

# Future of Food

## FOOD SUSTAINABILITY FOR 8 BILLION POPULACE



## Introduction

In the words of Malthus, a famous population geographer, **population increases in a geometric progression (i.e., 2, 4, 16, 132...)** while **food production increases in arithmetic progression (i.e., 2, 4, 6, 8...)**. With the global **population recently passing 8 billion**, governments across the globe face the challenge of further increasing food production, without exacerbating environmental degradation, soil health and climate crisis. **Additionally, as the population is projected to reach 10 billion by 2050, a better understanding of how a diverse range of food system functions is critical in ensuring sustainable food security.**

The sustainability of the **food security is also being influenced from the demand side. With changing lifestyles and increasing imprint of technology, consumer behavior is also increasingly focusing on healthy, hygienic and nutritionist diet** for their overall wellbeing.

In this context, we'll discuss about what is a sustainable food system? What are the emerging challenges to global food systems? What measures have been taken to address the challenges? How technology is impacting the food systems? What is the way ahead to build resilient food systems for future?

# What is a Sustainable Food System?

Sustainable food system (SFS) is a food system that **delivers food security and nutrition for all** without compromising the need of future generations in such a way that it is:

- **Profitable throughout** (economic sustainability).
- **Broad-based benefits for society** (social sustainability).
- **Positive or neutral impact on environment** (environmental sustainability).

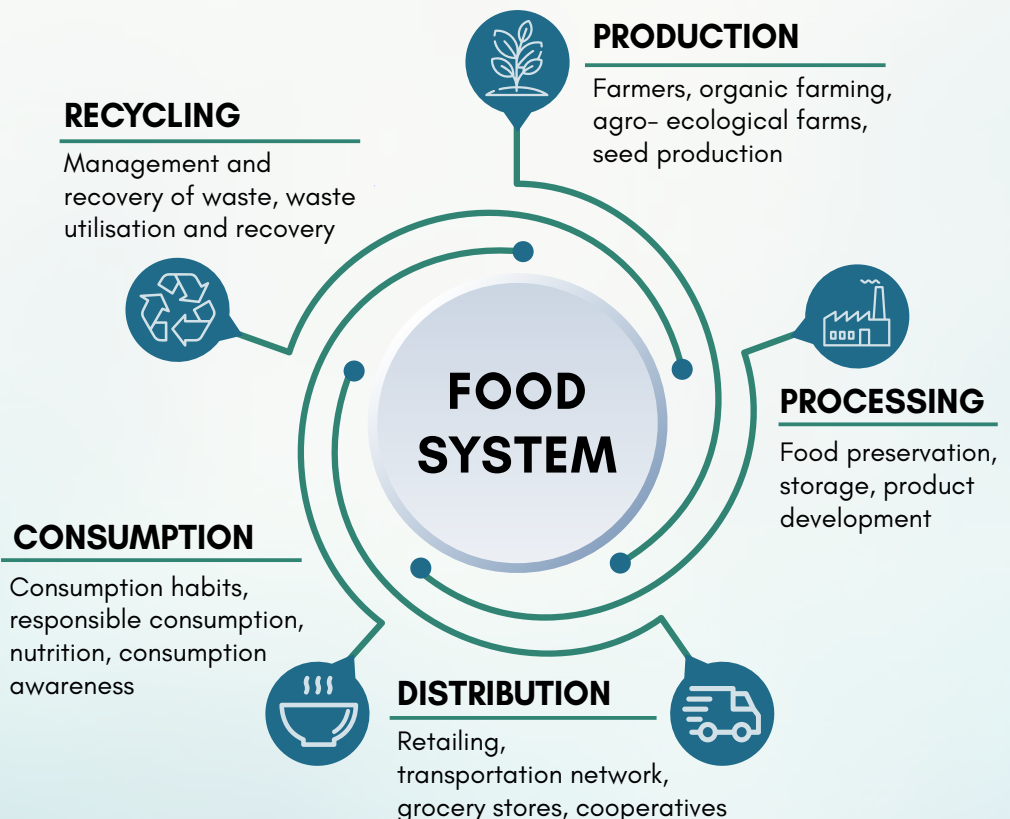
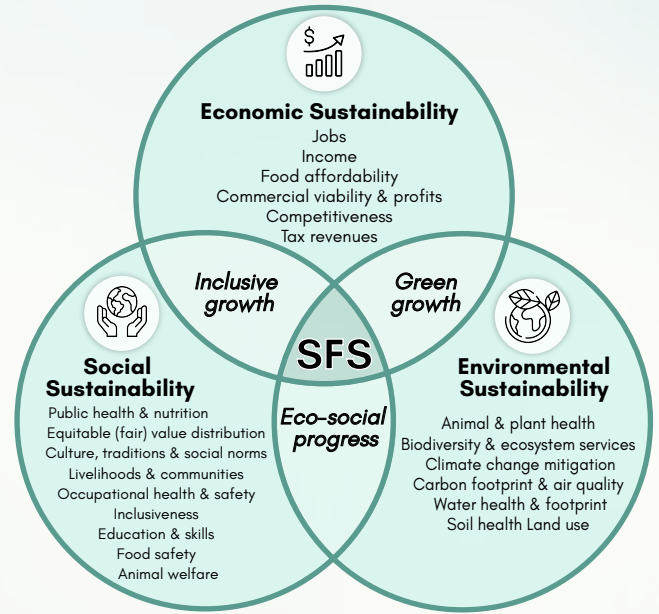
Food systems (FS) encompass the **entire range of actors and their interlinked value-adding activities** involved in the production, aggregation, processing, distribution, consumption and disposal of food products that originate from agriculture, forestry or fisheries.

- It **is composed of sub-systems** (farming system, waste management system, input supply system, etc.) and **interacts with other key systems** (energy system, trade system, health system, etc.)
- **Structural change in the food system can originate from a change in another system.** For example, a policy promoting more biofuels will have a significant impact on the food system.

