on tribal food and nutrition security.

Promote the agro-forestry and nutrition gardens through MGNREGA.

Promote smallholder women farmer-led climate-smart and nutrition-sensitive agriculture.

Introduce a major policy shift with dry-land agriculture incentivising nutri-cereals (millet varieties) and doubling the minimum support price of millet that of rice.

Introduce reforms on women's land leasing and gender mainstreaming women’s role in the food value chain.

Pathways

IMPLEMENTATION

Invest in tribal nutrition that promotes a life cycle approach and revitalise local food systems.

Make each district self-sufficient at least in six food groups to bring food and nutritional self-sufficiency at the district level.

Link MGNREGS for physical capital strengthening, nutri-garden, diversifying production through collective/community farming system.

Encourage local and household level non-farm enterprise promotions.

Conduct capacity-building training of producers around food safety and market standards to avoid exploitation and fetch better prices.

Recommend timely policy measures after reassessing the cost-effectiveness of the government's current food baskets offering, accounting for the nutrient adequacy recommended by the National Institute of Nutrition (NIN).

Have a policy shift from food to nutrition security. The tribal population, specifically women and children, must be able to afford foods and consume fruits, vegetables, legumes, dairy products, meat, fish, and eggs, which are significantly lower today.

Prioritise nutritional needs of aboriginal extinctive primitive tribal for their sustainable development. Local government bodies, through micro-level planning, social audits, community-based monitoring mechanism/community nutrition report cards, and IT-enabled technologies, can contribute towards this agenda.

Enhance convergence and coordination among key sectors and stakeholders, required for optimum results from the community level to the district and state level.

Promote the herbal plants and medicines for mission malnutrition-free India.

Start fruit plantation and set up bio-diversity parks in all villages for biodiversity conservation.

Pathways

KNOWLEDGE AND RESEARCH

Provide the tribal cultivators the basic technology and research know-how on the local foods they can grow and consume.

Develop an understanding of food habits, promote local nutritious recipes, and promote new nutrient-rich foods by organizing community recipe demonstrations.

Conduct nutrition education sessions with all the family members to improve the knowledge, attitude, and behavior of the tribal community.

Reach to zero mortality missions by addressing the inter-generational cycle of malnutrition.

Improve child feeding behavior by addressing myths/misconceptions, hygiene practices, and food safety through social behavior change and communication strategies based on tribal culture and tradition.

Written by:
Mr. Basanta Kumar Kar, fondly known as 'Nutrition Man' and recipient of Global Nutrition Leadership Award; Follow Basanta @basantak.

With inputs from:
Mr. N M Prusty (Human Aid International), Mr. Ram Rai Banra (JSLPS), Ms. Neha Khara and Ms. Nadine Baer (GIZ), Mr. Kirti P Mishra (Ecociate), Mr. Sachin Jain (Vikash Samvad), Dr Saikat Dattamazumdar (Agri-business and Innovation Platform (AIP), ICRISAT-India), Dr Padmaja (ICRISAT-India), Dr. Anitha (ICRISAT-Malawi), Mr. Satyajit Jena (FES), Mr. Rajeev Ahal and Mr. Berthold Wohlleber (GIZ), Ms. Ankita Marwah (PepsiCo).

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Food Production Systems for Pastoralism

6

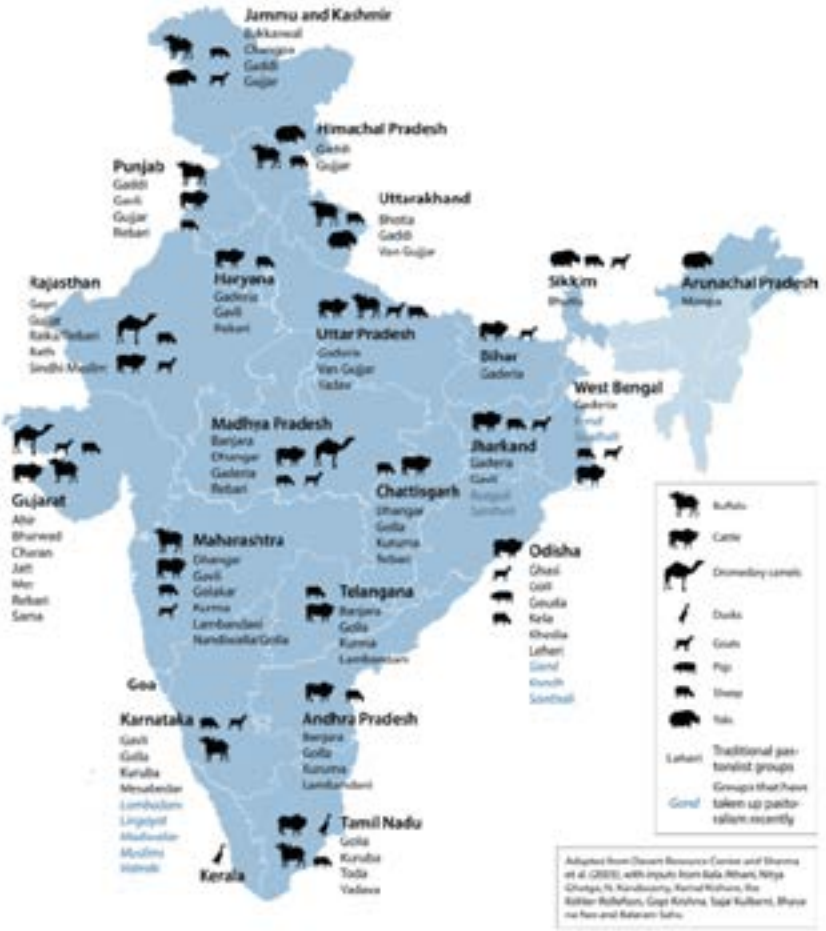
Actionable Area

Introduce and promote Pastoralism since it plays a significant role in livelihoods and nutrition of the rural population.

Issues

- Pastoralism is the extensive livestock production system that involves the tracking and use of grazing and water across a given landscape (normally a “rangeland”). Normally practiced in dry land areas, mobility is the key to this system.
- According to LIFE Network, 77% of the livestock in India are either herded or left to range on common land. These animals contribute to 53% of India’s milk and 74% of its meat. Thus, it is important to strengthen pastoralism to ensure a climate-resilient food system for the vulnerable sections of society.
- In India, pastoralism has not gained recognition in public discourses, and hence we do not have a working definition of pastoralism or pastoralists. In policies and administrative discourses, the term *nomads* is used, but it includes *non-pastoral* groups. There is no appreciation of pastoralism as a food system in policies and prescriptions.
- A study concludes that there are no official data on the number of pastoralists in India though, a figure of 35 million is often quoted. The study estimates that the actual number is likely to be closer to 1% of the population or about 13 million people.

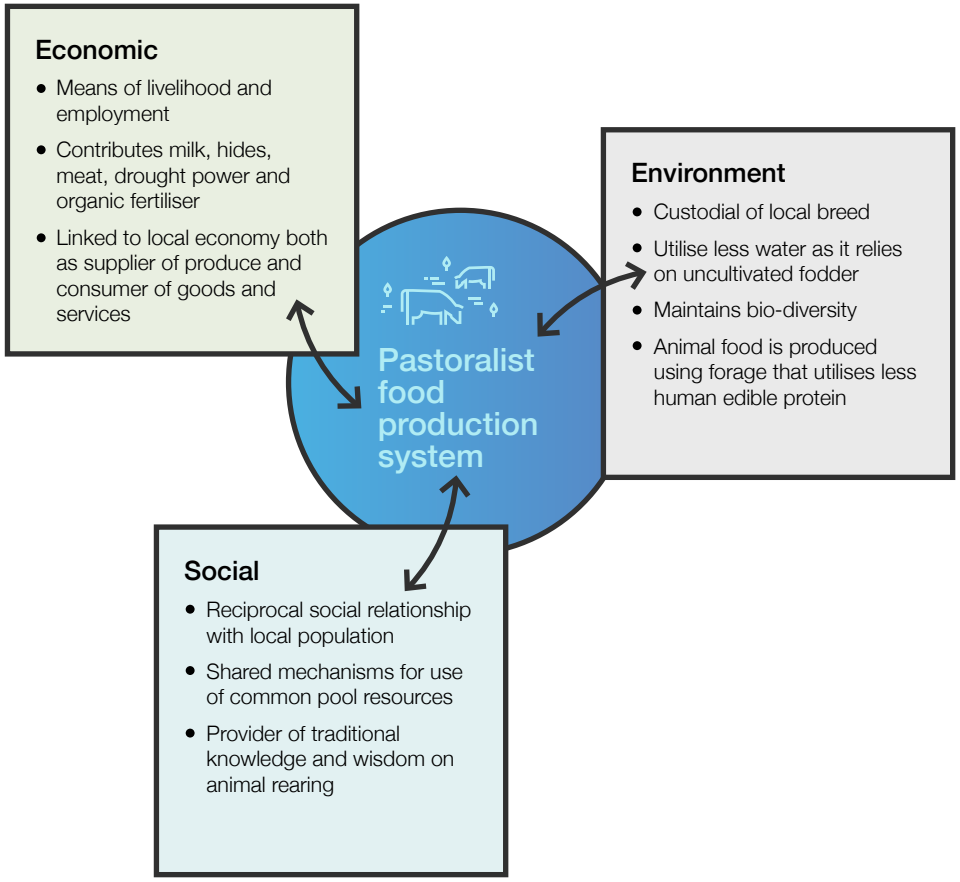
Pastoralist groups in India



- A variety of pastoralist systems in India include transhumance, nomadic, semi-nomadic, and village-based herding. Studies have documented that 46 caste communities have specialized pastoralists identities.

- The core elements of pastoralism include (a) sharing of a common resource pool (range or common lands for grazing and water); (b) herd comprising of indigenous breed of animals (e.g. pastoralists of Banni grasslands in Kutch maintain original bloodline of their buffaloes and every buffalo is marked and identifiable);(c) a closely interlinked relationship with farmers and local population (e.g. reciprocity in the sale of manure and fodder to farmers); and (d) a deep understanding of different ecosystems that determine their migratory routes and movements and thus represent a sustainable method of utilizing micro-ecosystems.

- Lack of recognition and appreciation of pastoralists' contribution as a sustainable food production system at the policy level is a major issue the pastoralist food production system faces. This has led to a common perception that they threaten conservative environmental measures, and hence their decentralisation often emerges as the only policy option.



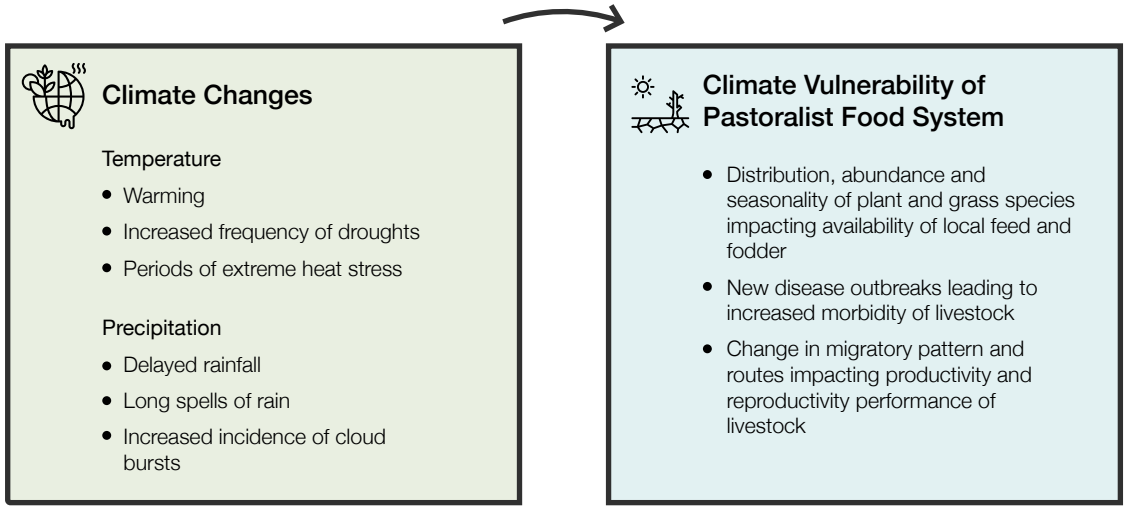
- The main institutional issues marginalising them in legal and development programs are the lack of tenure rights of pastoralists, especially on common lands and water, and their lack of representation in economic and political decision-making processes.

- Climate vulnerabilities for pastoralists appear both because of warming and changing rainfall patterns across the geographical terrain where they migrate to and move within. The direct impact these changes have on the pastoralist food production system are related to the availability, quality and abundance of fodder and water for their livestock, the two critical factors that determine the health and productivity of the herd.

- Shrinking of common lands, construction of urban landscape, changing cropping pattern and varieties, earmarking of protected areas (forest and national parks), multiple demands on water, and decrease in local biodiversity indirectly impact the sustainability of pastoralist's food production system.

Vision 2030

Make the Pastoralism system a significant food system and focus on transforming food systems in the country.



Pathways

POLICY

Acknowledge pastoralism in national policies to provide recognition and protection to pastoralists at the national level. A policy framework will impart institutional legal and administrative protection to pastoralists across regions.

Recognise rights and entitlements of pastoralists to allow them to practice their livelihoods across regions and geo-economic regions. Align the rights of pastoralists with the rights of local self-government bodies that determine land-use patterns.

IMPLEMENTATION

Develop and implement menu based development programmes for pastoralists that encompasses their linkages with veterinary services, animal gene pools for cross-breeding, market-based safety nets, grading of their produce/product, linkages with financial institutions and crafting of space in market and market institutions.

Conserve and sustain common lands for ensuring the availability of fodder. Such efforts would be well complemented with better crop residue as fodder for the pastoralist's livestock.

Pathways

KNOWLEDGE AND RESEARCH

Record pastoralism through series of layered micro studies that also map their migratory routes and grazing lands along with the traditional mechanisms for sharing common pool resources.

Document traditional knowledge of pastoralists on ecology, animal care and breeding to add value to the knowledge aimed at developing climate-resilient pastoralist food systems.

Incorporate pastoralism in State Action Plans for Climate Change as a distinct food system and undertake nuanced studies on the impact of climate variability on pastoralist food systems.

Written by:
Mr. Amod Khanna, Founder of Towards Learning and Action (TAAL).

Inputs by:
Madhuri Mewale (Expert NRM), Ms. Swati (RySS), Dr. Pankaj Tiwari (Aarohi), Mr Ashok Kumar Singha (CTran Consulting), Mr M P Vasimalai (Dhan Foundation), Dr. Jagdish Purohit (GIZ), Mr. Navin Twarakavi (IBM Weather company), Mr. Rajeev Ahal (GIZ), Mr. Ashirwad Das (GIZ), Mr. Kirti Prasanna Mishra (Ecociate), Mr. Kundal Burnwal (GIZ), Ms. Neha Khara (GIZ).

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Food Production Systems for Uncultivated Foods

7

Actionable Area

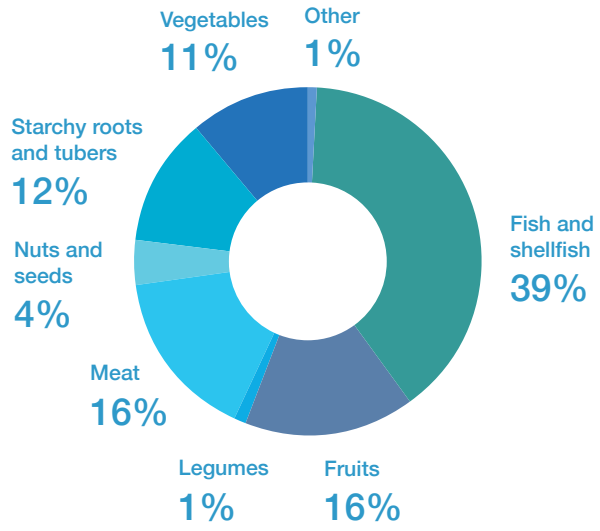
Recognise the important role of wild and uncultivated foods in climate-resilient production systems and protect biodiversity and provide policy and programme support for their recognition, conservation, and promotion.

Issues

- Forests and commons have been food reservoirs, and many communities rely on these sources to fulfill their food needs. There are various benefits of uncultivated foods. They are organic, naturally regenerative, based on local ecosystems, resilient to local climatic conditions, and represent an extensive low input food system. Communities living near forests and where common lands like permanent pastures and meadows have been preserved have reported rich biodiversity in the availability of such foods that significantly contribute to their food and nutritional security. Still, the uncultivated food systems, termed as “treasure troves” of nutrition, have not yet gained the required recognition in policies and programmes related to agriculture or forests.

- A study on wild edible plants identified 1403 wild edible species from 184 families consumed across India. Various other studies have suggested that uncultivated foods account for a significant calorie intake of households living in forest fringe areas. Food available from forests, common lands, and water bodies include edible flowers, leaves, fruits, seeds, mushrooms, roots and tubers, bamboo shoots, edible insects, birds, honey, fishes, crab, and other aquatic plants and aquatic species. Micro studies have indicated that these foods forming the food and nutrition bank for communities gain significance during food insecurities and intermittent cropping periods.

Wild foods in the FAO/INFOODS Food Composition Database for Biodiversity



Note: “Other” includes milk, eggs and miscellaneous wild foods.
Source: Authors’ calculation based on BioFoodComp 4.0, FAO/INFOODS

- Including edible wild food species as part of the human diet is directly correlated to plant availability, which is governed by local environmental parameters, namely soil type, temperature, altitude, rainfall, etc. The communities living near such food banks are well versed in the identification and consumption of these foods. They have a strong knowledge base and their wisdom for harvesting such foods. Being available as part of common resource pools, the communities have developed. They have shown resilience in demarcating areas for each other's that each one of them can maintain their respective food diversity from this pool.

- The economic system interlinked to uncultivated foods is based on barter/cash exchange of foods and the sale of surplus food that has been gathered/harvested. The underlying principle of this exchange is not profit maximization but optimization of dietary diversity – where each group can access and consume diverse food through these transactional exchanges.

- The uncultivated food system is representative of an agro-ecological production cycle as it is-

  a. based on the use of local resources (natural endowments);

  b. follows natural regenerative cycles;

  c. any organic waste is used and consumed within the habitat (as food for animals or for enriching organic matter);

  d. traditional knowledge ensures responsible harvesting/gathering so that the carrying capacity of the plant species is maintained;

  e. and the economic and ecological balance is maintained through reciprocal exchanges.

- Wild and uncultivated foods face increasing challenges from uncontrolled spread of industrial farming that not only encroaches common lands but also, using agro-chemicals, adversely impacts the ecological habitat of such foods. Further with the predominant paradigm of conservation through protection that governs forest policies have reduced access of communities to wild and uncultivated foods. Uncultivated foods do not appear in major development discourses, nor does it find place in agriculture or food policies of national or state governments.

- Climate variability of changing micro climatic weather patterns manifested in warming, extreme weather events of temperature and precipitation, increased incidences of frost and/or hailstorms, local storms and flooding has impacted the regenerative capacities of wild foods. Anthropogenic interferences have further slowed down the process of natural selection among these plant species. However, based on indigenous varieties and well adapted to local climatic conditions wild foods have an in-built resilience to bounce back and continue to provide bio-food diversity to human population.