There are **different types of food systems,**

- **Conventional FS:** Maximize production, lowers consumer costs, and provide safe and reliable food products.
- **Alternative FS:** Dynamic structures of food production, distribution, acquisition, and consumption. It includes Local, Organic FS, etc.
  - **Local FS** refers to **food distribution by smaller-scale farmers who sell directly to consumers** or to nearby restaurants and grocery stores.
  - **In Organic FS,** farmers and food handlers avoid using artificial agro-chemical inputs, including pesticides, synthetic fertilizers etc.

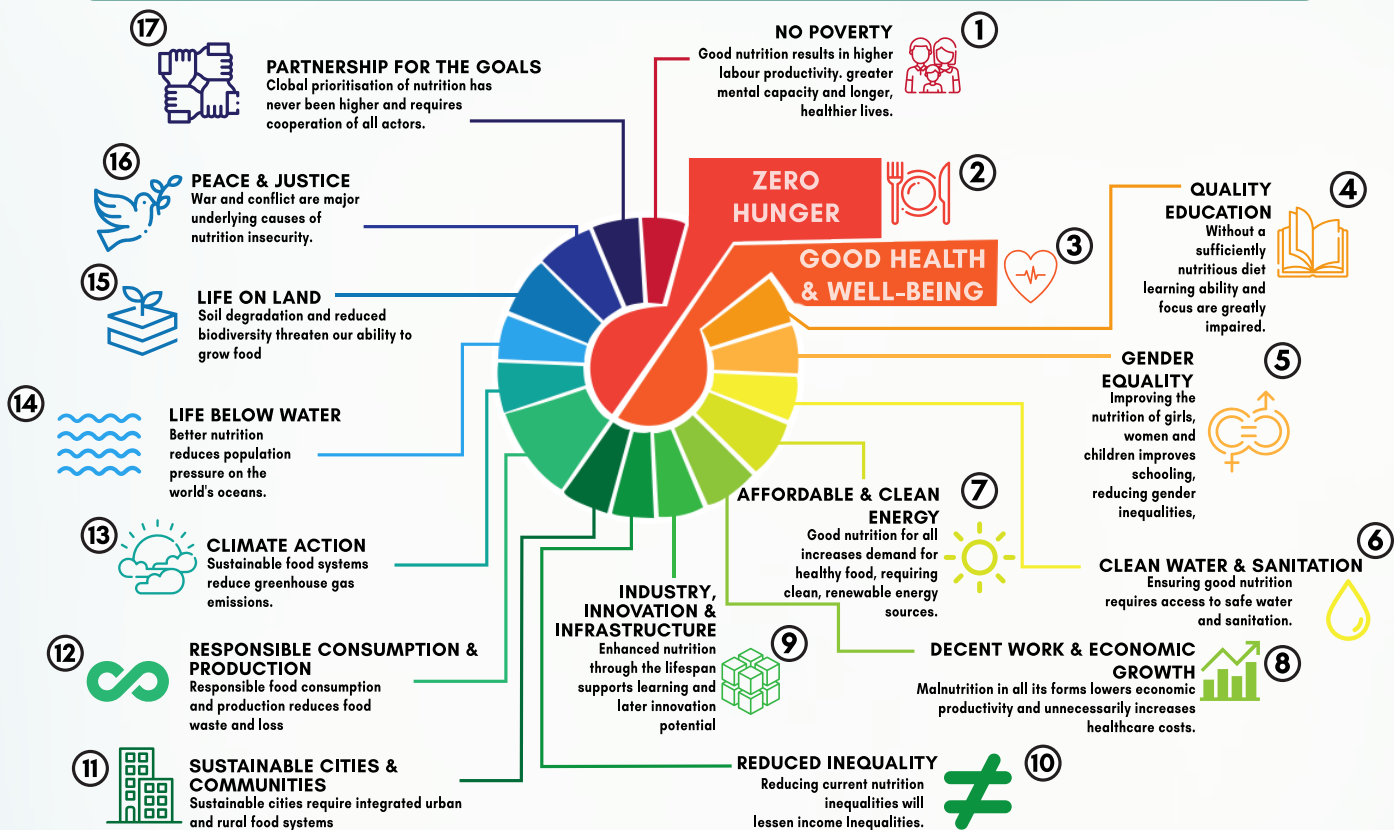
## Importance of Sustainable Food System



# Global Food System and Sustainable Development Goals (SDGs)

UN Food Systems Summit 2021 was convened as part of **Decade of Action to achieve SDGs by 2030**. It was **guided by five Action Tracks** i.e., nourish all people, boost nature-based solutions, advance equitable livelihoods, decent work and empowered communities, build resilience to vulnerabilities, shocks and stresses, and support means of implementation. It aims to **launch new actions to deliver progress on all 17 SDGs**, and plans to transform the way world produces and consumes food.

## Food Security and Nutrition & Sustainable Development Goals



## What are the emerging challenges to global food systems?

Current food system is rife with inequalities and other issues. This is hampering our food security alongside impacting the environment negatively. The integrity and security of food is of increasing concern due to challenges which exist within food system. These include:

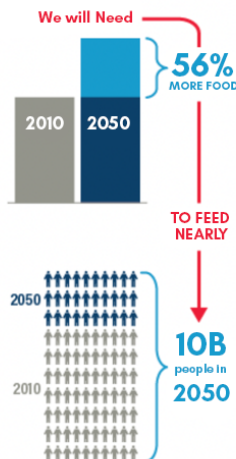
### • Environmental Challenges

- Climate change:** Extreme climate and weather events like **increase in temperatures, changes in precipitation patterns**, etc. all result in **reduced food production** with far reaching influences on crops, livestock, fisheries etc.

◆ According to a study by Cornell University, **climate change has reduced farming productivity by 21%** since 1961.

## CREATING A SUSTAINABLE FOOD FUTURE BY 2050

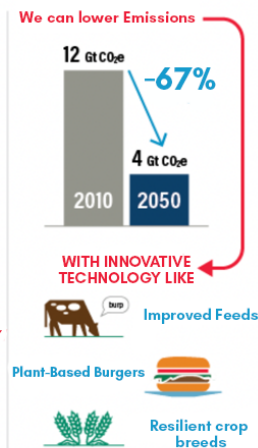
How do we feed 10 Billion people...



...Without using more land...



...While lowering emissions?