Vision 2030

Recognise and promote the wild and uncultivated food systems through policies and programmes related to agriculture and forest.

Pathways

IMPLEMENTATION

Increase awareness among consumers to switch food preferences for wild foods, enhance cooking skills, and popularise the recipes without compromising their nutritive value.

Develop a food grading and certification system that recognizes and certifies wild foods, e.g., wild honey, which will help food gatherers and harvesters a market advantage for their produce.

Use biodiversity registers as the benchmark for maintaining the stock and diversity of wild foods.

Promote sustainable and responsible harvesting practices to ensure that harvesting is within the ecological limits of the carrying capacity of the local ecosystem.

Promote niche crop diversity and link it to an efficient value chain under the cluster development approach.

Link strategies to the working plan of forests and dovetailed with CSR investments in localising minor forest produce on local lands. A specialised approach to assessing and managing the man-animal conflict will be required as fruit trees often form food for animals as well.

Adopt a landscape-level approach with convergence for landscape transformation to strengthen and enrich the wild food systems.

Pathways

KNOWLEDGE AND RESEARCH

Undertake research to enhance the shelf life of wild foods to enable these foods to find wider markets and cross-seasonal consumption. Encourage start-ups and other technology-enabled systems to take a lead role in finding such technologies and markets.

Undertake rigorous, nuanced, and immersive documentation of wild and uncultivated foods at the local, regional and pan India level and their contribution in nutritional and dietary diversity to bring such foods into the mainstream discussion on food and nutritional security.

Learn with the local communities to document edible wild foods and develop their gene pool so that these can be re-introduced in case their abundance is threatened or destroyed.

Undertake action research on habitat balance (private and common lands) in respect of biodiversity to account for changing contexts and demands on wild foods.

POLICY

Within food, policies recognize the contribution of uncultivated foods to increase the climate resilience of food systems and thus prioritise projects that conserve, protect, and promote such landscapes in the country.

Written by:
Mr. Amod Khanna, Founder of Towards Learning and Action (TAAL).

Inputs from:
Madhuri Mewale (Expert NRM), Ms. Swati (RySS), Dr. Pankaj Tiwari (Aarohi), Mr Ashok Kumar Singha (CTran Consulting), Mr M P Vasimalai (Dhan Foundation), Dr. Jagdish Purohit (GIZ), Mr. Navin Twarakavi (IBM Weather company), Mr. Rajeev Ahal (GIZ), Mr. Ashirwad Das (GIZ), Mr. Kirti Prasanna Mishra (Ecociate), Mr. Kundal Burnwal (GIZ), Ms. Neha Khara (GIZ).

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Agro-ecology Driven Water Management

8

Actionable Area

Emphasise on bringing agro-ecology at the centre of land and water management for greater water resource efficiency, environmental justice, and attention to poor and more inter-generational equity.

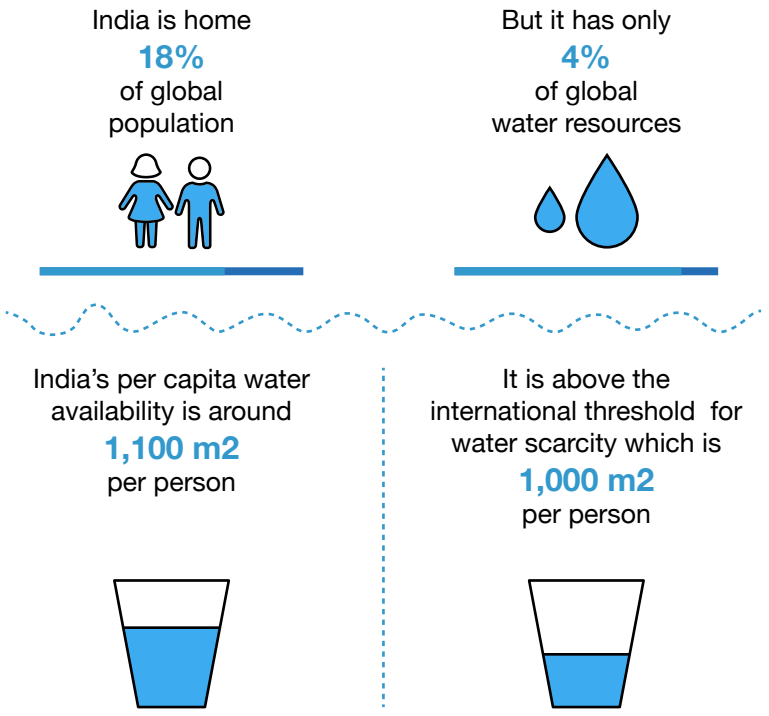
Issues

- With an average rainfall of 1105 mm and a land area of 329 million hectares, India's annual estimated water resources are about 3880 billion cubic metres (BCM). However, 30-year-studies (1985-2015) by Central Water Commission(CWC) showed that the average annual water resource available is estimated at 1999.20 BCM, out of which only 1122 BCM can actually be utilised.

- Several Indian basins like the Indus, Sabarmati, Pennar, and Krishna are already becoming “closed” basins, with little opportunity for further development. The 2030 Water Resource Group of the World Bank characterises India’s water security challenge as the problem of soaring demand, competing uses, and finite availability of water. If the current pattern of demand continues, about half of the demand for water will be unmet by 2030. At least 54% of India has been identified to be high to extremely water-stressed, and almost 600 million people are at higher risk of surface-water supply disruptions. Northwest India, the country’s breadbasket, is facing high stress.

- As the supply augmentation of water is getting increasingly difficult, attention needs to be focussed on-demand management of water on finding sustainable solutions to our water problem.

India’s water crisis: The big picture



Source: http://data.worldbank.org

- Agriculture is the largest user of water. A recent study by NABARD and ICRIER estimated that about 78% of India's annual freshwater withdrawals are for agricultural purposes. FAO's AQUASTAT database puts this figure closer to 90%. The NABARD-ICRIER study identified three "water guzzler" crops - rice, wheat, and sugarcane - which occupy about 41% of the gross cropped area and consume more than 80% of the freshwater withdrawals for irrigation. This has meant grave inequity in irrigation distribution across crops and farmers and a strong mismatch between existing water endowments and the water demanded by these water-guzzling crops.

Status

- Farmers grow such water-guzzling crops even in areas of patent water shortage due to the structure of incentives and steady markets for these crops. Therefore, even a small reduction in the area under these crops, in a region-specific manner that does not endanger food security, would go a long way in addressing India's water problem.

- In a recent paper written for FAO-NITI Ayog National Consultation, the possible crop switches in Kharif and rabi seasons were explored. The results showed that we could save about 18-36% of the water applied in agriculture through seasonally appropriate agro-ecologically suitable crop replacements. Given that water-intensive crops currently occupy over 30% of the gross irrigated area in these states, the amount of water saved annually would be considerable. However, the rapidly deteriorating water situation poses a very serious constraint to maintaining the productivity levels of water-intensive crops, especially in states like Punjab and Haryana. A study also showed that the Eastern states, which are safe in their groundwater reserves, are net importers while the water-scarce regions are net exporters of water.

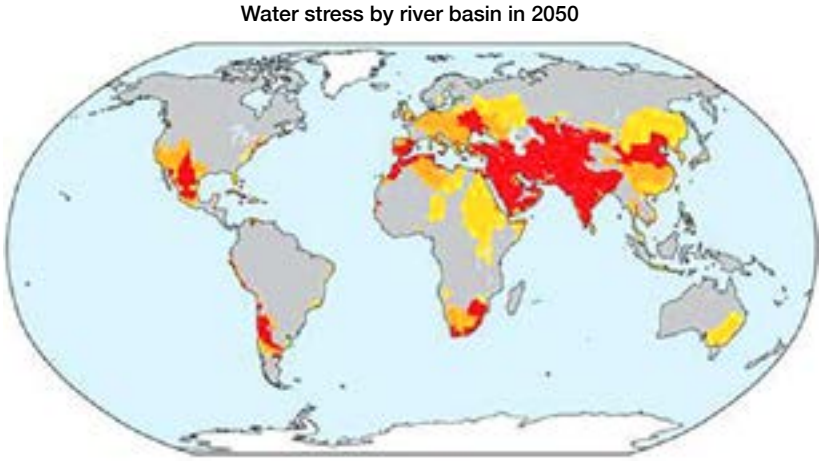
- Price incentives play a vital role in correcting the anomalies in water resource efficiency in agriculture by promoting cropping patterns appropriate to the local agroecology. However, the fundamental feature of the post-Covid food system is that it should cover a larger number of both farmers and consumers and evolve a stronger regulatory framework for agricultural markets, especially for food. Along with initiatives at rationalising water use in agriculture, we also need to focus on conserving rainwater through watershed management.

- MGNREGA is currently being used by many government and non-government agencies for public investment in water infrastructure. Since the outbreak of Covid-19, the uptake of MGNREGA has considerably increased, which could be leveraged for greater water conservation and groundwater recharge with locally appropriate technologies. Another major point of action is the management of our irrigation commands.

Vision 2030

Implement science & technology-based agro-ecology-driven inclusive and productive water and land management for food system transformation in India. By bringing agro-ecology at the centre of land and water management, science and technology interventions operate within limits set by the ecosystem.

India will face severe water stress



Note: Water stress is a measure of the total, annual average water demand of freshwater in a river basin compared with the annual average water available (precipitation minus evapotranspiration) in that basin.

Source: OECD (2012), Environmental Outlook to 2050: The Consequences of Inaction.

Pathways

Integrate water policy within other policies such as energy and food considering the water-energy-food nexus.

Set up irrigation management fund to finance private players to take up irrigation reform and canal maintenance.

Use MGNREGA as a tool for channeling public investment in the water infrastructure.

Develop incentives for farmers to move towards crops requiring lesser water.

Adopt mechanisms like MSPs along with market-based price incentives and base marketing and branding campaigns on the efforts put on water saving.

Evolve a concept wherein market prices are aligned with the water footprint of products. Adopt the concept of social MSP whereby farmers growing low water-requiring crops are compensated in terms of higher prices. This can be seen as a payment for the ecosystem services (ESS) rendered by them.

Explore a market development for crop diversification with an enhanced role of private sector players. In this context, Farmer Producer Organisations (FPOs) can play an important role.

Implement financial mechanisms for water use efficiencies like Jal Samruddhi in Maharashtra or Haryana's direct cash transfers for shifting to low water-requiring crops.

Look at ongoing projects, digital interventions, and capacity-building initiatives to draw learnings from these for upscaling and replication.

Use an area or landscape-based approach for subsidizing the micro irrigation systems.

Pathways

IMPLEMENTATION

Increase the irrigation efficiency in agriculture through systems like micro irrigation or public and private partnerships.

Promote PPP models around irrigation infrastructure.

Support further research on micro-irrigation systems.

Take up irrigation management of canal commands to cover the IPC-IPU gap.

Realign cropping patterns with agroecology-based practices to reduce the water footprint in agriculture.

Realign crops and crop varieties based on the agro-climatic regions.

Enhance farmer's coverage by diversifying the system of public procurement MSP and extending it as support for farmers to grow less favoured crops in rainfed regions.

Link the public distribution to food-based entitlement programmes such as Integrated Child Development Services and provision of noon meals in schools. This could go a long way in reducing the nutritional poverty of the most vulnerable.

Emphasise the importance of water budgeting with a focus on water reuse and recycling.

Recognise soil moisture and utilize it as a tool for reduced water use. Ground irrigation scheduling on soil moisture and other measures to improve soil health.

Promote water-saving methods and technologies such as Direct Seeding of Rice (DSR), pre-monsoon sowing, etc.

Enhance the area under micro-irrigation technologies such as drips and sprinklers.

Develop financial mechanisms and incentives.

Provide affordable finance for sustainable solutions within the banking sector. The "Umbrella Programme for Natural Resource Management (UPNRM)" project from GIZ & NABARD is an example of combing a hybrid model of loans and capacity building.

Finance the products through NBFCs.

Explore a blended approach of outcome-based financing around soil, water, climate, GHG emission transitions together.

Pathways

Implementation (Contd)

Enable smallholder farmers financially through micro-credits.

Rainwater use efficiency is enhanced through decentralised water harvesting, promoting the revival of traditional water harvesting structures, spring rejuvenation, wastewater recycling, and soil moisture management.

Address the village or watershed level water and energy use footprint. Within this set, a clearer focus on aquifer management and storage.

Bring together progressively an ecosystem services approach in water management to augment the water supply through a watershed approach and demand-side management at watershed, sub-basin, and basin levels.

Support the formation of more river basin organizations (RVOs) as well as their management, governance, and institutional management.

Involve Gram Panchayats in the planning of technology-based approaches creating infrastructure for water use and storage.

KNOWLEDGE AND RESEARCH

Create innovative solutions for enhancing water efficiency and promoting the role of private sector players and CSOs.

Pilot water-efficient technologies for large-scale adaptation.

Examine the social barriers and enablers to change water use behavior - Gender, local water practices, and dietary preferences all shape what is grown and how. Use a value chain-based approach to increase the benefits of farmers.

Establish crop advisory services along with technology introduction to enhance an optimum return on farmers' investment. The private sector has a great role in this.

Scale up the adoption of smart irrigation scheduling technologies.

Administer climate-based information and advisory to farmers.

Written by:
Mr. P.S Viiayshankar, SPS (Bagli) MP.

Inputs from:
Surender Makhija and Anil Jain (Jain Irrigation), Aijth Radhakrishan (2030 Water Resource Group), R.C. Kote (BAIF), Rajesh Jain (WAPSYS), Amita Bhaduri (India Water Portal), Dr. Jagdish Purohitand, Rajeev Ahal(GIZ), Shri Alok Sikka (IWMI), Manish Dubey and Chandni Singh (Indian Institute of Human Settlements), R.V.Ramamohan (W L Foundation), Maya Acharya (Netherlands Embassy).

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Agrobiodiversity and Nutrition Security

9

Actionable Area

Addressing the negative impacts of biodiversity and restoring the losing agrobiodiversity is important since it is critical to the lives and livelihoods of small farmers, rural communities and indigenous people and inherent part of their culture and tradition.

Issues

- Monocropping systems, loss in dietary diversity, and shrinking of food plates has become a new normal in today's world. This trend has serious implications for both human and environmental health. Biodiversity loss in agriculture is a big cause of concern. Globally, food systems are now the source of 60% of terrestrial biodiversity loss, 33% of soil degradation and 61% of the depletion of commercial fish stocks.

- The situation in India is almost consistent with these global statistics. India is one of the 17 mega-diverse countries in the world. It is characterised by 20 distinct agro-ecosystems based on soil type, rainfall amount and distribution, and altitude. It is also a repository for traditional knowledge of biodiversity. India is a center of origin and diversity of crops with respect to agricultural biodiversity, with 811 cultivated plants and 902 of their wild relatives documented in 2015. India also contains a broad spectrum of native breeds of farm animals. According to the International Union for Conservation of Nature (IUCN), 758 species of plants and animals are listed as threatened.

- Agrobiodiversity is important because it is the synergy and interaction between living things, land, technology, and social systems. It is also a gene pool of crop plants, livestock, local breeds, wild relatives, landraces, bio-control agents, and those offering vital ecosystem services such as pollination and nutrient recycling.

Some of the major trends observed during the last decade are as follows:

75% of plant genetic diversity has been lost

30% of livestock breeds are at risk of extinction; six breeds are lost each month

75% of world's food from only 12 plants and 5 animal species

0.1% of the 250,000 to 300,000 known edible plant species, only 150 to 200 are used by humans

60% of calories and proteins obtained by humans from plant comes from rice, maize and wheat only

30% of human requirements for food and agriculture comes from animals

12% of the world's population live almost entirely on products from ruminants

Status

Government Initiatives

- India is committed to conserving and utilising biodiversity in general and agrobiodiversity in specific, integrating both *in situ* and *ex situ* approaches. This includes improving opportunities for mainstreaming agrobiodiversity conservation and sustainable use through the policies and collaborative actions of all relevant ministries and government departments, particularly the Ministry of Environment, Forests and Climate Change (MoEF&CC) and the Ministry of Agriculture and Farmers Welfare (MoA&FW). The enactment of the Biological Diversity Act 2002 is one of the most significant steps in that direction.

  Other government initiatives include:

  a. Establishment of protection of Plant Varieties and Farmer's Rights Authority (PPV&FR Authority) and grant incentives to farmers in the form of "Plant Genome Savior Community Recognition" through creating National Gene Fund for conservation and development of plant genetic resources.

  b. Establish a multilateral system to facilitate access to Plant Genetic Resources for Food and Agriculture (PGRFA) through International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).

  c. National mission on sustainable Agriculture (NMSA)and its sub-programme to promote organic farming 'Paramparagat Krishi Vikas Yojna (PKVY)'.

Linkages with Sustainable Development Goals

Vision 2030

- **Demonstrate and promote ecologically intensive agricultural practices.**
- **Internalise agrobiodiversity concerns in routine departmental activities to make them part of relevant policies.**
- **Capture agro-biodiversity data routinely with the required new tools and appropriate indicators along with adequate capacity building for recording the same.**
- **Create consumer awareness for nutrition and healthy diets, which creates awareness about the significance of agrobiodiversity and explore the scope for public-private partnerships for alternate marketing that links the rural markets to urban areas.**

Pathways

POLICY

Formulate a comprehensive and cross-sectoral policy on ecological agriculture for safeguarding the country's agrobiodiversity and sustainable food production system.

Incentivise on-farm conservation of traditional and indigenous food crop varieties and establish decentralised seed/gene banks of traditional varieties. Establish food innovation funds to motivate startups to use more traditional varieties in food preparations.

Establish institutional partnerships that work both in the field and at the policy level.

Organise several routine departmental activities around agrobiodiversity concerns and ensure that the become part of relevant policies, programmes and agriculture extension institutions that deal with capacity building.

IMPLEMENTATION

Develop an action plan on conserving agrobiodiversity with specific geographical regions and map the relevant stakeholders for their involvement.

Conserve pollinators: plant native trees, herbs, climbers, and flowering plants in the farm fences, establish ecological infrastructure like hedges, small ponds and beetle banks to provide habitats for native pollinators promote honeybees and other natives agriculturally important insects under the Horticulture Mission.

Develop an understanding of how agrobiodiversity is perceived and valued by different sections of the rural community, especially women. Place its conservation in a locally relevant context and make the community partners in this crucial exercise.

Encourage private companies' role in conserving agrobiodiversity and create awareness with global buyers on the importance of different varieties.

Pathways

KNOWLEDGE AND RESEARCH

Recognise local capacity, and do capacity building through research and extension activities to empower stakeholders, e.g., NGOs, local communities, women seed savers etc.

Recognise the contribution of Women's participation in agrobiodiversity conservation.

Create consumer awareness via media and communication strategies for nutrition and healthy diets and the significance of agrobiodiversity (i.e. promote local varieties and its importance in dietary consumption). Explore the scope for public-private partnerships for alternate marketing that links the rural markets to urban areas.

Written by:
Ms. Seema Bhatt (National Biodiversity Expert with FAO India).

Inputs by:
Dr Poonam Pande and Mr Ravindra Singh (Both from GIZ, Biodiversity Team).