- **Crop Damage:** In India, over 339 lakh hectares of crop area were lost due to hydro-meteorological calamities like cyclones, cloud burst, droughts, etc. during 2015-16 to 2021-22.
- **Risks of Pests and Diseases:** Pests and diseases reduce crop productivity, compromise sustainability, reduce food availability and affect the quality of production.
  - ◆ India has faced major invasive pest and weed attacks.
  - ◆ For instance, **fall armyworm destroyed almost the entire maize crop** in 2018 and India had to import maize.
  - ◆ Also, **Locust attacks in the country damaged at least 200,000 hectares** of crops across **10 states in the last two years.**
- **Environmental Externalities:** Agriculture is a major contributor to pollution in many regions of the world through the use of synthetic input.
  - ◆ **For instance,** intensive pesticide and fertiliser use has resulted in the **accumulation of organic pollutants in the region's soils and eutrophication in water** in China's Yunnan province.
- **Biodiversity loss:** FAO's State of the World's Biodiversity for Food and Agriculture report points to **decreasing plant diversity in fields, rising numbers of livestock breeds at risk of extinction** and increase in proportion of overfished fish stocks.
  - ◆ Out of 6,000 plant species cultivated for food, fewer than 200 contribute to global food output, and only nine account for 66% of total crop production.
  - ◆ Out of nearly 7800 breeds of livestock reported globally, 26% are at risk of extinction.
  - ◆ Nearly a third of fish stocks are overfished, more than half have reached their sustainable limit.
- **Deforestation:** Agriculture is one of the biggest drivers of deforestation. **Farmland expansion is responsible for 90 percent of deforestation** around the world which in turn hurts the food production of existing farmland.

## ● Socio-Economic Challenges

What are the emerging challenges to global food systems?		
Environmental	Socio-Economic Challenges	Global Challenges
 <b>Environmental Externalities</b>	 <b>Poor agricultural practices</b>	 <b>Supply Disruption</b>
 <b>Biodiversity loss</b>	 <b>Rapid Urbanisation</b>	 <b>WTO Trade distortions</b>
 <b>Deforestation</b>	 <b>Consumption Pattern</b>	
 <b>Risk of Pests and Diseases</b>	 <b>Increased Biofuel Production</b>	
 <b>Crop Damage</b>	 <b>Supply side issues</b>	
 <b>Climate change</b>	 <b>Population</b>	

- **Poor agricultural practices:** Indiscriminate **use of chemical-based inputs** like fertilisers, pesticides, herbicides etc. have led to **groundwater contamination and soil degradation.**

- ◆ **Monoculture cropping** has led to increased **susceptibility of farms to pests and pathogens** as there is no native plants stopping the pests from destroying the crops.
  - ◆ As per study by Council on Energy, Environment and Water (CEEW), **less than 4 percent of Indian farmers have adopted sustainable agricultural practices** and systems.
- **Increased Biofuel Production:** Increased devotion of agricultural land to **produce food-based bio-fuels has resulted in global displacement** of people and rise in food prices.
  - ◆ For example, large land allocations in Tanzania have been reported as involving the displacement of local farmers.





◆ This is because the **incentives to produce biofuels** have raised the global competition for land.

This has **made it harder for smaller farmers to compete or maintain control** of their property

■ **Supply side issues:** Institutional gaps in the supply chain, for instance, dependence on APMC markets in India, **lack of focus on quality and safety standards** impact supply of food items and production of value-added products.

■ **Population:** Due to the constant **increase in population every year**, the food system faces challenges regarding producing adequate amounts of food to feed the entire humanity.

■ **Rapid Urbanisation:** As cities continue to grow, water—key resource for agricultural production—is becoming scarcer and often wasted because of excessive domestic and industrial use, thereby **endangering food supplies**.

◆ In **developing countries, poor urban dwellers are thus at risk of consuming insufficient and low-quality food including street food**, which may be unhygienic, exposing them to health risks.

■ **Consumption Pattern:** Overconsumption, inadequate distribution through public distribution system and food waste put unnecessary pressure on the food system.

◆ One in three people suffer from malnutrition (wasting, stunting and underweight); **micronutrient deficiency**.

◆ Food wastage is common across all stages of the food chain. Nearly **13.8% of food is lost in supply chains** — from harvesting to transport to storage to processing.

## ● Global Challenges

■ **Supply disruption:** Shocks to global supply chains that manifested in the latest Ukraine–Russia crisis has led to global food inflation.

◆ **This related dependency on food assistance** is affecting the access to and affordability of food. Also, ban on wheat export by India led to spike in global wheat prices.

■ **WTO Trade distortions:** Trade distortions are arising out of the steps taken and imposed by World Trade Organisation (WTO) and its members on agricultural exports.

◆ For example, European Union import tolerance Maximum Residue Level (MRL) of 0.01 ppm (parts per million) for the majority of pesticides. These trade measures could adversely affect agricultural exports from India and other developing countries to EU.

◆ **Non-Tariff Barriers:** Imposition of non-tariff barriers like sanitary and phytosanitary conditions on imports from developing countries.

➤ For example, USA restriction on Mangoes import due to packaging norms imposed by USA.

### Mega Trend Nutrition–Consumer Behaviour Challenge

- The idea of **sustainable nutrition is becoming embedded into all innovation by food producers and decision-making of consumers**.
- This **mega-trend refers to nutrition that is produced and delivered in a way that is mindful for people, the planet, and society**.
- This means an **increased focus on sustainable farming and sourcing practices, closed-loop supply chains, finding health and nutrition value in waste streams**, as well as development of solutions to feed populations in need.
- With **obesity and stress rising in a tech-oriented world, the food systems** must cater to this consumer behaviour by striving towards customised, tailor made diets.

### MEGATREND SUSTAINABLE NUTRITION



PLANT-BASED  
FUTURE



BOTANICAL  
BOOM



MOOD, COGNITION  
& SLEEP



MICROBIME  
BEYOND DIGESTIVE HEALTH



BODY-POSITIVE  
WEIGHT MANAGEMENT



NUTRITION  
ACCOUNTABILITY  
AMPLIFIED



IMMUNE  
HEALTH



PERSONALISED  
NUTRITION



TECHNOLOGY  
& THE FUTURE  
OF FOOD



ACTIVE  
AGEING

## Impact of Covid-19 pandemic on Food and Nutrition

In order to contain spread of COVID-19 pandemic, governments have imposed restrictions on mobility, temporary closure of markets, private, and government organizations. This **impacted all aspects of food systems** from production, distribution, and storage to food environments, consumption, and waste.

- **Food production and distribution:** Pandemic impacted **food production as crop, livestock and fishery** have been hit hard. Impact on livestock farming is due to **limited access to animal feed and shortage of labour**. Travel ban **affected the delivery of breeding stock** of poultry. Such disruptions **reduced food exports and imports** in global market.
- **Food demand and food security:** Demand of food has been affected due to **reduction in income and purchasing capacity**. Consumers were **stockpiling the foods** which in turn has **affected the food availability and price**.
  - **Consumption of animal protein decreased** due to misleading perception of animal as a reservoir of virus, leading to **food insecurity**.
  - Food insecurity **affected poorest and most vulnerable segments** of population. At present, 820 million people are facing chronic hunger and 113 million are facing acute severe insecurity.



Across the globe, many nations announced a slew of measures to tackle the situation. India also announced a series of measures to support the country's most vulnerable population and food security of their citizens.

- **Prime Minister Garib Kalyan Anna Yojana (PMGKAY):** It provides **5 kg of free foodgrains** (rice, wheat, or combination of both) **per person per month** and **1 kg of free pulses per family per month** to 80 crore beneficiaries **registered under NFSA, 2013**.
- **Atmanirbhar Bharat Scheme:** It provides **5 kg of free foodgrains** per person per month and **1 kg of free whole gram** per family per month to migrant laborers, stranded and needy families, **who are not covered under NFSA, 2013**.
- **Digital Transformation of Public Distribution System (PDS): National Informatics Center has developed software applications** that have been made available to all states and union territories.
  - These applications include modules for procurement, food stock reporting, ration card management, and Fair Price Shop (FPS) automation, etc.

## What measures have been taken to address the challenges associated with food system?

To address the above challenges with respect to food system and ensure nutrition security in the nation, several initiatives has been taken both at national and global level.

### National Level

#### ● Production

- **National Mission for Sustainable Agriculture (NMSA):** It addresses risks associated with climate change by devising adaptation and mitigation strategies for **ensuring food security, equitable access to food resources** and enhancing livelihood opportunities.
- ◆ It is one of the eight Missions within the National Action Plan on Climate Change (NAPCC).

■ **Climate Smart Agriculture (CSA):** CSA is an integrated approach of managing landscapes- cropland, livestock, forest, and fisheries- that addresses the interconnected challenges of food security and rapid climate change.

◆ Under **Sensor-based Smart Agriculture (SENSAGRI)** project in India, drones would be used for **monitoring soil and crop health**, collecting precious information and transferring the data to farmers on a real-time basis.

■ **India Digital Ecosystem of Agriculture (IDEA) framework:** It aims to **build a National Digital Agriculture Ecosystem and elevate agriculture** to higher levels of efficiency and productivity, and improve the welfare and income of farmers.

■ **National Food Security Mission (NFSM):** It is a **centrally sponsored scheme** that was launched by Government of India through National Development Council (NDC) in 2007.

◆ It aims to **improve the production and productivity of wheat, rice and pulses** on a sustainable basis through **productivity enhancement, restoring soil fertility and productivity**, and enhancing farm level economy.

◆ Also, it helps to **raise farmers income** through enhanced technologies and farm management practices, and **ensure food security** in the country.

■ **Integrated Schemes on Oilseeds, Pulses, Palm oil and Maize (ISOPOM):** It is a centrally sponsored scheme and implemented by **Ministry of Agriculture & Farmers Welfare** to increase **production of oilseeds** including soyabean in the country.

### ● Processing

■ **Mega Food Park Scheme:** Implemented by **Ministry of Food Processing Industries (MoFPI)** to boost food processing sector by **adding value and reducing food wastage** at each stage of the supply chain with particular focus on perishables.

■ **Production Linked Incentive Scheme for Food Processing Industry (PLISFPI):** It aims to support the **creation of global food manufacturing champions**, promote **Indian food product brands**, increase **employment opportunities** for off-farm jobs, and **ensure remunerative prices** of farm produce and higher income to farmers.

◆ It is a central sector scheme and launched by MoFPI.

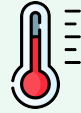
■ **Foreign Direct Investment (FDI):** 100% FDI is **permitted under automatic route** in food processing sector and 100% FDI under Government approval route is allowed for retail trading, including through e-commerce, in respect of food products manufactured and/or produced in India.

■ **Food irradiation centres:** India and Russia signed a pact to set up **25 integrated infrastructure centers for irradiation treatment of perishable food items to improve shelf life and cut post-harvest losses.**

◆ In irradiation, food products are subjected to a low dosage of radiation to treat them for germs and insects, increasing their longevity.

■ **Eat right India movement:** It was started by **Food Safety and Standards Authority of India (FSSAI)**. It aims to **transform the food ecosystem** in the country and usher in a culture of safe, healthy and sustainable food processes and practices.

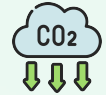
### Three Pillars of Climate Smart Agriculture



Helps farmers build resilience to adapt to climate change



Sustainably increases agricultural production and incomes



Reduces greenhouse gases, where possible

### RATION GIVEN UNDER PUBLIC DISTRIBUTION SYSTEM

ANTODAYA ANNA YOJNA



Per Household

PRIORITY HOUSEHOLDS



Per Person





● **Distribution:**

- **National Food Security Act (NFSA), 2013:** It aims to **ensure people' food and nutritional security by assuring access** to a sufficient quantity of high-quality food at reasonable prices.
  - ◆ It provides **subsidised food grains to 75% of India's rural population and 50% of its urban population** under Targeted PDS. (refer image)
- **Antyodaya Anna Yojana (AAY):** It is one of the public distribution system schemes in India implemented from 2000 to ensure food security and to create hunger-free India.
- **Promoting sustainable local food systems for a better rural-urban connect in India project:** It aims to improve people's access to food that is clean, safe and nutritious.
  - ◆ To achieve its goal, it seeks to raise awareness among consumer groups, collaborate with Farmer Producer Organizations (FPOs) to ensure fair prices for farmers organic produce etc.