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Enhancing Soil Health

10

Actionable Area

Work for improving soil health as a threat to the soils is detrimental for global food security and negatively impacts our climate, water systems, and biodiversity.

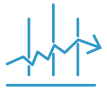
Issues

- Soil, a finite, fragile resource, is fundamental to food systems and “an estimated 95% of our food is directly or indirectly produced on our soils.”Soils supply the essential nutrients, water, oxygen and root support that our food-producing plants need to grow and flourish.
- Microbes in the soil are responsible for soil health, fertility and carbon reserve. Healthy soils maintain a diverse community of soil organisms that help control plant disease, insect and weed pests, form beneficial symbiotic associations with plant roots, recycle essential plant nutrients, improve soil structure with positive effects for soil water and nutrient holding capacity, and ultimately improve crop production.
- The heightened intensification in agriculture after the green revolution has led to the deteriorating health of soils in India, as indicated by many scientific studies. Many of today’s soil and crop management systems have now become unsustainable and are degrading the ecosystem. Soils are increasingly facing salinisation and acidification due to inadequate agricultural practices.
- Due to the injudicious use of fertilisers there have been nitrogen deposition on the soils, which have led to a low response to synthetic fertilisers and lower nitrogen uptake efficiency. It has also resulted in contamination of ground and surface water, soil and water acidification, micronutrient deficiency, low soil organic carbon, accumulation of heavy metals and metalloids through various forms of emissions.

Soil erosion in India results in:

7.2 million tonnes
of annual loss in output of main crops

4% - 6.3%
of loss in annual agricultural production of the country



1 to 1.7 %
of loss in terms of the replacement cost of the GDP

74 million tonnes
of loss in major nutrients per year

- Soil erosion results in an annual loss in output of main crops in India to the tune of 7.2 million tonnes, which is around 4- 6.3% of annual agricultural production of the country and ranges to a loss in terms of replacement cost from 1 to 1.7% of the GDP.

Status

Government Initiatives

- Improving soil health has been one of the main agendas of the governments and development sector players. Both central and state government has come up with programs and schemes to improve the soil health and reduce the instances of soil erosion.

- These schemes include Integrated Watershed Management Programme (IWMP), National Watershed Development Project for Rainfed Areas, Drought Prone Areas Programme (DPAP) and Desert Development Programme (DDP).

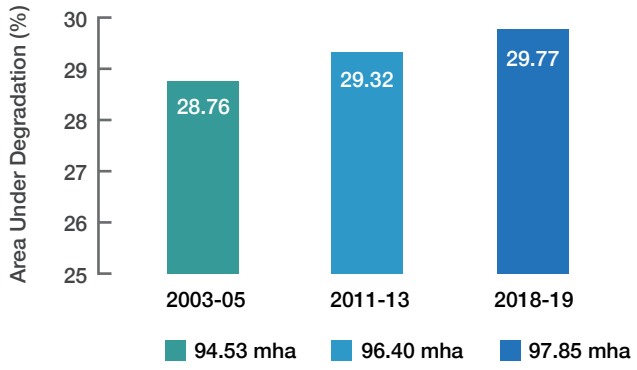
- The National Mission for Sustainable Agriculture (NMSA) has soil health management as a sub-scheme for promoting soil test-based balanced and integrated nutrient management. In 2015, a National Mission on Soil Health Card was launched to provide soil test-based fertiliser recommendations to all farmers in the country.

- Formation of dedicated research institutions focused on soil: Indian Institute of Soil Science; National Bureau of Soil Survey & Land Use Planning; Central Soil Salinity Research Institute; Indian Institute of Soil and Water Conservation.

Vision 2030

Farmers/farming systems move from exploitation of soils to recycling nutrients and organic material, leading to enhancing productive and adaptive capacities for sustainable ecological and food systems.

Desertification / Land Degradation Status of India



Source: Desertification and Land Degradation Atlas released Space Applications Centre (SAC), ISRO, June 2021

Pathways

POLICY

Adopt five forms of sustainable agricultural farming practices encouraged by FAO – agroecology, agroforestry, zero tillage, conservation agriculture and organic farming – to preserve and improve soil quality and set targets to increase the area under these practices. Targets for hotspot areas (saline, acidic, contaminated soils) to be treated with urgency.

Make nature-based agroecological solutions a part of policy and programs and support them. Set targets for soil carbon sequestration to reduce carbon footprint and global warming.

Manage land degradation neutrality.

Integrate soil management policies with land-use policies, so that good quality soil is not lost to non-agricultural use.

Develop the policy framework to support the creation of a favourable ecosystem around soil health management by bringing various stakeholders and different government initiatives on a single platform. This could be in the form of a lab to farm initiative.

Interlink Swachh Bharat Mission's focus on garbage collection and compost making to soil management initiatives through waste management.

Policymakers/ researchers need to acknowledge the bio-dynamic nature of soils and recognise farmers' knowledge and location-specific understanding of soils and their knowledge in practice.

Assess the efficacy of ongoing soil reclamation programmes and soil health schemes to give successful policy prescriptions.

Assess the costs of soil health degradation at a national/ regional scale and release a 'State of the Soil Health Report' every five years on the 'State of the Forest' report.

Incentivise the creation of local soil testing infrastructure to encourage testing by farmers. The use of Geographical Information Systems (GIS), Remote Sensing, Internet of Things (IoT), Artificial Intelligence (AI) and Machine Learning (ML) could be a game-changer for ensuring soil health by providing information and enabling the adoption of local level remedial measures.

Pathways

IMPLEMENTATION

Facilitate efficient nutrient management towards improving soil health.

Systematise compost making in every gram panchayat by allocating land.

Promote regenerative agriculture practices and encourage conservation tillage that leaves at least 30 % of the soil surface covered with crop residue after planting. This will help in carbon sequestration and reduction in CO2 emissions.

Encourage farmers to manage crop residues better and change cropping patterns by providing them incentives/price/procurement support/increased public funding.

Leverage watershed programmes and Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) to work on soil and water conservation, water harvesting, drought-proofing including afforestation, land development etc.

Treat catchments landscape-based and extend the tree cover outside forests through agroforestry as these practices can help reduce soil erosion.

Strengthen local NGOs with technical know-how and the right information. Farmer Producer Organisations (FPOs) may play a critical role in soil health management as they have a big role in promoting natural farming.

The Government should develop a trained cadre of community resource persons (CRPs) through Green Colleges to support soil health/ nature-based solutions/ agroecology/ Zero Budget Natural Farming (ZBNF)/ biochar etc. Promoting peer to peer learning and extension models such as farmer field schools is critical.

Pathways

KNOWLEDGE AND RESEARCH

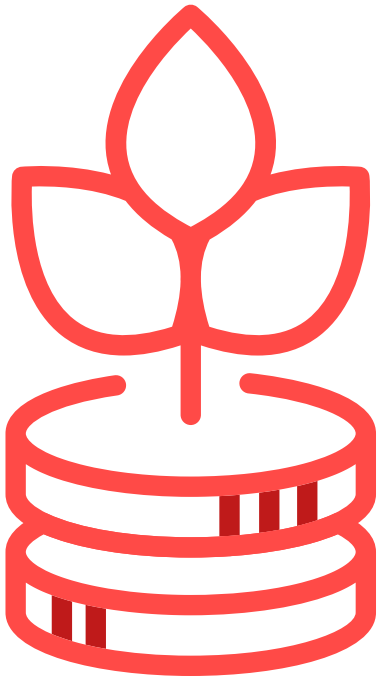
Build a science-based vision on soils with clear policy objectives and supportive instruments and initiate courses in sustainable farming practices.

Have better monitoring of land degradation for conservation of soil resources and improving soil health. Researchers need to develop evidence-based knowledge documents on the linkage between soil health and human health. Develop the broader parameters for collecting data around soil health monitoring.

Establish a property-specific benchmark for soil health to better monitor the progress.

Written by:
Ms. Amita Bhaduri (soil expert).

Inputs by:
Mr. Manoj Singh (TNC), Ms Poonam Pandey (GIZ), Mr. Amod Khanna (TAAL), Dr. I P Abrol (Centre for Advancement of Sustainable Agriculture), Ms. Medha Mathur (Earth analytics), Madhav Gholkar (WOT), Dr. Venkatesh Tagat (Development Consultant), Dr. Pradeep Dey (Indian Institute of Soil Science), Mr. Sharat Singh (SPWD), Mr. Navin Horo (GIZ), Mr. Jagdish Purohit (GIZ), Mr. Rajeev Ahal (GIZ), Mr. Kirti Prasanna Mishra (Ecociate).



SECTION 3

Prosperity

Prosperity

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Food Processing

Actionable Area

Improving access to nutrition through processed foods for combating malnutrition, micronutrient deficiencies, and reduced consumption of nutrients of concern.

Issue

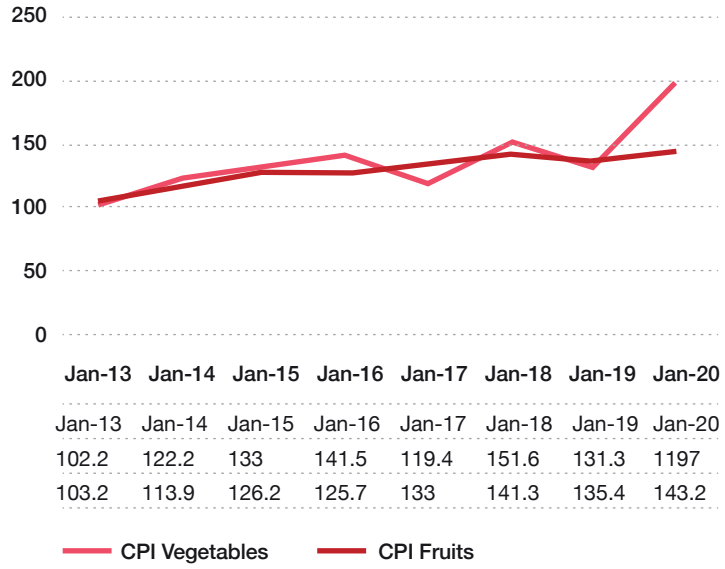
- Despite being the world's largest producer of milk & pulses and the second-largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruits, and cotton, the level of food processing in India is still low and limited to low value processed products.

- Meanwhile, 14% of India's population is undernourished. 'The State of Food Security and Nutrition in the World, 2020' report states that 189.2 million people are undernourished in India, and 34.7% of the children aged under five in India are stunted. In addition to all this, as per Global Hunger Index (GHI) 2019, India has been ranked 102 out of the qualifying 117 countries that were assessed.

- Between 1993 and 2011, the proportion of household expenditure on total food items decreased in rural and urban households. However, the proportion of income spent on fruits and vegetables has not changed much over time. On average, the Indian diet pattern is skewed towards cereals, and fruits and vegetables account for only 9%of the total calorie intake.

  The consumption of fruits and vegetables is further impacted by the price volatility of these products.

Price Fluctuation of Fruits and Vegetables



Jan-13	Jan-14	Jan-15	Jan-16	Jan-17	Jan-18	Jan-19	Jan-20
102.2	122.2	133	141.5	119.4	151.6	131.3	1197
103.2	113.9	126.2	125.7	133	141.3	135.4	143.2

Source: Ministry of statistics and Program Implementation (MOSPI)

- Currently, the country's consumption and food processing baskets are skewed towards cereals. This is primarily due to more conducive policy support for cereal production through assured procurement systems. These policies were indeed the need of the era prior to the mid-1960s when India was heavily dependent on imports and food aid to meet domestic requirements. But with the changing scenario now with India being a food surplus, there is a need to focus on more nutritious food such as fruits, vegetables, dairy, meat, etc.

- A well-developed food processing sector with a higher level of processing will help in the reduction of wastage, improve value addition, promote crop diversification, ensure better return to the farmers, and also address critical issues of food security, food inflation, and providing wholesome, nutritious food to the masses.

Status

- India currently processes less than 10% of its agriculture output (only around 2% of fruits and vegetables, 6% of poultry, 21% of meat, 23% of marine, and 35% of milk). Most of the processing done in India can be classified as primary processing – done through rice, sugar, edible oil, and flour mills, etc. However, primary processing offers lower value-addition compared to secondary processing that includes processing of high-value items viz fruits and vegetables, dairy, bakery, chocolates, etc.

- The high production levels and low current processing rates provide a huge opportunity for the sector's growth. Besides being a large sourcing hub for agricultural produce, India has the advantage of a large and growing market. Changing consumption patterns due to urbanisation, changes in the gender composition of workforce, and growing consumption rates have contributed to the increase in the size of the processed food market. The output of India's food processing sector is expected to reach USD 535 billion by 2025-26.

- However, to fully benefit from this growth potential, the need of the hour is to move up the value chain in processed food products by establishing efficient backward linkages to contribute to the nation's food security and proving healthy processed foods towards mitigating the country's malnutrition rates.

- The areas witnessing double-digit growth within the processed food segment include breakfast cereals, bakery products, processed fruits and vegetables, processed meat and seafood, pasta/noodles, ready-to-eat meals, sauces, and dressings. Growing consumer awareness is also leading to a demand for healthier product options. This has led to new and innovative products such as ready-to-eat meals, cold-pressed juices, etc., gaining popularity.

- Meanwhile, towards combatting malnutrition, staple food fortification is gaining prominence. The government has initiated several steps towards enhancing the consumption of fortified food for children and the more vulnerable segments of the population. The FSSAI has also initiated the process for setting regulations for mandatory

fortification of edible oil and packaged milk and, more recently, standards for processed foods such as breakfast cereals, buns, rusk, pasta, noodles, processed foods, etc.

- While a typical Indian diet focused on cereals may meet the calorie requirements, a key challenge isin meeting high-quality protein and fat intakes. It is pertinent to note that India's nutrition challenges span several fronts. On the one hand, a large portion of the lower-income classes is undernourished. On the other hand, the more well-off income classes are seeing an increasing rate of lifestyle diseases, such as diabetes, hypertension, and coronary heart disease.

- It is essential to control nutrients of concern (fat, salt, sugar) in processed foods to mitigate the latter. The government initiated the 'Eat Right India' campaign to bring about dietary modifications to reduce diet-related non-communicable diseases like diabetes, hypertension, heart diseases, etc. In line with this, several food manufacturers have begun reformulating their products to reduce the levels of salt, sugar, and saturated fats and increase positive elements of dietary fibres. Additionally, regulations are also under discussion on Front-of-Pack labelling to provide information on these nutrients and enable consumers to make judicious choices.

Government Initiatives

- To strengthen the food processing sector, the government has launched several initiatives to attract investments, incentivising primary processing infrastructure towards ensuring lower wastage, better shelf life, and nutritious values; enabling higher levels of processing through enabling the framework of mega food parks; and building consumer awareness regarding nutrition.

- 100% FDI is permitted under the automatic route in food processing industries.

- 100% FDI is permitted in the manufacture of food products and trading (including through e-commerce) for food products manufactured and processed in India.

- The whole idea is to increase FDI in the food processing industry, which in turn offers a huge opportunity for the sector by way of enhanced scope for technology transfer, backend integration, and expansion of the food processing industry as well as increased employment by way of setting up of more food processing units.

- Production Linked Incentive Scheme for Food Processing Industry (PLISFPI): The scheme has been launched to support the creation of global food manufacturing champions; promote Indian brands of food products; increase employment opportunities for off-farm jobs, ensure remunerative prices of farm produce and higher income to farmers. The critical components of the scheme include

  a. Incentivising manufacturing of four major food product segments viz. Ready to Cook/ Ready to Eat (RTC/ RTE) including millet-based foods, processed fruits &vegetables, marine products, and Mozzarella cheese.

  b. Incentivising innovative/ organic products of SMEs across all the above four food product segments, including free-range- eggs, poultry meat, and egg products.

  c. Support for branding and marketing abroad to incentivise the emergence of strong Indian brands.

- **Operation Greens:** Under the scheme, the Ministry of Food Processing Industries (MoFPI) provides financial support on transportation of eligible crops (horticulture) from surplus production cluster to consumption centre; and/or hiring of appropriate storage facilities for eligible crops.

- **Agri Infrastructure Fund:** The scheme provides a medium to long-term debt financing facility for investment in viable projects for post-harvest management infrastructure and community farming assets through interest subvention and financial support.

- **Mega Food Parks:** The Mega Food Park Scheme is based on a "cluster" approach. It envisages creating state-of-the-art support infrastructure in a well-defined agri/horticultural zone for setting up modern food processing units in the industrial plots provided in the park with a well-established supply chain. Mega Food Park typically consists of supply chain infrastructure including collection centers, primary processing centers, central processing centers, cold chain, and around 25-30 fully developed plots for entrepreneurs to set up food processing units. Currently, 41 Mega Food Parks have been approved under the scheme, of which 22 are operational.

- **Regulation support:** FSSAI established standards for fortifying rice, wheat flour, edible oil, double fortified salt (DFS), and milk in 2016. The momentum for fortification accelerated with the 2018 regulations being put in place. With fortified staples, problems of iron deficiency anemia, neural tube defects, iodine deficiency disorders, and deficiencies related to vitamin A, D, and B12 can be addressed effectively. For instance, wheat flour (with Iron, folic acid, and B12), oil (with vitamin A & D), salt (with Iron and iodine).

- Additionally, MoFPI provides financial assistance to the food industry for capital equipment and its installation for fortification, value addition, and demand creation.

- The government has made it mandatory to use fortified oil, fortified wheat flour, and double fortified salt in Mid-day Meal and Integrated Child Development Services (ICDS) programmes to strengthen child nutrition. Further, the government plans to distribute fortified rice through the ICDS and Mid-Day Meal Schemes across the country from the year 2021.

- The Government has also undertaken several campaigns to promote consumer awareness, such as Right to Protein, a nationwide public health initiative. It was announced in 2019 to educate people about the importance of proteins for their general health, fitness, and wellbeing. Also, the 'Eat Right India' movement was launched by FSSAI to improve the nutritional profile of processed food products in India.

Private Sector Initiatives

- The food processing companies in India have already shifted their focus to enabling access to nutrition with more prominence on lowering nutrients of concern, improving micronutrient access through fortification, enabling protein intake through innovative products, etc.

- In line with the government's 'Eat Right Campaign,' around 20 key food companies pledged to reformulate their products towards lower values of salt, sugar, and saturated fats. This focus has led to the launch of several new products such as 'zero sugar' product versions, amla-based drinks, lower salt content through the use of micronized salt, products with positive nutrients such as

high dietary fibers, etc. Given the high demand for foods such as noodles and pasta, companies are launching healthier variants replacing wheat with maize, ragi, millets, etc. The changing mindset of the urban consumer and a growing focus on nutrition awareness has led to companies constantly researching reformulating their products in a step-wise manner.

- Presently, 157 brands of five fortified staples are available in the open market with a pan India and regional presence. There has been tremendous traction in the oil and milk industry, with 47% of the top ten packaged refined edible oil industry players and 36.6% of the organised milk industry fortifying as per FSSAI standards. A prominent change has been seen in the uptake of plant-based proteins, including chickpeas, lentils, barley, almonds, etc. Plant-based proteins have already picked up in India, especially given the country's large vegetarian population. In India, the alternative protein sector can also help fight malnutrition sustainably.

- Growing awareness on nutrition, preventive healthcare, and rising cases of lifestyle diseases such as obesity, blood pressure, diabetes, etc., has shifted focus to the health supplements sector in India. As a result, the Indian Dietary Supplement Market was valued at USD 3924.44 million in FY2020 and is predicted to grow at a CAGR of 17.28% until FY2026, to reach USD 10,198.57 Million.

Vision 2030

- **Increase consumption of fruits and vegetables towards increasing calorie intake from 9% to 20% by 2030**

- **Leverage food processing towards reducing malnutrition rates in line with the NITI Aayog's SDG India Index and Dashboard Report -Reduce anaemia in children (6 – 59 months) from 40.5% to 14% by 2030**

  a. Reduce stunted growth in children (<5 years) from 34.7% to 2.5 % by 2030

  b. Reduce prevalence rate of underweight among children (<5 years) from 33.4 % to 0.9% by 2030.

Pathways

POLICY

Promote value addition of fruits, vegetables, and Nutri-cereals such as millets by enabling producers better access to technology, product knowledge, best practices, etc.

To offset India's protein deficiency, affordability is crucial; thus, bioavailable protein sources such as soyabean should be leveraged. Such products should be included in mid-day meals and other schemes.

Snacks and breakfast should be focused on as key means to deliver nutrition to children. Nutritious snacks and breakfast should be provided through mid-day meals.

IMPLEMENTATION

Organise learning missions to the countries like Thailand, Indonesia, etc., which have created a niche market for value-added nutritious products produced through simple primary processing such as dried/dehydrated vegetables, poached/pickled fruits as Indian farmers are unaware of such products.

Promote the market for natural, nutritious food products leveraging ingredients like Guava, Jamun, Algae, Seaweeds, etc., which have high amounts of micronutrients.

Incentivise and encourage innovative product development, such as high micro-nutrient fruits into dairy products, to enhance digestibility and increase absorption of nutrients.

Undertake mass awareness campaigns on nutrition and fortification like the initiatives undertaken for iodine in salt.

Propagate the benefits of Plant-based meat products for better consumer awareness.

Create awareness on the reformulation of products to reduce nutrients of concerns (fat, sugar & salt)

Pathways

KNOWLEDGE & RESEARCH

Fortification of products should be done, keeping in mind the nature of Indian cooking practices. For example, typically, in India, rice is cooked by draining off the starch water. Thus if the micronutrients fortified are water-soluble, there will be leaching off. Therefore, the mechanism of fortification is critical, and the industry should be trained in the same.

Focused Research should be undertaken in collaboration with industry and academia on sugar and salt alternatives, technologies to maintain product stability with reduced sodium levels, natural flavour enhancers, etc., for companies to reformulate healthier product options.

Focus on educating consumers on the value of the cold chain towards maintaining produce quality and nutritious value. There are common misconceptions of cold storage produce being ‘less fresh’ and processed foods being ‘unhealthy’.

Run educational, consumer marketing campaigns to build awareness of nutrient-rich foods' concept and benefits leveraging social media, influencers, and other mass media tools.

Separate nutrition profiles should be created and promoted for children, women, the geriatric population, etc. Targeted awareness around the nutrient requirement and the concept of a ‘balanced diet’ around each group is needed.

Prosperity

food future foundation

Food Storage

2

Actionable Area

Enhancing usage of high quality, scientific storage infrastructure to reduce foodgrain losses.

Issue

- Despite India achieving food sufficiency by producing a record 292 million tonnes of food grains in 2019-20, a substantial amount of food grains is being damaged after harvest due to a lack of adequate storage and processing facilities. Grains must be stored throughout the year to satisfy the demand for a plentiful supply of cereals and legumes. But post-harvest losses account for about 10% of total food grains due to unscientific storage, insects, rodents, micro-organisms, etc. Annual storage losses have been estimated to be 14 million tonnes worth Rs. 7,000 crore in which insects alone account for nearly Rs. 1,300 crore.

- Post-harvest losses due to inefficient storage are in 4 categories-

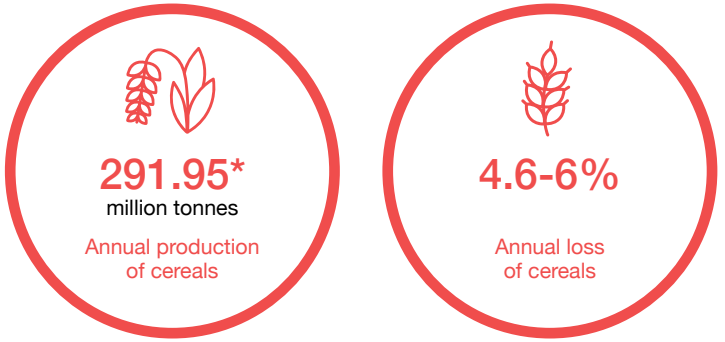
  a. **Quantitative loss:** This is the loss in weight caused by direct feeding by insects and pests.

  b. **Qualitative loss:** This is the loss caused due to chemical changes in grain due to infestation, such as the spreading of pathogenic micro-organisms.

  c. **Loss of seed viability:** Infestation causes a seed to become unviable. In the case of paddy, insects were found to cause the loss of viability of seeds to the extent of 41%.

  d. **Damage to storage structures:** Insects like Lesser grain borer have the capability to destroy the wooden storage structures, containers, polythene lined bags, etc., which causes direct and indirect losses.

Foodgrain storage losses in India



*Second advanced estimates, 2019-20

Source: Department of Agriculture, Cooperation & Farmer's Welfare: National Academy of Agricultural Sciences

Status

- In India, most foodgrains are stored in bulk (open) storage structures as it is easier for loading/unloading and is cheaper than storage in containers like gunnies. However, these structures lack efficiency and are prone to food loss by the infestation.

- The most common storage structures used for foodgrains and the respective challenges they face are -

Structure	Commodity Stored	Challenge
Bamboo Structures	Paddy, wheat and sorghum	Weight loss due to insect attack is 5% in paddy and 15% in sorghum
Mud and earthen structures	Paddy, wheat, sorghum, oil seeds and pulses	During rainy season this develops cracks leading to moisture absorption followed by insect and mould infestation
Wooden structures	Paddy	The structures are neither airtight nor moisture proof.
Brick structures	Paddy, sorghum and wheat	High initial cost. Not insect and moisture proof

Source: Indian Grain Storage Management & Research Institute

- Bulk storage capacity in silos presently is just around 2-3 MMT, which needs to be ramped up aggressively. Due to the lack of storage facilities, farmers often have to sell their surplus produce at below-market prices.

- Even the Food Corporation of India faces the challenge of the lack of storage space. It has food reserves well above the buffer norms, which further leads to food loss during storage. As of December 2019, FCI held 56 MMT of rice and wheat and 26 MMT of paddy (rice equivalent of 17 MMT) in its facilities. For instance, FCI's rice stocks were at 21 MMT in January 2020 compared to a buffer requirement of just 7.6 MMT.

- This, coupled with the rising cost of storage, has led to the FCI being compelled to use temporary storage facilities like cover & plinth (CAP) or take warehouses on lease. In 2019, 8.79 MMT of wheat was estimated to be kept in such temporary storage facilities in Punjab alone.

- Going forward, minimising post-harvest losses of food need to be approached through multiple lenses of type of storage, reducing overdependence on FCI/CWC, liquidation of surplus stocks, transportation issues, and lack of interest of the private sector. There needs to be a rapid scale-up in the usage of efficient silos of global standards. Storing grains in silos is a widely accepted method to ensure better and more scientific handling of grains. Countries such as the USA and Australia have advanced silo practices that help with post-harvest grain losses.

- Several best practices are available for sealed, unsealed, and aerated silos. For example, painting the silo white after installation on the pad is a useful management tool. A white-painted silo can be 4°C cooler than a weathered galvanised unit, leading to several advantages such as longer seed germination percentage, reduced moisture migration, reduced insect breeding, etc.

- However, large silos will not serve the needs of Indian small farmers whose production is often in the range of just 20-30 quintals. For this, village level/panchayat level scientific storage units need to be set up, which can be used by the farmers on a pay-per-use basis. Furthermore, apart from the storage of wheat in silos, the focus must also be on the proper storage of other grains such as rice, maize, and pulses.

- India needs to move away from the strategy of centralisation of storage and overdependence on the FCI. The recent steps taken by the government under the Pradhan Mantri Garib Kalyan Ann Yojana (PMGKAY) would help reduce excess stocks with the FCI. The government could also facilitate better uptake of PPP models for storage, thus bringing in competition and reducing costs.

Government Initiatives

- The government is promoting the Agricultural Marketing Infrastructure (AMI) scheme, which is a part of the Integrated Scheme for Agricultural Marketing (ISAM), under which assistance is provided for the construction/ renovation of godowns/ warehouses in the rural areas to enhance the storage capacity and promote scientific storage. AMI is a demand-driven scheme. In addition to the above, the Warehouse Infrastructure Fund (WIF) of the National Bank for Agriculture and Rural Development (NABARD) envisages the extension of low-cost loans to public and private sectors for construction/modernization of warehouses silos, etc.

- The government has also approved a new central sector scheme for the financial facility under the Agriculture Infrastructure Fund of Rs.1,00,000 Crore. The scheme provides a medium-long term debt financing facility for investment in viable projects for post-harvest market infrastructure (including warehousing facility and community farming assets) through interest subvention and financial support.

Vision 2030

- **Reduce foodgrain losses from the current 2-4% to <0.5%.**

- **Shift from open storage to fully scientific storage to reduce grain contamination and wastage.**

- **Atleast 50% of the foodgrain being transported should be in bulk instead of bags towards reducing pilferage.**

Pathways

IMPLEMENTATION

Towards moving from a bag to bulk approach for grain transport, it is critical to leverage railways by bulk cargo wagons or by installing roll-on-roll-off systems where entire trucks can be transported through rail.

Promote scientific temporary storage technologies such as silo bags, bulk flat storage, etc., towards reducing cover & plinth (CAP) storage.

Milled flour in sealed bags may be supplied into the PDS instead of wheat. This will increase transparency and reduce pilferages in the system.

Create state-of-the-art mandis with mechanised infrastructure such as mechanical driers, cleaners, automated weighers, packaging infrastructure, high-tech labs, etc.

Promote good storage practices among operators of small warehouses towards standardisation.

Enable pre-processing of grains (pulses, oilseeds) before storage to ensure homogeneous quality. This will reduce storage losses.

To reduce storage pressure on FCI and prevent the farmer from distress sale, farmers should be facilitated to store harvested grains at the farm gate for extended periods (6-8 months) until FCI procures it. This will be successful only if a warehouse receipt system is in place, certifying that the grains are FCI grade and giving the farmer some credit until final procurement at MSP by FCI.

Pathways

POLICY

The Agri Infra Fund will enable the creation of farmgate infrastructure. However, it is crucial to ensure commercial viability for the uptake of the scheme. Integrated farm gate storage models, including dry storage, mini silos, cold storage, milk collection centers, etc., should be promoted and encouraged.

The upper limit of Rs. 2 crore capital investment in creating farmgate infrastructure to avail interest subvention may be increased for promoting integrated storage facilities.

Enable access to long-term finance towards promoting private investments into storage infrastructure.

Enable standardisation of warehouse infrastructure towards a warehouse-based market mechanism. This will include standardisation of the warehouse structure through BIS, CWC certifications, verified financial status, credit ratings, etc.

Towards reducing food grain losses, the scientific silos under FCI should be connected by railways.

Prosperity

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Integrated Cold Chain

3

Actionable Area

Enabling integrated cold chain solutions that are energy and cost-efficient towards better logistics connectivity of farm to fork and reducing food loss.

Issue

- In terms of food storage and cold chain infrastructure, significant gaps exist in India at present. The gaps have been listed by the National Center for Cold Chain Development as given in the table.
- The optimum utilisation of cold storages is also a challenge with the most of the cold storages operating at sub-optimal capacities. This leads to higher operating costs as well as energy loss. Another problem is that the developments in the sector are happening in silos.
- While setting up new infrastructure and facilitation, ensuring the efficient use of the existing infrastructure and building sustainable integrated supply chains should also be focused on.
- An effective and economically viable cold chain will totally integrate the supply chains for all commodities from the production centers to the consumption centers, thereby reducing physical waste and loss of value of perishable commodities. For setting up such an effective and viable cold chain, it is imperative to keep pace with the necessary infrastructure development, commodity-specific protocols development, promoting technological innovations, dovetailing of various schemes, coordination among the various ministries for the financial outlay, and business model restructuring.

Type of Infrastructure	All India Gap
Modern Pack house	**69,831 units**
Reefer Transport	**52,826 units**
Ripening Chamber	**8,319 units**
Cold Storage Bulk	**34,164,411 MT**
Cold Storage Hub	**936,251 MT**

- While planning new cold chain infrastructure - be at seaports (dedicated perishable berths), railways (reefer wagons), airports (CPC's and quarantine areas), and on-farm infrastructure - it is critical to look at the existing available capacity. An unbroken cold chain network can then be shaped by interconnecting the existing components and the new infrastructure of the cold chain. This would be setting up new infrastructure at the required places rather than sporadic development.

- Technology must be continuously upgraded to ensure efficiency, integrity, and safety. The innovative methods should be integrated from time to time for a sustainable supply chain.

- Cold chain development is an integral element of growth in the food sector. It needs to be integrated into agriculture and food policies, strategies, and action plans, aligning various agencies working towards its development.

- An integrated cold chain can be an industry driver that can transform India's rural economy. Strong post-harvest and logistics have a direct multiplier effect on farmers' incomes. An industry-led pilot study on the impact of cold storage and refrigerated transport on extending shelf-life and expanding sales of Kinnow from Punjab showed how the cold chain is a game-changer. It increased profitability by up to 23%, reduced the post-harvest food loss and CO_2 emissions by 76% 16%, respectively, and opened up exports to 10 countries.

Status

Cold chain systems are vital to the growth of global trade in perishable products and the worldwide availability of food supplies. Global losses in the food industry total more than $750 billion annually. These losses primarily result from a lack of proper storage facilities, improper food safety handling procedures, and insufficient training for those personnel working in the cold chain.

Government Initiatives

- Various government initiatives like grant of infrastructure status to logistics, the introduction of E-Way bill, GST exemption, and financial support are facilitating the growth of the cold logistics sector. The National Logistics Policy with the key objective of integrated development of the logistics sector, by way of multimodal transport, digital transformation, sector modernisation, logistics excellence, and democratisation are in the offing.

- The government is providing support through various channels for the setting up of storage and cold chain infrastructure. Financial assistance for setting up cold storage for storing perishable horticulture produce is provided under two schemes.

  a. The mission for Integrated Development of Horticulture (MIDH) provides financial assistance for various horticulture activities, including setting up cold storage.

  b.'Integrated Cold Chain and Value Addition Infrastructure' scheme: This scheme is being implemented to reduce post-harvest losses of horticulture & non-horticulture produce and to provide remunerative prices to farmers for their produce.

- To promote scientific storage, the government is promoting the Agricultural Marketing Infrastructure (AMI) scheme, under which assistance is provided for the construction/ renovation of godowns/warehouses in the rural areas of various states to enhance the storage capacity for agricultural produce. Warehouse Infrastructure Fund (WIF) of National Bank for Agriculture and Rural Development (NABARD) envisages extension of low-cost loans to public and private sectors for construction/modernization of warehouses, silos, cold storages, cold chain infrastructure.

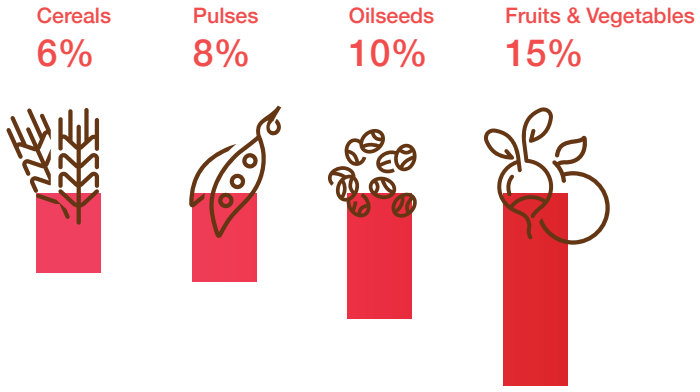
- The government has also approved a new central sector scheme for 'Financial Facility under Agriculture Infrastructure Fund' to provide a medium-long term debt financing facility for investment in viable projects for post-harvest market infrastructure (including warehousing facility and community farming assets) through interest subvention and financial support.

- Under the scheme, NABARD has received a total of 3,055 proposals, including the proposal for warehouses from Primary Agricultural Credit Societies (PACs) through state cooperative banks in 22 states for which Rs. 1568 crore has been sanctioned in principle.

Vision 2030

- **In line with the UN SDG, reduce post-harvest losses by 50% by 2030.**
- **Ensure harmonised scientific post-harvest protocols towards retaining the nutritious value of food.**
- **Promote environmentally sustainable cold chain solutions.**

Post-harvest losses in India (2018-19)



Source: ICAR - Central Institute of Post-Harvest Engineering & Technology, Annual Report 2018-19

Pathways

INFRASTRUCTURE

Ensure cross-functional utilisation of cold chain infrastructure towards improving efficiencies and focusing on multi-commodity cold storage.

Focus on pre-cooling infrastructure to reduce post-harvest losses ensuring to have at least 1 pre-cooling unit per district.

Enable access to the steady power supply at the village level, which is crucial for sustainable cold chain infrastructure, by exploiting renewable energy sources.

Build up food producers' and retailers' storage, processing, and packaging capacities to reduce spoilage and contamination of nutritious foods.

Build up capacities of infrastructure operators towards efficient utilisation of infrastructure.

SUSTAINABILITY

Promote sustainable business models for cold chains as once the business is sustainable, investments into technology will follow automatically.

Focus on phase-wise shifts to sustainable technologies. A one-go shift will lead to high operating costs and thus will have lower uptake. It is pertinent to scale up business and technology in tandem.

Promote renewable energy-based on-farm storage.

Promote cost-efficient rural cooling solutions such as community cooling hubs.

Pathways

KNOWLEDGE & CAPACITY BUILDING

Create an integrated cold chain infrastructure database up to district level, and also at ports, airports, farm gate, distribution channel, etc., utilized capacity, projects being supported by various agencies. This will enable optimum utilisation and cross-sectorial usage of infrastructure. The database can be linked to a digital platform to support national and global initiatives.

Enable tech solutions with traceability and visibility to farmers to enable informed decision-making with regard to price realisation. Develop and disseminate innovative post-harvest storage technologies, packaging, and processing techniques that are conducive to India for nutritious foods to reduce nutrient losses.

Establish national 'Clean Energy Information and Coordination Platforms' complemented by international information sources to expand clean, affordable, and reliable energy access along food supply chains.

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Reducing Food Waste

Actionable Area

To reduce the current level of food waste in India by encouraging to process of more food towards longer shelf life.

Issue

- Currently, global food waste is at an epidemic level, with approximately one-third of the food supply worldwide being lost or wasted.
  This coupled with the fact that the world population expected to reach 9.7 billion in 2050, global food production systems will be stressed.
  Thus, towards reaching the SDG Vision of Zero Hunger by 2030, it is crucial to work towards reducing food waste.