**Global Level**

- **Zero Hunger Challenge (ZHC):** It was launched by then UN secretary-general at Rio+20 Conference on Sustainable Development in Brazil in 2012.
  - It addresses five elements critical for **eradication of hunger and malnutrition.** (refer image).  
It began in India in 2017 to improve agriculture, health and nutrition.
- **High-Level Task Force (HLTF) on Global Food and Nutrition Security:** HLTF was established by the United Nations Secretary-General Ban Ki-moon in 2008.
  - It aims to **promote a comprehensive and unified response** of the international community to achieve global food and nutrition security.
- **Food and Land Use Coalition (FLUO):** It is a self-governing coalition composed of over 30 organizations established to **transform the global food and land use systems.**
  - It was established in 2017 at United Nations General Assembly.
- **FAO-UNEP Sustainable Food Systems Programme (SFSP):** It was started in 2011 with support from Government of Switzerland.
  - Its objective is to **reduce the pollution intensity of food systems from production to consumption,** and address issues of food and nutrition security.

## ZERO HUNGER CHALLENGE

TRANSFORMING OUR FOOD SYSTEM TO TRANSFORM OUR WORLD

ALL FOOD SYSTEMS ARE FROM SUSTAINABLE PRODUCTION TO CONSUMPTION

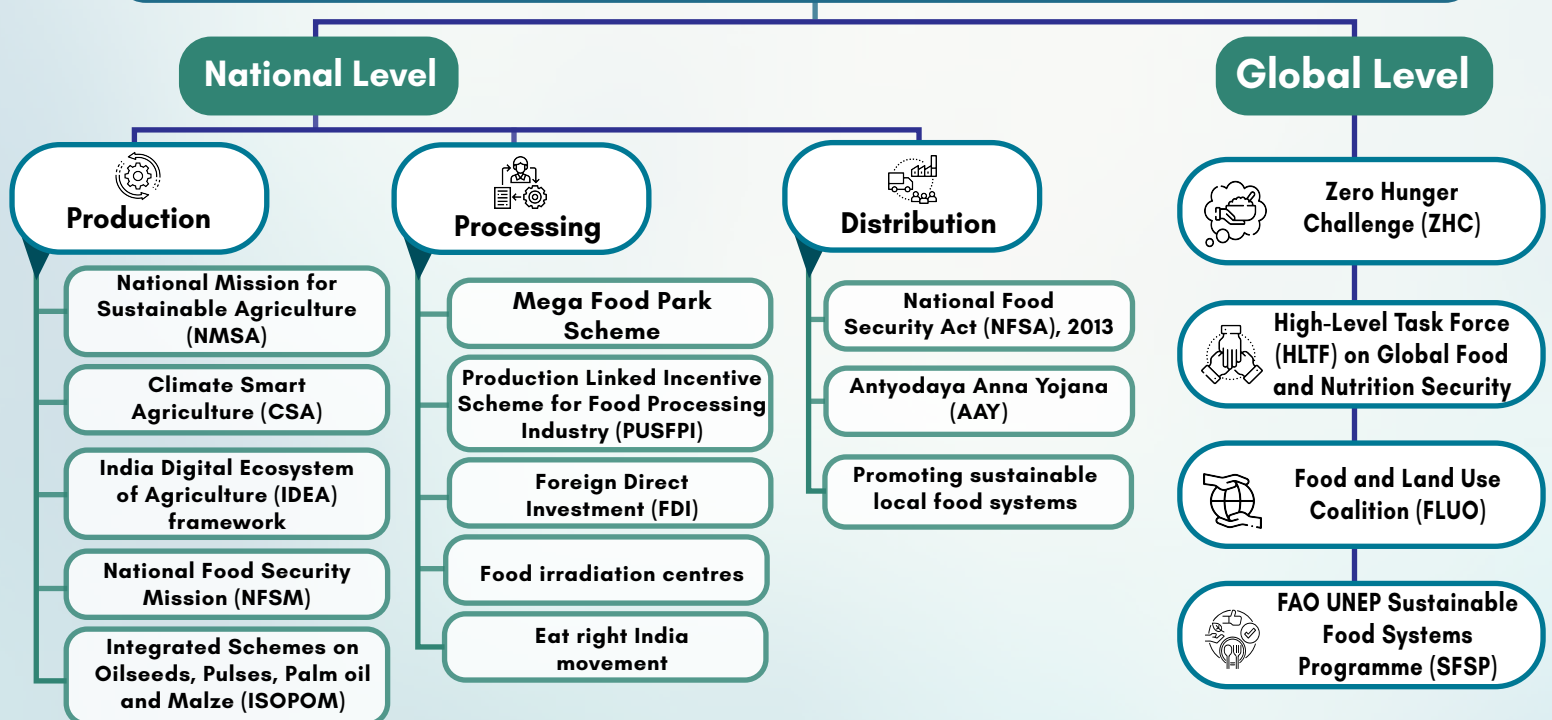
AN END TO RURAL POVERTY: DOUBLE SMALL-SCALE PRODUCER INCOMES & PRODUCTIVITY

ADAPT ALL FOOD SYSTEMS TO ELIMINATE LOSS OR WASTE OF FOOD

ACCESS ADEQUATE FOOD AND HEALTHY DIETS. FOR ALL PEOPLE ALL YEAR ROUND

AN END TO MALNUTRITION IN ALL ITS FORMS

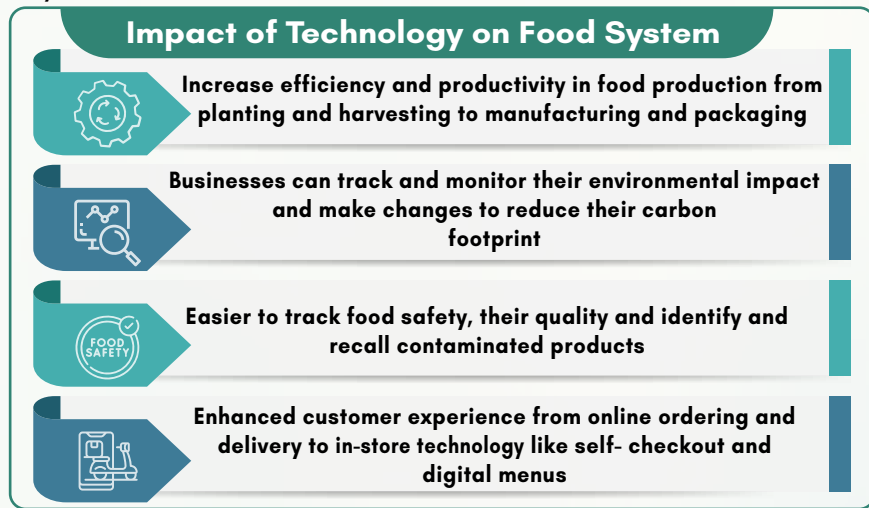
**What measures have been taken to address the challenges associated with food system?**