- It is imperative to understand the difference between food loss and food waste. Food loss is defined by the FAO as the decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retailers, food service providers and consumers.

- Food Waste refers to the decrease in the quantity or quality of food resulting from decisions and actions by retailers, food service providers and consumers.

- Food waste is generated through following modes -

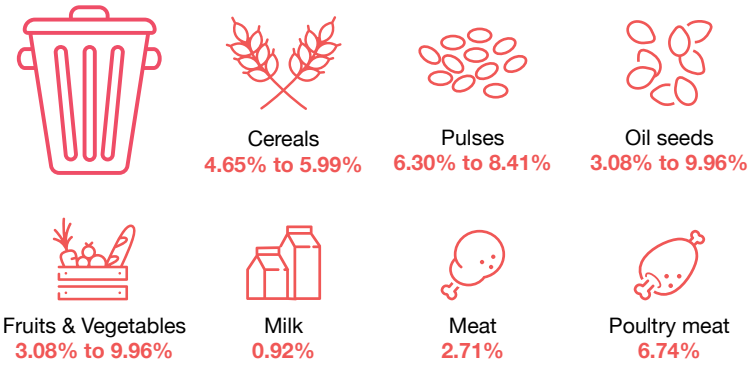
  a. **On-farm food waste:** Fresh produce that isn't considered optimal in terms of shape, size and colour, and is therefore discarded during sorting/grading operations.

  b. **Retail level food waste:** Foods that are close to, at or beyond the "best-before" date, which are discarded by retailers and consumers.

  c. **Household level food waste:** Large quantities of wholesome edible food are often unused or left over at households. These are discarded from household kitchens and eating establishments.

What & How much India wastes

The average range of food loss is 4.6%-15.8%



FOOD SECURITY VS FOOD WASTAGE

Annual cost of food security
$ 1.5 Lakh cr (approx)

Annual wastage of farm produce
$ 92,651 cr (2016)

Source: PIB, ICAR/CIPHET

- While reducing both food loss and food waste will lead towards 'Zero Hunger', it will also enable better usage of land and water resources and positively impact climate change and livelihoods.According to FAO, 17% of total global food production may be wasted (11% in households, 5% in food service and 2% in retail).

- It is pertinent to note that the household per capita food waste generation is found to be broadly similar across country income groups, suggesting that action on food waste is equally relevant in high, upper-middle and lower-middle income countries. This also showcases that building awareness around food waste among citizens is crucial, as thehousehold level waste contributes the largest share to food waste globally.

- For India, there is no national level estimation of food waste. There are a few studies which estimated food waste based on a very small sample size and isolated to particular cities. Hence, they cannot be considered at a national level. Following are the details of those studies -

Study	Study Area	Food waste estimate (kg/capita)
Grover & Singh, 2014	Dehradun	73
Ramakrishna, 2016	Rajam, Andhra Pradesh	58
Suthar & Singh, 2015	Dehradun	20

- The leading cause of food waste at a manufacturing level is due to production issues which globally account for 32.4% of food wastage in manufacturing. A top concern for food manufacturers is always pathogen contamination. Production lines are under strict scrutiny to produce safe products and remove any product that could be suspected. The rejected products can add up to large amounts of waste. Thus, updated technologies and automated manufacturing lines will help reduce this wastage.

- Transportation is one of the biggest challenges for food waste because a lot of products can be lost due to spillage. Time in transit plays a substantial role in the life of a product, especially fruits and vegetables. Having a climate-controlled mode of transit is beneficial for products with a very limited shelf life. If the transportation system is not controlled, there is a possibility of infestation, spoilage, and reduced shelf life.

- The challenge for the food industry is to tap its immense creative capacity to re-engineer waste in food production in both the developing and the industrialised world. Re-engineering food processes can minimize losses, turn waste by-products into profit and introduce a new dimension of the product value.

Status

Government Initiatives

- The government is undertaking several initiatives towards reducing food waste. The Indian Food Sharing Alliance (IFSA) has been set up as a social initiative for retail-level food waste reduction by the Food Safety and Standards Authority of India (FSSAI). IFSA aims to solve India's food waste and hunger crisis by integrating various partner organisations, food recovery agencies, and NGOs. However, towards scaling up the food donation initiatives in India, a few crucial aspects of taxation implication, liability on donors, and regulatory issues such as labelling on products need to be streamlined.

- Towards reducing food waste at the on-farm and manufacturing level, the government has initiated several schemes by strengthening infrastructure and encouraging food processing. These include,

  a. **Mega Food Park Scheme:** The scheme aims to link agricultural production to markets by using a cluster approach, implemented by a Special Purpose Vehicle (SPV). It supports the creation of infrastructure for setting up modern food processing units in the park and connecting it with a well-established supply chain. Currently, 41 Mega Food Parks have been approved under the scheme, of which 22 are operational.

  b. **Cold Chain, Value Addition & Preservation Infra:** The scheme aims to provide integrated cold chain and preservation infrastructure facilities along the entire food processing supply chain. It covers a minimal processing centre having weighing, sorting, grading, packing, storage, and quick freezing facilities. Grant-in-aid is provided for 35% - 50% storage infrastructure and transport infrastructure and 50-75% value addition and processing infrastructure. As of June 2021, 353 cold chain projects were approved, and 230 were completed.

  c. **Creation of Food Processing & Preservation Capacities:** The scheme aims to create and modernise processing and preservation capacities by increasing the level of processing and value addition, leading to a reduction in wastage. Under the scheme, a capital grant of 35-50% is given. As of February 2021, 145 projects were approved under this scheme.

  d. **Food Safety & Quality Assurance Infra:** The scheme aims to give the food and agro-processing sector a competitive edge in the market by creating infrastructure for safety and quality assurance services. Under this scheme, the government extends financial assistance of 50-70% for the cost of laboratory equipment and 25-33% for civil work, and 50-75% reimbursement for HACCP/ ISO Standards/Food Safety/Quality Management Systems. As of January 2021, 76 food testing labs were instituted under the scheme.

  e. **Agro Processing Cluster:** The scheme aims at cluster approach-based development of modern infrastructure and common facilities to encourage a group of entrepreneurs to set up food processing units. The scheme provides grants-in-aid of 35-50% of the eligible project cost. As of March 2021, 56 projects were approved under the scheme.

Private Initiatives

- The Private sector in India has also been actively participating in reducing food waste by investing in food processing and undertaking initiatives towards strengthening donations by participating in IFSA and undertaking food donation on an individual level.

- During the 5 years ending 2018-19, the food processing sector grew at an Average Annual Growth Rate (AAGR) of around 10.00% at 2011-12 Prices. The Food Processing Sector has also emerged as an important

segment of the Indian economy regarding its contribution to GDP, employment, and investment. India's food processing industry had a fixed capital investment of approx. Rs 245000 crs (2017-18) and attracted an FDI Equity Inflow of US $ 3.28 Billion from April 2014 to March 2019.

- While levels of secondary processing are high, additional focus is needed on strengthening farm gate infrastructure as primary processing plays an important role in increasing shelf life and reducing waste, especially of perishables.

- Several other initiatives are attempting to reduce food waste by focusing on collecting and distributing food donations.

a. **India Food Banking Network:** IFBN is developing an ecosystem for food security interventions to support thousands of feeding programmes in India by bringing the government, private sector, and NGOs together to fight hunger and malnutrition in India. IFBN works with the vision of establishing a strong and efficient network of FoodBanks throughout the country so that every district has access to at least one FoodBank by 2030.

b. **All India Roti Bank Trust:** AIBRT works across 20 cities in India with over 1000 volunteers to serve an average of 2,00,000 meals each month. The main aim of the organisation is to collect surplus edible food from various channels and distribute it among the needy with due dignity.

c. **Annakshetra:** The Jaipur-based NGO collects unused surplus food and makes it available to those in need through a network of volunteers. Between 2018 and 2021, they have recovered and redistributed more than 3 million meals.

d. **Feeding India:** The NGO channelises excess food from events, restaurants, weddings, corporates, etc., to beneficiaries in need and runs sustained feeding programs through their kitchens. Feeding India works with a network of 3,500 volunteers in 45+ cities of India and has served 5 million meals to people in need.

Vision 2030

- **Reducing food waste in India through raising awareness across households, retail, and industry.**

- **Reducing farm food waste and post-harvest losses of perishables from 40% to 20% by 2030.**

Pathways

POLICY

Date labelling affixed to food products is a major driver of food waste and an obstacle to food donation. Most food donors and recovery organisations are appropriately cautious about donating food that may no longer be safe. Still, it isn't always clear whether the date label accompanied by language such as 'sell by,' ' best before,' 'expiry' relates to food safety. In fact, date labels are generally intended to reflect freshness or quality rather than food safety. It is thus suggested that India should reconsider its labelling laws to move away from 'expiry' based labelling towards reducing waste.

At present, there are no tax incentives or any other monetary or recognition incentives for food donations in India. Also, Food donations (in-kind) generally cannot be used by companies to meet CSR requirements.

Several countries globally have focused on tax incentives towards encouraging food donations. For example, in Colombia, a 2016 tax reform confirmed that donors might claim a tax credit of up to 25% of the value of donations made to non-profit entities during the taxable year. Further, the country also ensures that value-added tax (VAT) does not deter food donations. It may thus be considered to amend India's GST law to include donated products to be eligible for input credit claims.

In India, at present, there is a void of information regarding the legal liability of donated food products. There is no Good Samaritan liability protection law for food donation. The lack of this deters food donation and increases wate levels. There are several global learnings on how liability protection can enable food donation. One of the best examples of strong Liability Protection laws is Argentina. Argentina amended its Food Donation Law in 2018 to include a new liability protection clause that extends to food donors and recovery agents that receive and equitable distribute free donations of food to the needy. It is thus suggested that clear and transparent guidelines be put in place for India towards providing clarity regarding the legal liability of donated food products.

For reducing the wastage of cooked food, the government can set up a service where they collect food from every source and set up a shelter where the hungry people can come and feed themselves for free or at a subsidized rate.

Pathways

IMPLEMENTATION

Raising awareness amongst citizens on the level and impact of food wastage towards reducing waste. Encouraging food redistribution or donation programs for reducing both food loss and waste.

Scaling up local food banks to collect food donations may be accessed by the needy or distributed as appropriate.

Strengthening food packaging innovations towards increasing shelf life of perishables.

Strengthening primary processing infrastructure, including sorting/grading, packaging, etc., towards reducing farm-level wastage.

Focusing on developing cluster-level infrastructure aligned with One District One Product Vision towards optimising output and reducing food waste.

Rationalising /Reducing portion sizes for consumers by restaurants and other foodservice providers can decrease food waste and save money for food providers since food portion sizes can dictate the amount of food waste. Larger portions increase the probability of waste as a consumer may not consume all the food purchased.

Pathways

KNOWLEDGE & RESEARCH

Creating a national-level benchmarking system for measuring Food waste.

Skilling up towards better handling and logistics protocols towards reducing food waste at the farm and transport level.

Prosperity

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Supporting Rural Livelihoods

5

Actionable Area

Promoting and enabling primary processing towards enhancing rural incomes through value addition and reducing waste.

Issue

- India leads production worldwide in several commodities, including shrimps, spices, fruits such as mango, papaya, banana, is the second largest producer of rice and has the largest population of buffaloes. However, India currently processes less than 10% of its agri output (only around 2% of fruits and vegetables, 6% of poultry, 21% of meat, 23% of marine and 35% of milk).
- In terms of India's exports as well, share of raw commodities is higher than processed goods. Processed foods only constitute 16% of India's agriculture exports; in comparison, 25% of US exports and 49% of Chinese exports are value-added. Reasons for low value-addition include relative lack of private sector investment and adequate incentives. Improved infrastructure can also in some instances help with value-addition.

Category	Total value of world imports, USD bn	Total value of India's exports, USD bn	India Share of market %	India Ranking	World leader	World leaders share of market
Processed F&V	52.4	.5	.9	18	China	15.6
Processed fish & sea food	97.2	4.4	4.6	6	China	14.6
Meat	101.8	1.7	1.6	10	USA	12
Dairy	77.9	.2	.3	35	New Zealand	14.3
Poultry & egg	24.7	0	.2	61	Brazil	22.2

Status

- During the 5 years ending 2018-19, the food processing sector has been growing at an Average Annual Growth Rate (AAGR) of around 10.00% at 2011-12 Prices. The food processing sector has also emerged as an important segment of the Indian economy regarding its contribution to GDP, employment, and investment.

- India's agriculture exports at USD 38.7 billion in 2019, a mere 7% of India's production, have stagnated over the last 5 years, with processing having only ~15% share. Despite a strong starting position, India, with a market share of 2.5%, ranks 13th globally, lagging several countries such as the Netherlands, Belgium, and Italy, not just in exports but also in export realisation.

- To scale up India's food processing basket, there is a need to strengthen primary processing at the farm level, including sorting/grading, packaging, drying, etc., while focusing on higher levels of value-addition is also required.

- While primary processing offers lower value-addition than secondary processing, which includes processing high-value items, viz fruits, and vegetables, dairy, bakery, chocolates, etc., it is crucial to enable distributed primary processing towards building upscale for higher-value processing.

Government Initiatives

- The Government has undertaken several initiatives towards scaling up food processing in general and focusing on primary processing, in particular, to enable better sourcing opportunities for processing, the reforms announced under the Prime Minister's Aatma Nirbhar Bharat stimulus package have indeed been gamechangers.

- The Agricultural Produce Market Committee (APMC) Act has been amended towards promoting barrier-free trade in agricultural produce. It will help farmers gain a better price for their produce by opening up more choices and reducing marketing costs. The freedom of inter-state trade will expand the market available to the farmers, which in turn will help them have better prices.

- During the period of the Covid-19 lockdown, several innovative direct procurement models were witnessed, wherein several large food processing companies stepped in to procure directly from farmers and Farmer producer organisation (FPOs), allowing a win-win situation for both parties.

- In line with the demonstrative success of these procurement models, the government has facilitated legalised engagement of farmers with processors, aggregators, wholesalers, large retailers, exporters. This will give great impetus to bulk buyers to invest in extension services to the farmers to improve productivity and return. The amendment to Essential Commodities Act is expected to encourage private investment into cold storage. It is also expected to grow the modernisation of the food supply chain, which in turn will help reduce food wastages.

- Moreover, to offset the challenge of small landholdings, there has been a dedicated focus on building farmer aggregation through the Farmer Producer Organisation (FPO) model. The FPO model allows farmers to leverage economies of scale towards better prices of inputs and technology, easier access to finance, and also allows them better control on prices and stronger market access of processed as wellas fresh produce.

- Several schemes have been launched towards Incentivising primary processing infrastructure. These include -

a. **PM Formalisation of Micro food processing Enterprises Scheme (PMFME):** The scheme has been launched for providing financial, technical and business support for upgradation of existing micro food processing enterprises. This will not only reduce wastages by enabling food processing at the grassroot level, but also improve farmer income levels.

b. **Creation/ Expansion of Food Processing/ Preservation Capacities (Unit Scheme):** The schemeaims to increase the level of processing and value addition, leading to a reduction in wastage. The setting up of new units and modernisation/ expansion of existing units are covered under the scheme. As of February 2021, 145 projects were approved under this scheme.

c. **Production Linked Incentive Scheme for Food Processing Industry (PLISFPI):** The scheme has been launched with the objective to support the creation of global food manufacturing champions; promote Indian brands of food products; increase employment opportunities for off-farm jobs, ensure remunerative prices for farm produce and higher income to farmers. The key components of the scheme include

- Incentivising production of four major food product segments viz. Ready to Cook/ Ready to Eat (RTC/ RTE) including millet-based foods, processed fruits &vegetables, marine products &Mozzarella cheese.

- Incentivising innovative/organic products of SMEs across all the above four food product segments, including free-range- eggs, poultry meat & egg products.

- Support for branding and marketing abroad to incentivise the emergence of strong Indian brands.

d. **Operation Greens:** Under the scheme, the MoFPI provides financial support on transportation of eligible crops (horticulture) from surplus production clusters to consumption centres; and/or hiring of appropriate storage facilities for eligible crops.

e. **Agro Processing Cluster scheme:** The scheme aims to enable a cluster approach-based development of modern infrastructure and common facilities to encourage a group of entrepreneurs to set up food processing units. As of March 2021, 56 projects have been approved under the scheme.

f. **Agri Infrastructure Fund:** The scheme will provide a medium to long-term debt financing facility for investment in viable projects for post-harvest management infrastructure and community farming assets through interest subvention and financial support.

Vision 2030

- **Increase on-farm primary processing through district-level primary processing clusters.**

- **Increase share of processed products in India's export basket from 15% in 2019 to 30% by 2030.**

Pathways

KNOWLEDGE & RESEARCH

Predominantly processed food is regulated by FSSAI, while there is no regulation for fresh produce. To enable the shift from primary production to primary processing, it is crucial to educate farmer groups and entrepreneurs on FSSAI regulations on pesticide, contaminants, toxins, labelling, etc., to ensure a smooth transition as they get integrated into larger supply chains. Additionally, in terms of market access, primary produce that meets safety standards will receive a higher market price, thus impacting rural incomes.

In the case of agri produce, produce wasted is equivalent to income loss. Thus, it is key to reduce post-harvest wastage levels towards improving rural incomes. Proper post-harvest protocol training, including time/technique of harvest, sorting/grading, pre-cooling, packing, etc., extends the shelf life of perishables and is crucial for reducing wastage and income loss. Such commodity-specific training should be disseminated on a large scale. While the partnership of industry and academia can be leveraged to develop commodity and region-specific protocols, KVKs can be leveraged for dissemination.

While there are Business incubation units for developing primary processing technologies at the national and state levels, the challenge remains to disseminate the access of information amongst farmers. Krishi Vigyan Kendras should thus be leveraged to develop an awareness of technologies and innovative products developed by several food processing training institutes and innovative solutions developed by start-ups for their greater adoption by farmers and micro-entrepreneurs through learning missions product showcases.

Increase awareness about government schemes to support investments into primary processing by connecting all KVKs on a digital platform for better dissemination of information.

Create small videos on schemes available for primary processing infrastructure and disseminate them in regional languages.

Pathways

POLICY

Also, common processing infrastructure such as packaging and bottling units, common cold storage for perishables, etc., should be encouraged. This will bring in scale towards primary processing and greatly improve the incomes of rural producers and entrepreneurs.

To catalyse investments and help encourage smaller farmers and entrepreneurs, access to long-term finance is necessary. Towards this, food processing should be treated at par with agriculture, and banks should be incentivised to pay equal attention to food processing companies. Food processing should be included as a separate priority sector and not just part of agriculture.

IMPLEMENTATION

It has been empirically observed that the price realisation of farmers is better for a processable variety of crops compared to table varieties. Thus, the cultivation of processable varieties amongst farmers and farmer groups should be promoted through workshops and capacity-building programmes to increase acreage under cultivation and build up a procurement base.

Given the potential of food processing towards impacting rural incomes, the power tariff for food processing industries should be set at par with the tariff on agriculture activities.