# How technology is impacting global food system?

In recent years, technology continues to make advancements and revolutionize the food industry to streamline the production process, and benefit the environment. Some of emerging technologies associated with food system includes,

- **Robotics and Machines:** They ensures **quality and affordability of food** as well as help with **planting, harvesting, and packaging task.**
  - Machine learning tech can **analyze and optimize land and water usage for different crops and farms** depending on the condition.
  - Food harvesting robots can **keep workers safe from harmful working conditions** in the case of hazards such as wildfires.
- **Drones:** Agricultural industry is incorporating drones for **effective management of precision farming operations**, spraying of pesticides, irrigation etc.
- **Satellite Technology:** To provide **satellite imagery to monitor crop growth**, weather patterns and prevent soil degradation to increase efficiency on the farm.
- **Artificial Intelligence (AI):** AI system have been integrated into machines that can **sense flavors for food safety quality** and deep analysis of **product composition**, create accurate forecasts to manage inventory and pricing.
- **3D Food Printing:** It allows **food customization according to their choice** as it helps to **determine the exact quantity of vitamins, carbohydrates etc.**, saves both time and energy when it comes to experimenting with different types of food dishes.
- **Blockchain Technology:** Blockchain can be used to verify the authenticity of food products, improve food safety, quality control and prevent food fraud.
- **Genetically Modified Organisms (GMOs):** They can help to increase food production, nutrient enrichment to address nutrient deficiency and develop pest resistant crops such as BT Cotton.
- **Lab-Based Food Systems:** Although still in the initial stages of development, cultured foods, like synthetic chocolate or lab grown meat, **offer an alternative to total reliance on increasingly delicate and unpredictable supply chains.**
  - They are also touted as a one of the **viable source of alternative proteins.**
  - They offer **advantages like zero animal cruelty, less saturated fats, less antibiotics resistance, cheaper source of protein diet**, etc.



## How healthy are alternative proteins?

### PROS

- Foodborne diseases are eliminated.
- Nutritional composition can be tailored.
- More fibre and less saturated fat than meat.
- Comparable protein content to meat.
- Good source of protein, polyunsaturated fatty acids, vitamins and minerals.
- Good source of protein, polyunsaturated fatty acids and fibre.
- Source of vitamin B12 and iodine.



- Complex structure of meat is replicated using additives.

- Plant-based compounds reduce protein digestibility.
- Can contain high amounts of added fat and sodium.

- Nutritional values vary.
- Possibility of allergy.

- Low raw digestibility and may contain heavy metals.
- Nutritional values vary.

### CONS



## Role of women in achieving Sustainable Food Systems (SFS)

Women are active participants in food systems. They are farmers, producers, processors, distributors, researchers, vendors, cooks, and consumers. They are responsible for **half of the world's food production**, and in most developing countries they **produce between 60 and 80 percent of food**. Still, their contributions are often not consistently recognised.

As per UN Food and Agriculture Organization (FAO), **women make up at least 43 percent of agricultural workforce** in developing countries. Moreover, women are instrumental in fight against hunger and malnutrition and in making **food systems more productive and sustainable**.

### Obstacles faced by women in Sustainable Food System

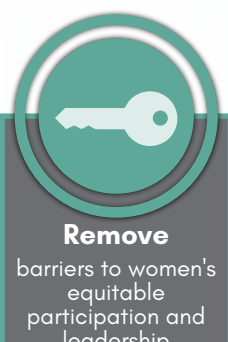
- **Land:** Land is predominantly **owned by men and transferred intergenerationally to males**. Therefore, women lack access to land, water rights and livestock. Not even 2 percent of land is owned by women.
- **Credit:** Women have **less access to credit and control over financial resources**. This, in turn **limits their ability to purchase agricultural tools, seeds, fertilizers** or hire labour that could increase their crop production.
- **Education:** Women and girls **do not receive adequate education and training opportunities**, which results into decreased agricultural productivity and increased poverty and malnutrition.
- **Extension services:** 5 percent of women receive agricultural extension services worldwide. Most of it are **focused on cash crops rather than food and subsistence crops**, which are primary concern of women farmers and key to food security.
- **Technology:** Women farmers' roles and needs are ignored when devising technology which may cause labour displacement or increased workload.
  - For instance, **many farm mechanisation equipment like tractors** are made by keeping men in mind not women.

### Measures to empower women to attain Sustainable Food System

- **Access to land:** Incentivizing extending land titles to women and implementing awareness campaigns to inform women about their rights with respect to land ownership.
- **Finance:** Facilitate lending to women entrepreneurs working in agriculture, make financial services more accessible to women.
- **Technology:** Ensure that agricultural programs consider the needs and preferences of both men and women when developing and introducing new varieties and technologies.
- **Policy making:** Review and re-orient government policies to ensure that problems constraining role of women in food security are addressed.
- **Capacity building:** Strengthening productive and entrepreneurial capacities of women through tailor-made training and improved service provisions.