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Local Food Systems in Rural Areas

6

Actionable Area

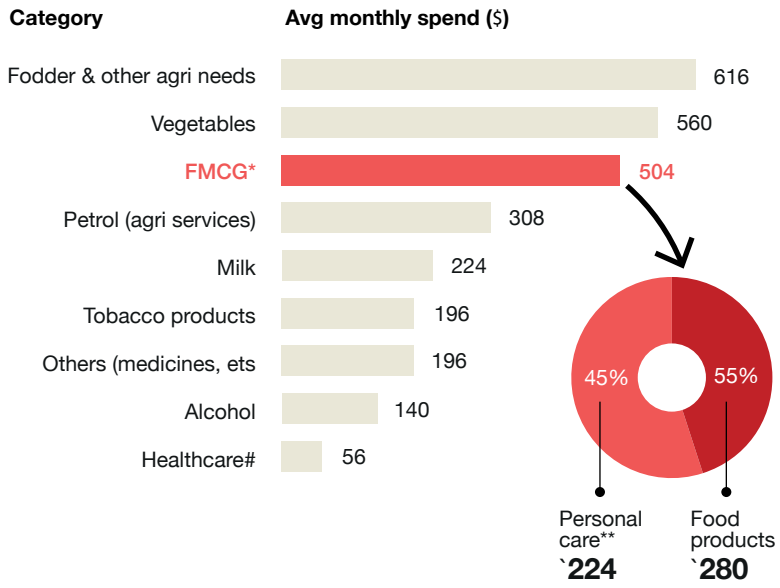
Focus on developing local employment and entrepreneurial opportunities and maintaining biologically diverse landscapes for sustainable intensification of agriculture by focusing on 3 'I's - Innovations, Incentives, and Institutions - that could help produce more diversified and nutritious food economically and in an environmentally and financially sustainable way.

Issue

- By 2030, India will become the first country to be home to more than 1.5 billion people. Consequently, the proportion of the rural population will decline from 69% to 61% as the urban population is projected to increase more than twice the projected increase in the rural population. While the percentage decline is seen, the rural population and people depending on agriculture will continue the same when it comes to absolute numbers. The landholdings are going to remain small. The transformation of urban industrial production systems towards automation etc also may not generate major employment opportunities. The current internal migration of 100-125 million people will stay and probably increase as the incomes in rural areas go down, and opportunities in urban areas may decrease.

- Along with this, the demand for food is expected to double, and the issue of climate change is projected to become severe in the years to come. These emerging challenges will have to be met, and food and agricultural policies will be molded accordingly.

Rural India's consumption patterns



Source: Rural Establishment Survey, Chrome Data Analytics. 2016

*Primarily soap, shampoo, hair oil, detergent, beauty cream, refined oil

#Includes Chyawanprash

**Skin care forms 16%, or `36, of personal care each month

- The COVID19 pandemic and the lockdown have exposed how a large section of our society is highly vulnerable with regard to food security, while agriculture has shown resilience as a sector. Food systems perform a central role in determining the quantity, quality, diversity, and nutritional content of the foods available for consumption and sustaining the livelihoods of 54% of the people dependent on agriculture in the country. In addition, food systems have a major impact on human health (both positive and negative) through various channels and on our planet's environment, ecosystem, and health.

- As such, how food systems function, the cost and quality of the food they deliver, and their impact on the health of people and our planet, directly and indirectly, impact outcomes of food security and nutrition. Any measure taken towards this must comprehensively consider these issues in design. Unfortunately, there had been a narrow focus on a few approaches since independence without understanding the overall implications and administrative and bureaucratic failures. The situation worsened after the 90s, with India opting for liberalisation and globalisation without strengthening its own support systems and climate change.

- The main problem seems to be the lack of a comprehensive and integrated approach and trying to solve today's and the futuristic problem with yesterday's knowledge. Three of the important challenges to ensure food and nutrition security for all are ecological degradation, climate variability and extremes, and economic slowdowns and downturns, which are exacerbated by the underlying causes of poverty and very high and persistent levels of inequality.

a. **Ecological Degradation:** Currently, 97.85 million hectares (mha) of land have already been degraded. Of this, 3.32 mha has been added in the 15 years between 2003-04 and 2018-19. Almost 37 mha of the degraded land is what the report classifies as agriculture unirrigated land. And water erosion is the most common reason (80%) for degradation of unirrigated farmland, followed by wind erosion (17%), salinity/alkalinity inland (2%), and waterlogging (1%). Loss of crop productivity, one of many negative impacts of soil erosion by water, has serious consequences for the country's food, livelihood, and environmental security.

b. **Climate variability and extremes:** These are the key drivers in the recent rise in global hunger. The impact of climate change is often underestimated, and agriculture's contribution to climate change is ignored. In reality, if farmers have to adapt to the changing climate, we need to understand climate change in a broader context of ecological, economical, and socio-political crises which Indian farmers are already undergoing.

The relationship between climate change and agriculture is three-fold -

- Climate change has a direct bearing on the biology of plant and animal growth.

- The changes in the farm ecology – such as soil conditions, soil moisture, pests, and diseases, etc.

- The ability of the existing social and economic institutions, particularly in rural areas, to deal with the challenges posed by global warming. In the larger context of food security and climate change, it is also important to consider other sectors like animal husbandry and livestock, which are closely linked with agriculture.

a. **Poverty and Inequality:** It negatively impacts the nutrition quality of diets. In all its forms, food insecurity and malnutrition are made worse by high and persistent levels of inequality – in terms of income, productive assets, and basic services (e.g., health, education) and, more generally, wealth. Income inequality, in particular, increases the likelihood of food insecurity – especially for socially excluded and marginalized groups – and undercuts the positive effect of any economic growth on individual food security. Structural vulnerabilities, including inequalities related to gender, youth, ethnicity, indigenous people, and people with disabilities, exacerbate poverty, food insecurity, and malnutrition during periods of economic slowdowns and downturns or following conflict and climate-related disasters. Furthermore, these levels of inequality are being accelerated by the COVID-19 pandemic.

b. In 2016-17 Government of India set up a committee for Doubling Farmers' Income (DFI) in real terms over seven years (2016-17 to 2022-23). All India Rural Financial Inclusion Survey (NAFIS) 2016-17 estimates that an average Indian farming household earned Rs 8931/month (Rs 1,07,172/year) in the agriculture year 2015-16. This is up from Rs 2,115 earned in 2002-03 as per NSSO's Situational Analysis Survey, implying a Compounded Annual Growth Rate (CAGR) of about 12% in nominal terms and 3.7% in real terms (2015-16 base). To achieve the DFI by 2022-23, the Dalwai committee points out that farmers' real incomes need to grow at 10.4% per annum, i.e., 2.8 times the growth rate achieved historically (3.7%) has not been achieved yet. Instead, it went down to less than 3.0% by 2017-18, and the achievement was far lower than the targets.

Initiatives

- Food security exists when all people have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and preferences for an active and healthy life. To achieve food security, India has taken a series of approaches, some influenced by developments across the world, some due to advocacy efforts of civil society groups and political parties, and the judicial system in India forces some. All these initiatives can be summarised as follows -

Approaches to Food and Livelihood Security

Productivity Enhancement
- Green Revolution
- Genetic Engineering
- Biofortification

Wealth Redistribution
- Land Reforms
- Forest Rights
- Livelihood Security

Social Protection Measures
- Food Security Programs
- Employment Guarantee
- Direct Income Support

Market Mechanisms
- APMCs
- Price Stabilisation
- Market Reforms

Vision 2030

- A significant focus on developing local employment and entrepreneurial opportunities can be provided by strengthening the local food systems.
- Maintain biologically diverse landscapes for sustainable intensification of agriculture.
- Focus on the role of Innovations, Incentives, and Institutions that could help produce more diversified and nutritious food economically and in an environmentally and financially sustainable way.

Pathways

POLICY

Rationalise subsidies as current subsidies distort cropping patterns and production practices.

Shift subsidies for more ecologically sustainable models of agriculture.

Focus on Income Security for farm households rather than on increasing yields since the progress of agriculture needs to be measured in terms of growth in incomes of producers than the increase in yields.

Invest in income diversification opportunities for small and marginal farmers.

Strengthen direct income support measures.

Correct price distortions.

Government should announce the Minimum Support Prices (MSPs) for all the crops along with approximate quantities which may be procured, and the states should decide the procurement quantity.

Give food security budgets to states based on the proportion of the targeted population and other criteria.

Strengthen the Farmer Producer Organisations (FPOs) and let them procure and distribute the grain grown within their region.

Pathways

IMPLEMENTATION

Promote multiple cropping models, kitchen (Nutri) gardens etc., to achieve a major local production and consumption goal.

Several changes have to be made in assessing MSPs taking all real costs into consideration as current price support policies are highly skewed.

If the farmers do not get access to the MSP for any reasonable price compensation mechanisms can be followed.

Decentralising procurement by developing state level and district level plans of cropping systems, the food produced, and the foods distributed under PDS.

Use the existing FPOs, women self-help groups, PACS, and other community organisations to procure and distribute the grains under various food security schemes. With this, the costs will go down significantly, and the subsidies and benefits can be passed on directly to the producers as they are the ones in crisis.

Develop a mechanism to compensate for self-consumption of food by the farmer's family, which is about 40%. Otherwise, it forces farmers to sell off what they produce and buy cheaper grains from PDS.

Linking urban food demand with rural prosperity while ensuring environmental sustainability will be essential to ensuring urban and rural food security.

Improve last-mile delivery of support services.

Develop a mechanism to identify actual cultivators since the current identification mechanism used for farmers based on land registration/ownership discriminates against tenant farmers, women, Adivasi farmers, and assigned landowners who may not have 'land records.

Written by:
Dr. G. V. Ramanjaneyulu is an agricultural scientist with the Centre for Sustainable Agriculture working on agroecological approaches, local food systems, and public policy issues.

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Empowering Farming Communities

7

Actionable Area

It is critical to optimise the usage of resources – land, water, agricultural machinery – and to negotiate better terms of trade, cooperation, and collectivisation among farmers, especially women.

Issue

- The green, white and blue revolutions have achieved food security in terms of calorie sufficiency, but input-intensive farming practices have dealt a blow to ecological sustainability. About one-third of the land area is degraded, becoming acidic, alkaline, or saline. Water is under stress, yields are plateauing, and the costs of cultivation are rising. The climate crisis exacerbates these problems threatening farmers' livelihoods and the country's food and nutrition security.

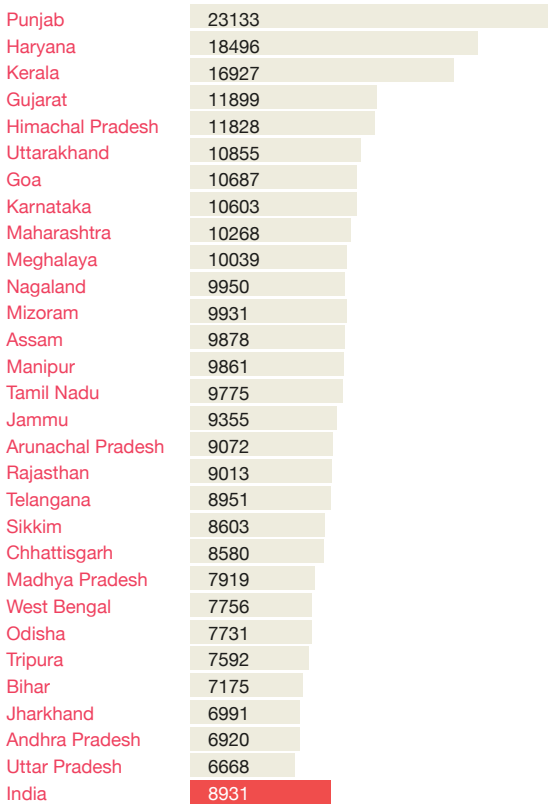
- Despite achieving a surplus in food production, the farming community is not assured of remunerative returns and income. A very large proportion (23% - 45%) of farming households in most central and eastern states live below the poverty line (BPL). This is significantly higher than the national average of 22.5%. Even in some so-called agriculturally progressive states, such as Gujarat, Karnataka, Maharashtra, and Tamil Nadu, the proportion of BPL farming households is 17.5% – 22.5%, close to the national average.

- Access to institutional finance at reasonable interest rates is often a challenge for small and marginal farmers, especially in central and eastern states. While they operate almost half of the area under cultivation, they only account for about a 9% share of total credit.

- Over 42% of India's population is dependent on farming, out of which more than 50% do not own land but work as wage labourers. The average size of the Indian farm has shrunk by more than half to 1.08 hectares over the last 45 years, with significant impacts on farming potential, the scale of production, adoption of technology, marketable surplus, credit, and ultimately profitability.

Monthly earning of agricultural households

State-wise comparison; Income in Rs



Source: NABARD All India Rural Financial Inclusion Survey (2016-17)

Major issues in empowering farming communities are -

a. Farmers do not benefit equally from government subsidy programs and employment guarantee schemes.

b. Some negative outcomes of interest subsidies and loan waivers include impaired credit discipline; weakened state finances; avoidance of agricultural finance by banks; inequitable treatment of farmers without access to bank loans; and elimination of the incentive for farmers to gradually move away from crops and agricultural practices, that, at market interest rates, would be un-remunerative.

c. 38% of farm households depend on non-formal sources, with 30% relying exclusively on informal sources.

d. At least 60% of India's districts are facing water stress. There is a visible mismatch between existing water endowments and the water demanded by water-guzzling crops.

e. There is no overt emphasis either in policy or in execution for encouraging participation of women in FPOs.

Status

- India has showcased an impressive growth trajectory from a food-scarce to a food-sufficient and, finally, a food surplus country. This was made possible with the infusion of innovative technologies, supportive policies and institutions, and the adoption of high-yielding varieties of wheat and rice, with intensive water, fertilizers, and pesticides.
- However, not all farmers are profiting equally from government support and subsidies such as free electricity, cheap fertilisers, no income tax, and assured Minimum Support Prices (MSPs). The slew of subsidy programmes demands more funds than productivity-enhancing investments in irrigation, roads, electricity, research, and development. The composition of total investments in agriculture shows that farmers bear the brunt themselves (78.2% of investments are from households) while public investments constitute a 19.4% share. The private corporate sector accounts for less than 2.5% of investments in the agriculture sector.
- The agriculture sector employs 80% of all economically active women comprising 33% of the agricultural labour force and 48% of self-employed farmers in the country. The National Rural Livelihood Mission (NRLM) has mobilised women from rural areas into self-help groups and is taking up skilling of women farmers in sustainable agriculture. However, the huge government initiative to promote Farmer Producer Organisation (FPOs) is still largely gendered agnostic.

Vision 2030

- **We need farmer-centric policies, institutions, systems, and processes to promote sustainable agriculture. Farmers, especially women, require financial security, access to information, and alternative solutions to manage risks and learn new skills.**

Pathways

IMPLEMENTATION

Institutionalise farmers' collectives as crucial elements of an efficient agricultural extension system and multipliers for innovative farming technologies.

Develop water use protocols (pumping, sequencing of water use, distance norms between wells and tube wells) through participatory water management systems.

Facilitate convergence between FPOs and MGNREGA, e.g., for the creation of farm ponds.

Facilitate financial services for small farmers through farmers' collectives.

Pay the highest attention to warehousing (both cold and dry).

Drastically increase insurance coverage to encourage farmers to embrace new ways of farming while protecting them against weather extremes. Use funding allocated to subsidising interest rates and loan waivers for crop insurance schemes. Initiate and scale-up mutual insurance with re-insurance of covariant risks using the existing network of self-help group federations and farmers' collectives.

Ensure women's asset ownership, access to technical training for production and value addition, access to institutional credit, markets, and women-friendly equipment.

Ensure joint ownership of land and other agricultural assets.

Ensure women membership in FPOs to provide institutional space and improve access to different services. Enable women self-help group networks to play a larger role in negotiating spaces for women producers.

Result-oriented convergence between NRLM and other ministries dealing with food production and value addition to leveraging the strength of women self-help groups.

Support interdisciplinary administrative units at the district and local levels.

Institute a single-window system for promoting integrated farming systems.

Pathways

POLICY

Develop State-specific and context-specific strategies for the next decade on improving farmers' income and different levels of agriculture development, including plans for different agro-climatic regions.

Systematically collect regional best practices and promote their scale-up through well-designed policy and operational advocacy.

Develop models for different climatic zones with a focus on small and marginal farmers in rainfed areas with the participation of farmers. Focus policy and practices on maximising incomes beyond food production.

Align and converge central and state government policies and schemes for sustainable incomes and the welfare of farming communities.

Assess policies, programmes, and budgets to remove discrimination against women and ensure affirmative actions.

KNOWLEDGE & RESEARCH

Assess any new policy or policy change for its impact on different actor groups in the larger food system.

Written by:
Ms. Girija Srinivasan, who is an expert in development finance and rural livelihoods with over 30 years' extensive experience.

With inputs from:
Mr. PVS Suryakumar (NABARD); Mr. Yogesh Sawant, Dr. Rajashree Joshi and Mr. Girish Sohani (BAIF); Mr. J. P Tripathi (ACF); Dr. Kalpana Sankar (hand in hand); Malika Srivastava (CMF); Ganesh Neelam (Tatatrusts); Mr. Roopak Bhat; Dr. Janak Palta McGilligan (Jimmy McGilligan Centre For Sustainable Development); Mr. Govind Dash (Gram Utthan); Yogesh Bellani (Field fresh); Mr. Rajeev Ahal, Ms. Neha Khara and Mr. Ashirbad Das (GIZ); Mr. Kirti Mishra and Mr. Santosh Gupta (Ecociate).

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Food Safety in the Informal Sector

8

Actionable Area

Support and strengthen the participation of street food vendors in the implementation of food safety programmes to ensure safe and nutritious food for all consumers.

Issue

- Street foods play an important socio-economic role in meeting food and nutritional requirements of city consumers in the lower and middle-income groups at affordable prices. They are also appreciated for their unique flavours, tastes, and convenience. Street foods also assure food security for the low-income urban population and livelihood for a significant proportion of the people. They are also important in contributing to the nutritional status of the population.

- In contrast to these potential benefits, it is also recognised that street food vendors are often poor, less educated, and lack knowledge in safe food handling, environment, sanitation and hygiene, mode of food display, foodservice, and handwashing, sources of raw materials, and use of potable water. Consequently, street foods are perceived to be a major public health risk. According to India's Ministry of Urban Poverty Alleviation, there are over 100 lakh street vendors in the country, roughly 20 lakh of them food sellers.

- The traditional processing methods used in the preparation of street foods, inappropriate holding temperature, and poor personal hygiene of food handlers are some of the main causes of contamination of street foods. Also, the foods are not effectively protected from flies and dust. For the sake of public health, it is important to understand the epidemiology of foodborne illnesses. This will help in prevention and control efforts, appropriate allocation of resources to control foodborne illness, monitoring and evaluating food safety measures, development of new food safety standards, and assessment of the cost-effectiveness of interventions.

Street Story

There are over 10mn street vendors in India. NASVI's report based on 10 cities and other research agencies estimates,

30% vendors are of age group 21-30 years while 51% are in age group 31-50 years and 12% are in the age group of 61-80.

40% street vendors are illiterate

82% sell perishable goods, while 71.5% are stationary vendors and 29% are fruit sellers

65.5% of vendors store their goods at home, 33.5% keep it at their vending place while only 1% use rented space.

70.5% vendors spend between 8-12 hours on the street, besides two hours for cleaning and display.

- Application of Hazard Analysis Critical Control Point (HACCP) will also help identify and control hazards for different types of products prepared and sold on the streets. Along with general training to vendors on good hygiene practices, each vendor needs to understand the critical control points for their product and how to prevent and manage hazards in a cost-effective manner.

- Street food vendors are not dependent on any institutional structures to find their livelihoods. Their enterprises evolve exclusively around their strengths and the support extended to them by their immediate social networks such as family members and other close associates. The earnings from their business enterprises are a means of living for the vendors themselves and their dependent family members. As such, these economic activities of the street food vendors have provided a source of livelihood and have reduced the plight of their becoming an economic and social burden on the state.

- Street vendors face unique kinds of livelihood risks. The most pressing and ongoing risk is the possibility of forcible eviction by local government authorities from their business place on streets and even confiscate their merchandise. The risk of displacement often increases in the context of elections, mega-events, or efforts to beautify historic city centres.

- Street traders face several routine occupational hazards as well. Many have to lift and haul heavy loads of goods to and from their point of sale each day. The physical environments in which they work typically lack proper infrastructures, such as clean running water, toilets, and solid waste removal. Street vendors are exposed to physical harm from the improper provision of fire safety equipment and the traffic regulations in commercial areas. They are also exposed to a high concentration of air pollutants and inclement weather. Income and earning risks are also common to many street vendors. Harassment on the part of local authorities is a common source of income risk.

- Street vendor's legal status can act as a bridge between their employment conditions and the range of employment risks they face. For example, a vendor with a fixed structure in a designated market may be more likely to hold a license or permit, and in turn, would be less exposed to certain kinds of risks. Likewise, a street food vendor who works as an employee selling a particular product may be better protected by law and, therefore, less vulnerable. Therefore, obtaining a legal status of some kind is a key demand of street trading organisations in many cities.

- Street food vendors mostly come from economically weaker sections of society. This section of the urban poor tries to solve their problems through their meagre resources. The study on street vendors in seven cities shows that the average earnings range between Rs. 40 and Rs. 80 per day. Women vendors earn even less.

Status

- In June 2020, the Ministry of Housing and Urban Affairs (MoHUA) unveiled the 'Pradhan Mantri Street Vendor's Atma Nirbhar Nidhi (PM SVANidhi)' scheme to support street vendors in regaining their livelihoods. It was to provide easily repayable loans of up to Rs. 10,000, with the government hoping that it would benefit over 50 lakh street vendors in India. According to government data, nearly 30 lakh applications were received, with the Centre sanctioning a little over half of them. More than 7.5 lakh loans were disbursed as of November 2020. But, going beyond the mandate of this scheme, the government wants to use the data for comprehensive poverty alleviation. The NSSO data estimated that around 200,000 women and 21,500 children were also engaged in street vending.

- Bureau of Indian Standards (BIS) had published Indian Standard IS 16066:2017 for street food Vendors for food safety requirements, including control checkpoints covering all aspects of the process flow using Level 1 and 2 methods.

- Covid-19 pandemic has restricted consumers from stepping out and forced them to follow physical distancing norms. In the given scenario, it is important to connect Street Food Vendors with technology-enabled platforms to help them grow their business, thus helping them gain financially. As a part of the PM SVANidhi Scheme, the MoHUA entered into MoU with Zomato and Swiggy, the largest online platforms for ordering and delivery of food in India, to onboard street food vendors on its food-tech platform. This will give street food vendors online access to thousands of consumers and help these vendors grow their businesses. MoHUA has coordinated with the key stakeholders, including Municipal Corporations, FSSAI, Zomato, and GST officials, to ensure that street food vendors are facilitated in completing the necessary prerequisites for this initiative. Further, MoHUA launched the mobile application for PM SVANidhi se Samriddhi- Socio-economic profiling of PM SVANidhi beneficiaries and their families to link them to various Central Government Schemes.

- FSSAI is responsible for ensuring safe and hygienic food to citizens. In addition to the mandatory regulatory requirements for street food vendors, it has initiated a "Clean Street Food Hub" initiative under the "Eat Right India" umbrella to uplift food safety and hygiene in street food vending through a cluster approach. Recognition of these clusters involves auditing and training street food vendors in basic food safety and hygiene. Clusters meeting eighty per cent of specified benchmarks framed for street food safety and hygiene will be declared as "Clean Street Food Hub". So far, a total of twenty-eight hubs have been recognised.

Vision 2030

- Support & Strengthen the participation of street food vendors and local communities in improving food safety and sanitation management.
- Enhance Public-Private Partnership involving municipalities, street food vendors, FSSAI, BIS, food business operators, consumers, and stakeholders to ensure a safer, healthier, better nourished India.

Street Vendors Act - Compliance Index (SVACI), 2017

Gujarat among states having least compliance with new street vending law, Delhi highest

State	Rank	SVACI score
Delhi	1	75
Andhra Pradesh	2	64
Chhattisgarh	3	63.3
Jharkhand	4	58.59
Tripura	5	58.5
Manipur	6	57.86
Mizoram	7	56.81
Kerala	8	55.92
Maharashtra	9	50.88
Karnataka	10	49
Punjab	10	49
Odisha	10	49
Goa	11	48.42
Assam	12	44.87
Bihar	13	41.71
Himachal Pradesh	14	38.7
Tamil Nadu	15	37
Gujarat	20	14

Pathways

IMPLEMENTATION

App-based quick learning lessons for consistent training, list of approved vendors and affordable sourcing from local market suppliers for purchasing, standardised RM/PM/serving plates/PPE/Hygiene kits/ waste management etc. at affordable rates.

Promote sustainable mobile vending platforms or kiosks for selling goods.

Monitor free moving vendors who form the major bulk of street vendors by using simple assessment procedures.

A rigorous evaluation of the microbial loads of street foods should be conducted throughout the year.

Launch a mobile app to receive citizens' feedback on food safety, hygiene street food stall, covering all vendors, and use the feedback for further relevant actions as required.

Involve college and school students with local food vendors in the promotion of food safety and hygiene check.

Provide hygiene kits, model vending carts and other better facilities like water storage, covered display unit, heating/cooling facility through company CSR funds to empower vendors.

Pathways

POLICY

Local-self-governments should integrate street vendors into market architecture by giving them proper space to earn their livelihood and basic necessary facilities and support at the workplace.

The local authorities should recognise the importance of this informal sector and provide identity cards as proof of legal business. Identify natural markets in town to make it easier to integrate vendors via relocation as per trade.

Do more research to determine the nutritional contribution of street foods in consumers' diets.

Preparation and promotion of guidelines for street food vendors based on the products they sell and handle.

Introduce inspection and monitoring by approved third party experts at regular intervals.

TRAINING

Strengthen capacity building, hand-holding, and infrastructure on food safety and hygiene culture development, good storage practices, good manufacturing practices, integrated pest management, and food nutrition regularly.

Conduct capacity-building programmes on the usage of online delivery applications and use digital marketing for payments. Localised delivery networks could be encouraged where the larger delivery platforms don't work.

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Connecting Consumers and Producers

9

Actionable Area

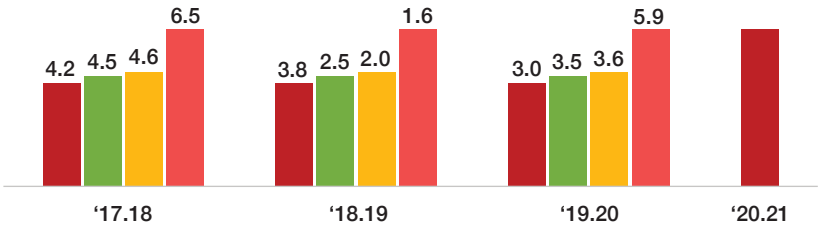
Initiate bridging producer-consumer integration with technology and digital intervention as an enabler in the value chain and effectively use social capital for transforming the food system.

Issue

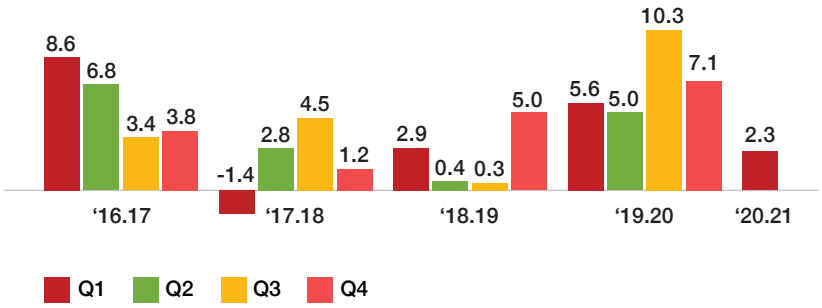
- India's current population of 1.38 billion, 17.7% of the world's population, will surpass China by 2030. This means consumers are increasing fast.
- India accounts for 2.4 percent of the global land, farmers in half the Indian states are marginal (land less than 1 ha), and the remaining are small farmers (landholdings of 1-2 ha). About 58 percent of the total workforce in the country is still engaged in agricultural and allied sector activities, which accounts for approximately 17.8 percent of the country's Gross Value Added (GVA) for the year 2019-20, the share of crops and livestock contribute about 85 percent of the overall agriculture output.
- The composite average growth rate (CAGR) in the last 30 years has been satisfactory. However, producers and consumers face several constraints, including input supply, technical expertise, credit availability, storage support, transport, output quality, and organic market connection. The Producer Support Estimate (PSE) for India was negative 11.2% of the value of farm receipts between 2000-01 and 2019-20, while Consumer Support Estimate (CSE) was one of the highest in the world at 28.8 percent.

Growing Strong

Gross value added for agriculture & allied activities at constant prices (FY12) (%)



Difference between current and constant prices for GVA in agri & allied activities (%)



Source: MoSPI, Government of India

- In the overall food system, the non-technical subsystems such as governance, institutions, policy and regulations, and social norms are influential institutions. The base characteristic of this ecosystem is usually historically rooted, socially dynamic, cross-regional and works at cross-scale interactions among many processes and actors, and is culturally sensitive in multi-cultural settings. Thus it is systemic in an emergent rather than a planned sense. Social capital becomes an important carrier of the whole ecosystem.

- At a macro level, the unpredictability of agricultural production and the demand, risk in supply chain and value chain, absence of the organised social networks of producers, and volatility in the aggregation of platforms are critical challenges in a sustainable food system.

- India loses around USD 12.5 billion in terms of rejection at farm gate and loss during distribution. There is about 5-18% waste in the fruits and vegetable sector, 4-6% waste in farm produce and poultry and fish food loss is between 6% and 12%. The reasons for Post-harvest losses (PHL) are inadequate storage infrastructure, lack of knowledge on storing practices, inadequate timely market access, and small farm holdings to scale up, which account for 80% of the farm holdings.

- The traditional agricultural Value chain has been long with many intermediaries, which has created low returns for producers and a high price for consumers. A lively relationship between producers and consumers were never established given the volatile behaviour of the market intermediaries.

- The quality of the produce, adulteration at source and in transit, information asymmetry about the product and supply chain, and lack of transparency are concerns in the producer-consumer connection ecosystem. They affect customer order-to-fulfilment lead-time (CLT), supplier order-to-fulfilment lead-time (SLT), the complete cycle time (CT), and the delivery-to-customer lead-time (DTC).

Status

- Towards making the systems robust and more efficient, market integration activities are getting designed for better outcomes. Developing a unified market for agricultural commodities, India launched the Electronic National Agriculture Market (eNAM) in 2016 by networking existing Agriculture Produce Marketing Committees (APMCs), primarily to increase the choice of the farmers' produce for sale in 'Mandi'. The immediate future looks at 22,000 'Mandis' and about 7,500 APMCs connected with eNMA, which expands the ecosystem of the producer network. This has brought in the unorganised produce community on a platform offering efficiency and scale.

- In policy environment, introduction of Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020 and Farmers (Empowerment and Protection) Agreement of Price Assurance and Farm Services Act, 2020, The Essential Commodities (Amendment) Bill, 2020 and Farmer Service Bill 2020 argue to favour farmers directly for their products and reduce the value chain benefits transferring partial advantages to consumers.

- Market actors and stakeholders such as input suppliers, farmers, and other producers like FPOs and cooperatives, intermediaries, food processors, traders, consumers, and others in forwarding and backward integration are experimenting with new business models. The collaborative models of cooperatives/ FPOs with corporate chains, small farmers clustering to 'Haats', technology-led facilitation, and end-to-end solution to producers by companies are success cases, but the scale is big to manage in India.

Vision 2030

Creating self-sufficient, inclusive, integrated, fair, sustainable, and technology-led global value chain ecosystem delivering food & health assurance by the producer-consumer partnership. The producer structure, expertise, network, partnerships, and alliances optimising the management cost, screening cost, and transfer cost would make the efficient producer-consumer relationship commercially beneficial.

Pathways

POLICY

Create a food system execution council (FSEC) to plan, execute and monitor the sector requirement. This can be attempted with the help of technology to avoid delivery asymmetry. Developing the tracing of the produce model, the value distribution in the value chain, partnership value acquisition, and automation of data collection and analytics for policy.

Develop quality standards and marks for safe and traceable farms and food.

Launch programs and schemes of incentivisation to produce safe, natural, organic foods.

Rationalise the logistics cost of farmers to leverage the digital marketplace.

Pathways

IMPLEMENTATION

Promote consumption-linked production, i.e., understanding food consumption patterns of both domestic and exports markets and taking those to the producers.

Mapping the consumer behavior for taste, preferences in the food sector and accordingly developing the market systems.

Dialogues and discussions at the farmers' end and orienting them around the market systems assured market for farmers and risks associated.

Promoting federation of FPOs, cooperatives, and SHGs as the new set of institutions to address the market and marketing-related challenges.

Netting the demand side by active engagement with consumers' associations, hotel associations, industry bodies like CII, FICCI, PHD chamber of commerce.

Creating capacity-building programs to achieve the goals and actions in Traceability Agenda, i.e., reduced cost of cultivation, improved productivity and product quality, and food safety and certification norms.

Develop a contract farming financing model by the buyer to the farmer.

Developing products of crop assured insurance, weather insurance, market risk insurance with smart claims management system.

Develop micro-farm market with smartphone technology connect and offer packaging, branding, logistics support to produce the high end.

Develop dual transaction systems, i.e. farmers as consumers for commodities, input supplies, and services like finance, insurance, logistics.

Pathways

KNOWLEDGE & RESEARCH

Develop the designs of traceability and modelling the engagement of produce and supply chain stakeholders, i.e., farmers, FPOs, cooperatives, cold chains, retailers, etc.

Develop local, regional, national, and global models of traceability in food systems.

Develop scalable best practices and dissemination to replication.

Create comprehensive digital and data system at Gram Panchayat level since Digital ecosystem is being laid down for two-way communication towards support and connect

Design local level network (LLN) initiatives to connect producers and consumers such as Residents Welfare Associations in urban settlement and FPOs connect.

Frame the inclusive institutional system connecting PDS, CBOs, and private players.

Develop and design capacity-building programs for all stakeholders in new food systems requirements, including policymakers, intermediaries, financial institutions, FPOs, and smallholders.

Develop responsible consumer education programs for deeper engagement.

Enhance multilateral and bilateral agencies' role in building social capital and social infrastructure to directly link with consumers.

Develop commodity-specific systems of measurement of food waste at each level of supply chain and value chain and bring the circular economy principles into practice.

Written by:
Rahul Singh is Professor and Area Chair of Strategy and Business Policy at Birla Institute of Management Technology, Greater Noida

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Farm Technologies

10

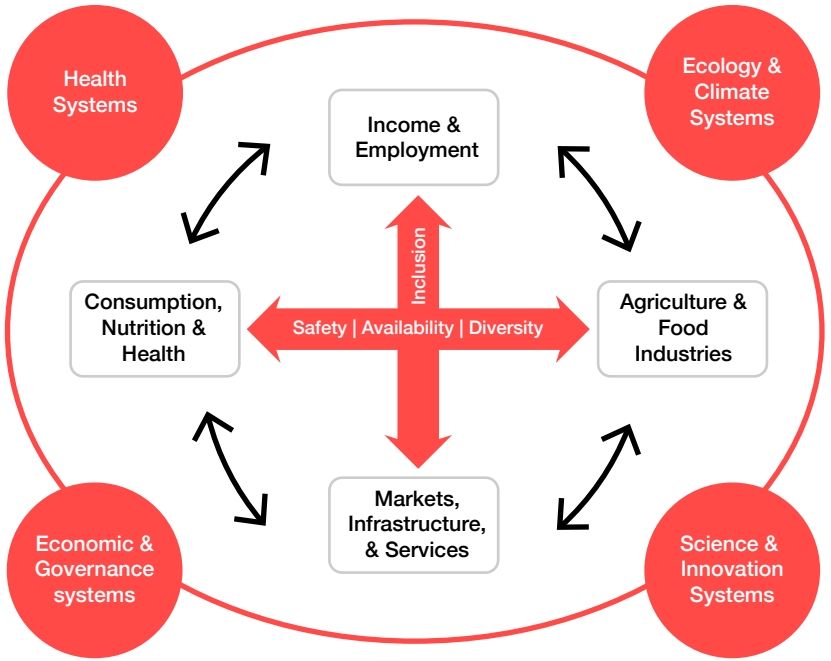
Actionable Area

Providing access to all the small and marginal farmers in the on farm technologies that are already developed for testing, demonstration and adoption.

Issue

- Indian population is expected to surpass China in 2027 as the world's most populous country. Though Green Revolution has tripled the food grain production with only a 30 percent increase in land under cultivation, this growth in food production has challenged the country's resource base, resulting in varied economic access to nutritious diets indicating high rates of stunting amongst children. The resource-intensive food production systems of the past 7 decades in India, the challenges of nutritional security, and the degrading resource base in the country call for transformation in food systems.

- Anchored by the Indian Council of Agriculture Research (ICAR), technological contribution towards production and productivity enhancement has made significant strides in the last few decades. Contributions from this public system to the fields of germplasm conservation, varietal/breed improvements, good agricultural practices, pre-production – production – post-harvest equipment and machinery, processed food compositions, and shelf stability for diverse products from Camels, Goat, Poultry, Mithun, supply chain technologies, climate-smart technologies (soil, water, nutrient conservation, and crop husbandry) has been multi-fold. These technologies, which hold huge potential, need to find their way to on-farm adoption.



- India's economic growth since independence has seen the co-existence of the 'best' and 'not so best'. Despite India's economic progress, the persistence of regional inequalities, and malnutrition exacerbated by the growing population, the country can get into a public health challenge if not addressed immediately.

- These nutritional deficiencies in society result from various challenges that the three principle stakeholders of India's food system, viz., 'producer', 'consumer', and the 'value chain player', are facing. Indian food systems are fraught with multiple dimensions from farm gate to the consumer plate.

- Various challenges at the ecosystem level include (a) Deteriorating quality of natural resources viz., soil (overuse of nitrogenous fertilisers and very low use of micronutrients), water (overuse of groundwater to depletion levels), and air. (b) Climate change (rising temperatures, frequency & distribution of rainfall – droughts & floods). (c) Poor access to land, credit, technology, and infrastructure to marginalised communities in the food production systems.