### The 3 R's Framework

for Catalyzing Women's Visibility  
within Food Systems:



IF WOMEN FARMERS HAD THE SAME  
ACCESS TO TOOLS AND CREDIT,  
THERE WOULD BE UP TO

**150**  
MILLION  
FEWER HUNGRY  
PEOPLE



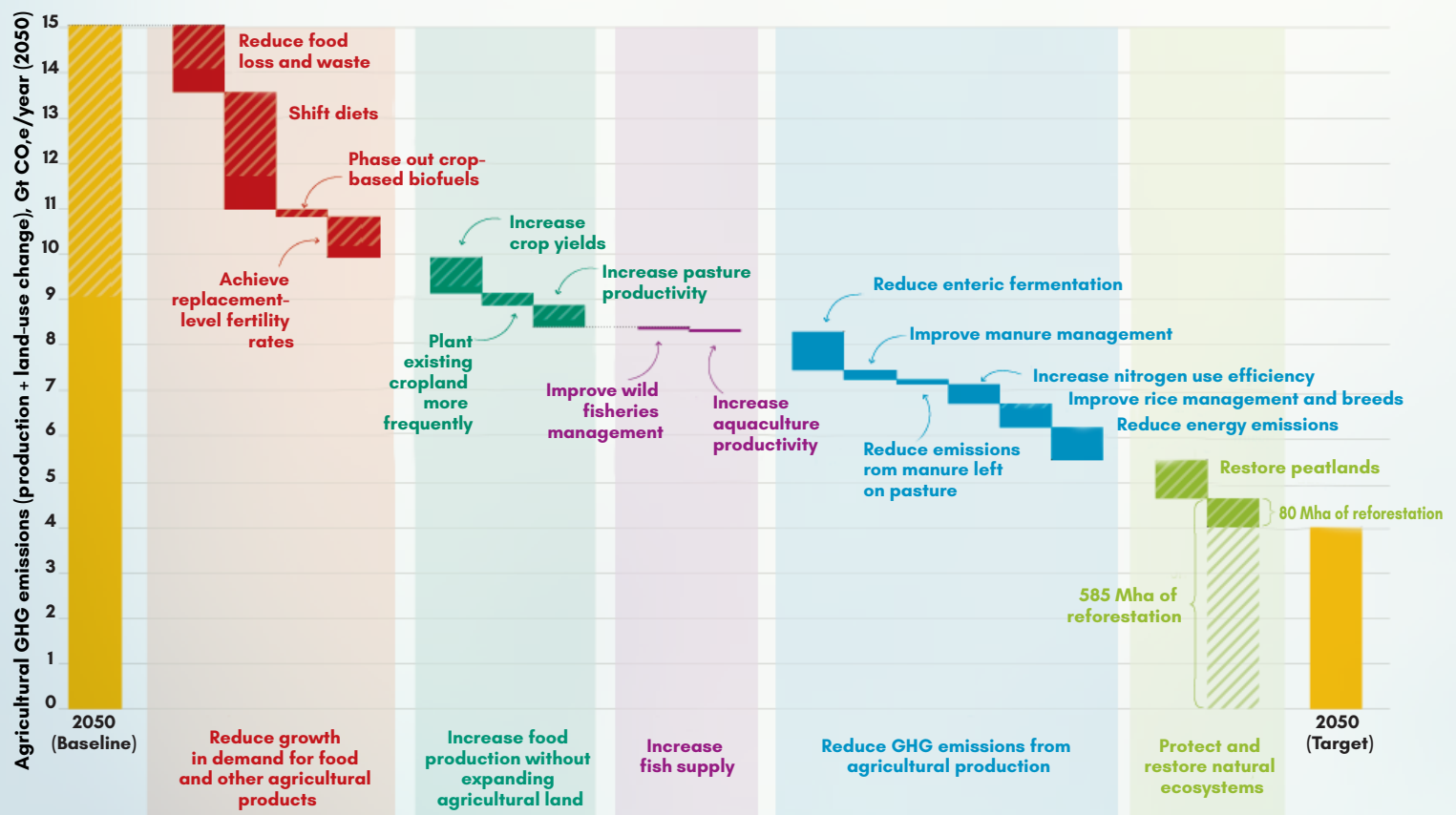


# What is the way ahead to build resilient food systems for future?

To improve the efficacy of food system and ensure economic, social and environmental sustainability of future generations, transformations are required in agricultural systems. These includes

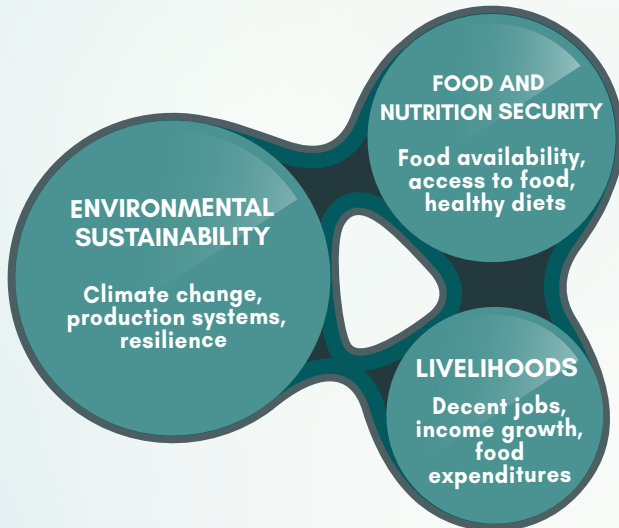
- **Climate Solutions from Sustainable Agriculture:** In wake of climate change, there is need to **transform agricultural systems** and help farmers build resilience against future environmental and economic shocks.
  - **Reducing food loss and waste**, which account for 8% of greenhouse gas emissions globally.
  - **Agroforestry (incorporating the cultivation and conservation of trees in croplands or pastures)** can cut emissions by creating additional “carbon sinks” on farms.
  - **Better soil management on farms**, practices such as reduced tillage, can keep carbon in the soil while increasing productivity.

## A 5-Course Menu of Solutions Can Reduce Agricultural Emissions by More than 70%



- **Address triple challenge:** Globally, food systems need to meet the triple challenge. (refer image)
  - **Food and Nutrition security:** Providing sufficient, safe, and nutritious food to a world population that is expected to approach 10 billion in 2050.
  - **Livelihood:** Providing **incomes to more than 500 million farmers** and others in the food chain and **promoting rural development.**

## THE TRIPLE CHALLENGE OF FOOD SYSTEMS



- **Coordination:** There is need to **develop links between agricultural, nutritional and health research centers**, both nationally and globally to deliver solutions customized to local needs and realities.
- **Investment:** Investing in **sustainable agricultural techniques** by adopting measures to strengthen and develop resilient food supply chains, resource use efficiency and eco-friendly food packaging.
- **Ensure inclusive and equitable food systems:** There is need to **measure and address the drivers/ causes of inequity in access to food** through inclusive, equitable, and accessible creation and dissemination of information related to domestic and global food security.
  - Also, to create inclusive and sustainable growth, the productivity and efficiency of the regional food system must be improved.