- Various challenges in food production and distribution constituted (i) Fragmented landholding and continued decline in landholding size – with implication on increasing extension, aggregation and agency costs which in a way influences both the availability, access, and cost implications at consumer plate; (ii) Food supply system losses to the tune of 40% leading to inefficient use of production factors; and (iii) Poor logistics in agriculture (input supply, produce aggregation and connect of rural-urban production-consumption centres) and urbanisation leading to high transaction costs.

- Challenges of Indian food systems at food basket level include – (a) High emphasis on twin staples; (b) Calorie sufficiency focus and neglect of quality & diet diversity; (c) Differential dietary / nutrition requirements across socio-economic strata of the society; and (d) Mismatches in consumer demand (for diversified foods) and production planning – leading to issues of cost, access, convenience, and the default choice.

- While India is aspiring to harvest its demographic dividend, it is time nutritional security with an implication on the mental & physical growth of its population is paid at most attention, a pre-requisite to the economic and social progress of the Nation.

- Technological innovations in the supply chain have been fundamental drivers of dietary change throughout human history. A shift to healthy and sustainable food habits would need transformation in the land use, crop diversity, aggregation, and seamless supply to the end consumer through big data analytics, given smaller land sizes in India and disaggregated supply centres. An analysis of land use to deliver a healthy diet to everyone revealed that land under cereals, oil crops, and sugar crops would decline by 150, 105, and 30 million hectares, respectively. For vegetables & fruits, it would increase by 170 million hectares.

- The multi-dimensional transformation is only feasible through higher digital inclusion that can potentially increase on-farm technologies to farmers, especially the majority – small and marginal categories. The technologies developed by public and private systems are demonstrated and facilitated for adoption through strong digitally-driven extension systems.

Status

- With its large network of research institutes, bureaus, directorates, and research centres contribution of ICAR has been into diversified fields of the Indian food system such as genetic improvement, farm machinery (viz., pea depoding machine; poultry processing cum by-product collection unit), value chain efficiencies (viz., Ultraviolet disinfection system, fat-free flavoured makhana, adulteration testing kits for chillies, black pepper, turmeric powder, red chillies, black pepper, coriander), food processing & products (viz., primary makhana roasting machine, soy-based composite edible film, a natural dye extracted from the walnut hull, etc.,). While these technologies are piloted, demonstrated, and disseminated through 722 Krishi Vignan Kendra across the country, measuring the success of such technologies' adoption at the producer level and by the food industries are the need of the hour.

- In the age of Google-led translations and free vernacular tools available, professional agencies can reach out to the partially literate at a low cost. It is high time to reach the end-user, and technology adoption finds a place in the evaluations.

- A World Bank report suggested that 'The digital revolution—and the data it generates—are key to building an agriculture and food system that is efficient, environmentally sustainable, equitable, and able to link the world's 570 million farms with 8 billion consumers'. Given the challenges discussed in the above sections, the aspirations of the directorate of digital agriculture to support 'farmers in informed decisions – crop choice, varietal choice, time and practices for yield maximisation', 'planning by supply chain players based on timely and precise information, 'decision by farmers on when, where and what price to sell' etc., are in the right direction.

- In the recent past, India witnessed the growth of various big data analytics / digital startups that can offer relevant and need-based advisory services ranging from nutrient advisory, crop advisory (pest and disease forecasting, detection) to weather and market advisory, that can potentially bring inefficiencies in the production and supply systems through resource use efficiencies from farm gate to consumer plate. An indicative illustration of such technologies is provided below:

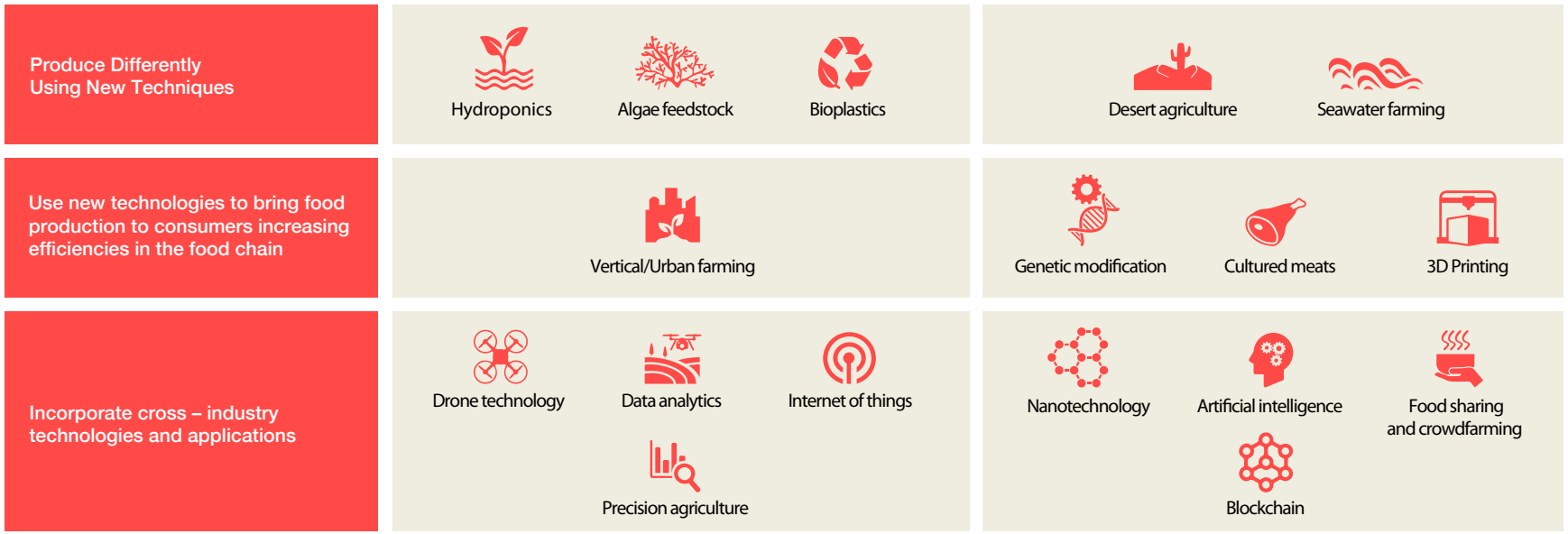
Application utility for farming	Examples
Identification of nutritional status and advisory	Chlorophyll Metre
Pest-disease forecast, diagnosis & package of practices recommendation	Plantix, Cropin / mKrishi / Kisan Suvidha / Kisan Hub
Supply of good quality agri-inputs	Dehaat / Big Haat / Agro Star
Facilitate irrigation water use efficiency	Agsmartic / Kisan Raja / Flybird
Weather advisory	Skymet / Satsure / Yuktix
Access to warehouses with credit linkages	Ergos, Arya Collateral
Access to farm machinery	Oxen Farms / EM3 / Gold Farms
Technology based financial access	KisanDhan/ Arya Dhan / Origo

- Such individual digital technologies that are hitherto unable to offer services at affordable prices are to be brought together for integration viably and sustainably. Private Sector curated models such as ITC e-Choupal, TCS's mKrishi, Better Life Farming Alliance, EM3 are harvesting the technology-driven efficiencies through their model scale-up in multiple geographies.

Vision 2030

A strong digital backbone of the country is in the making. The farming community across geographies and diverse resource bases is provided access to the on-farm technologies already developed for testing, demonstration, and adoption. On the lines of the UID mission pursued by the country, the inclusion of all the small and marginal farmers by 2030 is the principle means of transforming the food systems for a sustainable future.

Map of technologies and maturity



Source: Report published by The World Government Summit, 2018

Pathways

POLICY

Agricultural extension and advisory services are strengthened towards technology adoption, sustainable production practices, and remunerative income for producers.

Promote staple diversity through policy-driven crop planning and strengthening MSP procurement mechanisms through public-private partnership especially achieving synergies through technological interventions.

IMPLEMENTATION

Innovate the farm technologies on the dimensions of their frugality, adaptability, and relevance of market demand.

Supporting the use of digital technologies with data analytics and the internet of things (IoT)

a. In achieving resource use efficiency at the farm level.

b. In enabling supply chain efficiencies from farm gate to consumer plate.

c. In demand aggregation and production, planning to align production with changing consumer preferences and needs.

d. In popularising various processed products and technologies that are already developed for wider currency and consumer acceptance.

Supporting outcome-driven partnerships between technology agencies and public-funded institutions in the ambit of Digital Agriculture. Encouraging private sector investments into technology agencies that cater to the needs of end-users (producer/consumer).

Pathways

KNOWLEDGE & RESEARCH

Communication between MSP and PDS data stacks and promotes nutritious cereals and pulses for the beneficiaries of PDS.

Mainstream use of modern media tools for information exchange and technology transfer.

Written by:
Dr. Saikrishna Nanduri is the Chief Executive of NSFI (A Not-for-Profit Organisation based out of Gurugram) and is the member of Committee that brought out ninth volume of Doubling of Farmers' Income Report on "Farm Linked Activities and Secondary Agriculture: Adding Value to Primary Produce and Building Agricultural Enterprises in the Rural India".

With inputs from:
Dr. Basavaraja H, Professor of Agricultural Economics [Retired], University of Agricultural Sciences, Dharwad

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Research and Innovation

Actionable Area

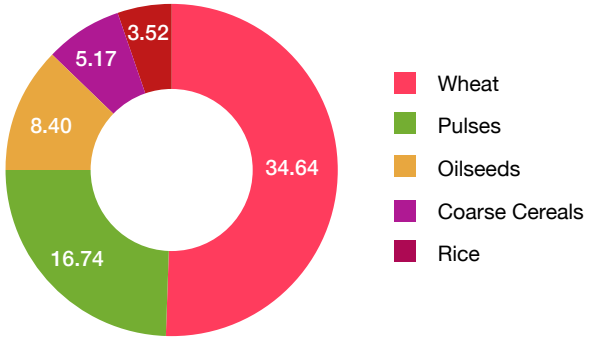
Promote research and innovations by academic institutions in the agriculture and food sectors for enhanced production and access to safe and nutritious food to contribute to a healthy society and future.

Issue

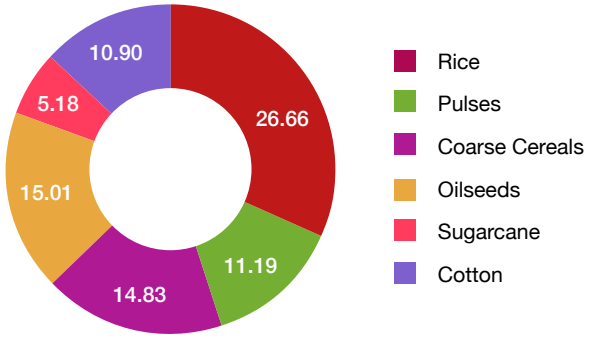
- More than ever before, people are mindful of the food they eat, its source, safety, quality, nutrition value, and cost today. Focus on Research & Development towards pre and post-production quality management of food is therefore critical. Sustainable food systems are interconnected and represent the full agri-value chain, from pre-production and production to supply chains and consumption. Thus, R&D focus is needed in areas like genetic resource improvement, good agricultural practices, post-harvest management, food processing, packaging, and food waste management.

- There is increasing demand to develop high-yield, climate-resilient varieties of agro produce, lengthening or shortening their harvest cycles based on end-use, and introducing processable varieties. There is also a need to develop cost and energy-efficient post-harvest management technology, improve shelf life, and innovate on the packaging front. In response to consumer demand for specialty products based on “clean labels,” new ingredients, functional foods, alternative protein sources, gut health, and bioactive formulations are also gaining R&D focus. Further, traceability is gaining center stage in the changing market dynamics, and R&D focus on the production and processing side will help meet this requirement.

Rabi area sown in 2020-21 (million hectares)
(as on January 29, 2021)



Kharif area sown in 2020-21 (million hectares)
(as on January 31, 2020)



- The resilience of India's agriculture production has been an outcome of synergy among the scientists and researchers fraternity in the National Agricultural Research System (NARS), comprising the Indian Council of Agricultural Research (ICAR), state agricultural universities (SAUs), etc. Further, various research Institutes and centers work on the food processing side like CFTRI -Mysore, Indian Institute of Technology-Kharagpur, NIFTEM-Sonipat IIFPT-Thanjavur, etc.

- Constant technological improvements have led to a four times increase in food grain production, six times in horticultural crops, nine times in fish, and 27 times in eggs since 1951. More than 5,000 ecologically sustainable crop varieties and hundreds of animal breeds have been developed by ICAR institutions for maintaining a resilient food system. With the advancement in mobile technologies, the expanded reach of disease and pest surveillance mechanisms to farms has effectively reduced crop losses. To address malnutrition, several bio-fortified crop varieties have been released recently. Conservation of nearly one million diverse plant and animal genetic resources has maintained India's tag of a biologically diverse country. In the last decade, the compound annual growth rate of patents filed in the agricultural sector in India was 12.5% — higher than the global growth rate of 11%. This indicates the underrated strength of Indian R&D in agriculture.

- Still, agricultural R&D in India has a long way to go; to develop solutions tailored to the local needs of particular crops and agroecologies. This calls for invigorating the scientific temper, focusing on problem-solving as part of the human resources capacity, and fostering R&D funding.

- India's gross expenditure on R&D (GERD) has been consistently increasing over the years and has nearly tripled from Rs. 39,437.77 crore in 2007- 08 to Rs. 1,13,825.03 crore in 2017-18. But, it still hovers around only 0.40% of agricultural GDP while most other countries spend more than 1%. Government expenditure, almost entirely by the Central Government, is the driving force of R&D in India, in contrast to the advanced countries where the private sector is the dominant and driving force of R&D spending. There is a need for greater participation of state governments and the private sector in overall R&D expenditure in India, especially in application-oriented research and technology development.

- It's time for the agriculture and food sector to have a long-term strategy focusing on food systems within each agro-climatic region per se, instead of a generalised food production strategy. The cornerstone of success in bringing about a more vibrant agricultural sector lies in increasing agricultural R&D expenditure to at least 1% of agricultural GDP, thereby charting a trajectory of higher and inclusive growth and making the national plan of doubling farmers' income in the near future possible.

- Apart from funding, quality of research is another area of concern as many institutes do not have mandatory research goals for individual faculty, and most do not have adequate systems or infrastructure for quality research. The need for sharing knowledge between research institutions and industry has become increasingly evident in the present scenario. Through collaborative approach can also be leveraged for planning and policy decision-making.

Status

Government Initiatives

- India has one of the largest agricultural research systems in the world with the largest number of scientific personnel of any developing country engaged in research and education relating to agriculture and allied areas.

- The research system includes approximately 30,000 scientists and more than 1,00,000 supporting staff actively engaged in agricultural research. The present agricultural research system comprises essentially two main streams - the ICAR at the national level and agricultural universities at the state level. Although agriculture is a state subject, ICAR has established many central research institutions over the years to meet the research needs of the country. There are about 4 deemed universities, 44 national institutions, 15 national research centres, 6 national bureaux, 13 directorates/project directorates, and around 8 Agriculture Technology Application Research Institutes (ATARIs).

- 'Lab to Land'programme launched in 1979 by ICAR intends to improve the economic condition of small, marginal farmers and landless agricultural labourers by improving their access to technology. The program is supported by a network of 722 Krishi Vigyan Kendras (KVK; Agriculture Science Centres) across India which fall under the jurisdiction of one of the 11 ATARIs.

- The World Bank aided National Agricultural Technology Project (NATP) is also being implemented by the ICAR and the Department of Agriculture and Co-operation (DAC) since 1998. It aims at improving research and extension services. R&D initiatives are also supported by 15 National Research Centers under ICAR.

- While ICAR is focusing on technology innovation and dissemination, AgriInnovate India is helping in technology commercialisation through technology transfer, incubation, contract manufacturing as well as JV and equity investments. All the technologies developed by ICAR institutions across India are commercialised by AgriInnovate via licensing and technology transfer to relevant stakeholders across Agri-Food value chain.

- On the processing side, the Ministry of Food Processing Industries (MoFPI) has been extending financial assistance to undertake demand-driven R&D for the benefits food processing industry in terms of product and process development, efficient technologies, improved packaging, value addition, etc. Standardization of various factors like additives, coloring agents, preservatives, pesticide residues, chemical contaminants, microbiological contaminants, and naturally occurring toxic substances within permissible limits is also a focus area of R&D in processing.

- The Government of India has taken several initiatives to enhance investment in R&D as well as to promote and improve the overall research eco-system in the country. These include Uchhatar Avishkar Yojana (UAY), which promotes industry-sponsored, outcome-oriented research. 25% of the funds under UAY are contributed by the Industry. Impacting Research Innovation and Technology (IMPRINT) focuses on socially relevant research in higher educational institutions. Establishment of 9 research parks at a total cost of Rs. 775 crore, 8 of them being in the Indian Institutes of Technology (IITs) and one in the Indian Institute of Science (IISc) will propel innovation through incubation and joint research between academia and industry. Prime Minister's Research Fellows (PMRF) Scheme incentivises the most meritorious students to pursue research in the frontier areas of science & technology by offering attractive rates of a fellowship from Rs.70,000/- to Rs.80,000/- per month in addition to research grant of Rs. 2.00 lakh per year for five years.

Vision 2030

- **Increasing R&D spending to at least 1% of GDP from agriculture, food processing and nutrition sector.**
- **Ensuring close interaction between industry, academia and research Institutes for carrying out application research meaningfully.**
- **Strengthen the scientific and technological capacity to move towards more sustainable consumption and production.**
- **Creating an ecosystem for outcome-oriented and applied research.**

Pathways

IMPLEMENTATION

Lab to land scale-up operations should be at a higher pace.

Academic institutions should create a framework for evaluating technology solutions developed by startups and scaling the commercialisation of the tested innovations.

Strengthen linkages between Indian research and academic institutions and the global academic system to help Indian scholars understand and contribute to advanced scientific developments.

Facilitate inter-disciplinary interaction within existing top Indian institutions and universities to expand in size and meet the diversity needed.

Create specific allocation of grants to encourage scientists to test their ideas commercially.

Strengthen the curriculum of education boards to integrate food safety and nutrition aspects for much larger dissemination to create mass awareness.

Develop and disseminate the post-harvest handling protocols for crops, especially export-worthy ones.

Pathways

POLICY

Research focus needs to be on commercially viable and need-based solutions.

Develop a collaborative framework between the research machinery and the private sector.

Mandate academic institutions to have a minimum number of industry-funded PhD researchers with well-defined and milestone-based focused objectives.

Make special allocations for the upgradation of infrastructure and technical capabilities in the testing & research labs.

Offer tax concessions to scale up private participation in research.

A mechanism should be put in place for better convergence amongst the research institutions to reduce repetition in areas of work.

KNOWLEDGE & RESEARCH

Assessing the "Input use Efficiency" and "Cost of production" with respect to various commodities is important to understand the need for developing climate resilient varieties or shifting cropping patterns.

Focus research on co-product and by-product utilisation for minimising food losses and waste.

Regulatory research which are relevant to the information on the adopted international standards and prepares us future-ready.

Indigenously developed processing facilities that can work for traditional produces of the Indian subcontinent.

Research in traceability to ensure sustainable growth of crops.

designed@woodapple.in