- **Common Food Policy (CFP):** There is need of CFP **addressing food production, farming, trade**, as well as **food and environmental quality, health, resource and land management**, ecology, social and cultural values, and help reshape the entire agricultural and food market chain.
- **Restructuring agricultural support:** Shifting away from market price support to direct payments to farmers can improve production and promote sustainable practices.
  - For example, due to European Union Common Agricultural Policy a **20% reduction in fertilizer use and increased cereal production by 28%** was witnessed from 1990 to 2015.
  - Nitrous oxide emissions from agricultural soils were also reduced by 17% from 1990 to 2015.



## Conclusion



Food system being complex in nature, necessitates a holistic and coordinated approach to ensure food and nutrition security for all. India needs a new paradigm, where the food systems approach is in coherence across all sectors like agriculture, food, health, trade and environment. An integrated and stable policy framework with budgetary support is essential to make the food production and consumption sustainable.

## Topic at a Glance- Future of Food

Sustainable food system is a food system (FS) that **delivers food security and nutrition for all** without compromising need of future generations in such a way that it is **profitable throughout, broad-based benefits for society, and positive or neutral impact on environment** i.e., economic, social and environmental sustainability respectively.

FS encompass **entire range of actors and their interlinked value-adding activities** involved in production, aggregation, processing, distribution, consumption and disposal of food products that originate from agriculture, forestry or fisheries.

### Emerging challenges to global food systems

- **Climate change (CC):** Increase in temperatures, changes in precipitation patterns etc. **reduces food production** and influences crops, livestock, fisheries etc.
- **Risks of Pests and Diseases:** Reduces crop productivity, compromise sustainability, reduces food availability and affect production quality. **Fall armyworm destroyed maize crop** in 2018 and India had to import maize.
- **Deforestation:** **Farmland expansion is responsible for 90 percent of deforestation** around world which hurts food production of existing farmland.
- **Poor agricultural practices:** Indiscriminate use of chemical-based inputs like fertilisers, **monoculture cropping** have led to groundwater contamination and soil degradation.
- **Increased Biofuel Production:** Agricultural land to **produce food-based biofuels has resulted in global displacement** of people and rise in food prices.
- **Consumption Pattern:** Overconsumption, inadequate distribution, food waste put **pressure on food system**.
- **Supply disruption:** Dependence on APMC markets in India, **lack of focus on quality and safety standards**, shocks to global supply chains due to Ukraine-Russia crisis has **led to global food inflation**.
- **Rapid Urbanisation:** In **developing countries, poor urban dwellers are thus at risk of consuming low-quality food** which may be unhygienic and exposing them to health risks.

### Measures taken to address challenges with food system

- **National Mission for Sustainable Agriculture:** Addresses risks associated with CC by adaptation and mitigation strategies for **ensuring food security and equitable access to food resources**.
- **Climate Smart Agriculture:** An **integrated approach of managing landscapes**- cropland, livestock, forest, fisheries- that **ensures food security** and address CC.
- **National Food Security Mission:** It is a Centrally sponsored scheme to **improve production and productivity of wheat, rice and pulses** on sustainable basis through **productivity enhancement, restoring soil fertility and productivity**.
- **Food irradiation centres:** India and Russia signed a pact to setup **25 centers for irradiation treatment of perishable food items** to **improve shelf- life and cut post-harvest losses**.
- **National Food Security Act, 2013:** It provides **subsidised food grains to 75% of India's rural population and 50% of its urban population under Targeted PDS**.
- **High-Level Task Force on Global Food and Nutrition Security:** To **promote comprehensive and unified response** of international community to achieve global food and nutrition security.
- **Food and Land Use Coalition:** A self-governing coalition of over 30 organizations established to **transform global food and land use systems**.

### Way ahead to build resilient food systems for future

- **Climate Solutions from Sustainable Agriculture: Reducing food loss and waste,** which account for 8% of greenhouse gas (GHG) emissions globally.
- **Address triple challenge:** Providing **food and nutrition security** to 10 billion in 2050, **incomes to more than 500 million farmers** and others in food chain and improving **environmental sustainability** by lowering GHG emissions.
- **Common Food Policy (CFP):** Need of CFP for **addressing food production, farming, food and environmental quality**, and help reshape entire agricultural and food market chain.
- **Restructuring agricultural support:** Shifting away from market price support to direct payments to farmers can improve production and promote sustainable practices.
- **Investment:** Investing in **sustainable agricultural techniques** by adopting measures to strengthen and develop resilient food supply chains.
- **Ensure inclusive and equitable food systems:** To create inclusive and sustainable growth, productivity and efficiency of regional food system must be improved.

### How technology is impacting global food system?

- **Robotics and Machines:** Ensures **quality and affordability of food** and help with **planting, harvesting, and packaging task**.
- **Drones:** Agricultural industry is incorporating drones for **effective management of precision farming operations**, spraying of pesticides, irrigation etc.
- **Satellite Technology:** To provide **satellite imagery to monitor crop growth**, weather patterns and prevent soil degradation to increase efficiency on farm.
- **Artificial Intelligence:** Integrated into machines that can **sense flavors for food safety quality** and deep analysis of **product composition**, create forecasts to manage inventory and pricing.
- **3D Food Printing:** Allows **food customization as per choice** as it helps to **determine exact quantity of vitamins, carbohydrates etc.**, saves time and energy when it comes to experimenting with different types of food dishes.
- **Blockchain Technology:** Blockchain used to verify authenticity of food products, improve food safety, quality control and prevent food fraud.
- **Lab-Based Food Systems:** They are **viable source of alternative proteins, offer less saturated fats**, less antibiotics resistance.