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# Sustainable Nutrition: Food Systems for A Healthier Planet

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#### ABSTRACT

Sustainable nutrition is at the core of ensuring food security, environmental conservation, and global health. Food systems are undergoing significant transformations due to climate change, socio-economic disparities, biodiversity loss, and global economic disruptions. This paper examines the multifaceted approach needed to achieve sustainable nutrition, focusing on food production, consumption, policy interventions, and the role of technological advancements. It also examines the interplay between local and global food systems, the importance of regenerative agriculture, food waste management, and economic considerations. A holistic approach integrating nutrition, environmental sustainability, and socio-economic equity is essential for achieving the Sustainable Development Goals (SDGs) and promoting long-term global resilience.

Keywords: Sustainable Nutrition, Food Systems Transformation, Climate Change and Food Security, Regenerative Agriculture, Food Waste Management, Global and Local Food Systems, Economic Sustainability in Agriculture.

# INTRODUCTION

Global food systems are at a turning point. The UN Secretary-General will host the UN Food Systems Summit (UNFSS) in October 2023 to mobilize support for transforming food systems and advancing the 2030 Sustainable Development Goals (SDGs). The summit will address how food systems can safeguard food security and nutrition amid climate change, social inequity, biodiversity loss, and economic disruptions from the pandemic. Changes needed in food systems focus on five pillars: food production and livelihoods, nature-positive economies, nutritious and safe food supply chains, equitable access to food, and promoting inclusive systems. There is an increasing recognition of a holistic food systems approach. The symposium preceding the UNFSS involved experts in discussing sustainable nutrition and synthesizing priority action areas for food system transformation. With a global population nearing 8 billion, sustainable consumption patterns and competition for resources necessitate accelerated global efforts. Food systems are essential for health and achieving SDGs, requiring a comprehensive approach to nutrition and sustainable production to reduce food waste. Alfani-style transformations are critical for equitable food systems, emphasizing social protection and resilience for vulnerable populations. Challenges call for addressing the social and political factors behind malnutrition. Rasmus Engberg-Pedersen urges donors to consider the economic drivers of famine, while Nitin Barman stresses that safety nets must account for structural causes of malnutrition and protect against rising food prices  $\lceil 1 \rceil$ .

#### The Importance of Food Systems

Food systems are at the intersection of several UN goals (eliminating poverty, hunger, and malnutrition; achieving good health; and promoting environmental sustainability) underscoring the urgent need for their transformation. The need for transformation is now major inescapable if these UN and other food-relevant climate and biodiversity goals set for 2025 and 2030 are to be approached. The more recently announced UN Food Systems Summit (UNFSS) at the September 2021 meeting will catalyze efforts aimed at inspiring collective action to ensure that major commitments are made to improve food systems at a time of great need against a backdrop of intensified climate change, widening socio-economic inequities, and a global pandemic. Food systems are defined herein as involving the various production,

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processing, packaging, transportation, storage, retail, food service, and ills of outcomes including, but not limited to, crops, aquaculture, livestock, and the articulated land-sector linkages between soil/climate/biodiversity management that help determine these food category identities. In diet change food systems are, of course, the essential mediators by which 'consumed' food comes to be 'available' – the so-called supply-demand nexus. On the supply side, food systems are comprised of a vast number of producers and processors that feed almost 8 billion people in more than 195 countries – although the last five countries are dominated by imports from the output of the first 15  $\lceil 2 \rceil$ .

# Nutritional Science and Sustainability

Almost universally, expecting and new mothers struggle to access safe and nutritious food both because of income limitations but also because of social values that prioritize the rest over women's and children's well-being. Advancing gender equality is essential to improving nutrition, particularly the nutritional status of vulnerable populations. While dollar-for-dollar, investments in nutrition are among the most effective in reducing maternal and child mortality, there is currently underinvestment in these programs. The insights provided in this special collection offer perspectives on accelerating the pace of malnutrition reduction and food systems transformation. The first piece identifies new metrics to assess the capacity of food systems to deliver diets that meet nutritional needs and promote health. The second pair of pieces explores emerging connectivity among various sectors to develop new agricultural goals for dietary diversity and human nutrition. Solutions to the problem of malnutrition in all its forms involve health, medical, or nutritional interventions; the mandate to prevent and treat malnutrition has rested primarily within the health sector such that most efforts to improve nutrition have been conducted in isolation from other sectors, notably agronomy, fisheries, early warning systems, and many other areas directly related to food systems. The insights in this special collection explore the case for multidisciplinary landscape approaches to developing new agricultural targets for improving human health through enhanced food and nutrition security  $\lceil 3 \rceil$ .

## **Understanding Nutritional Needs**

There is an urgent need for strategies to ensure the health of the planet while providing nutritionally safe foods. Food systems encompass all aspects related to the production, storage, distribution, access, marketing, regulation, and waste management of food and related products. Effectively guiding these systems to support health-promoting diets necessitates collaboration among various disciplines, including consumer behavior, nutrition, public health, and the environmental impacts of food production and disposal. However, potential allies often struggle to communicate due to differing goals, terminology, and responsibilities, complicating collaborative efforts. This text discusses metrics to quantify seven domains relevant to food systems: exposure, hazard, uptake, transfer, impact, vulnerability, and response. These metrics aim to establish common language and understanding. Additionally, the metrics support a 'safe and healthy' food system scenario that contributes to the EU's environmental evidence base and justifies the need for debates on fossil fuel restriction strategies. The SYMPHONY project, initiated in 2013, was funded by the EU to enhance access to freshwater resources through integrating Earth observation data with in situ monitoring. In 2016, the EU introduced a regulation designed to protect the environment from chemical misuse, ensuring chemicals are assessed for safety before market approval. Following a request from three Member States regarding the approval of glyphosate, the European Commission opened a public consultation on its draft renewal assessment report to decide its future use as a farm chemical product [4].

#### Key Components of Sustainable Food Systems

To ensure long-term sustainability, the food system must support food and nutrition security for all while safeguarding human health and minimizing costs without harming the environment. However, current dietary patterns and food waste management negatively impact both the environment and human health, making them unsustainable given population growth. Food systems are complex, involving production, processing, transport, trade, and disposal, influenced by socioeconomic and biophysical factors, requiring a multidisciplinary study approach. Sustainable food systems should provide safe, healthy, and culturally relevant food, preserve the environment and biodiversity, and ensure economic viability and equity with decent work opportunities. Fair food systems enhance development and equitable access to resources, promoting justice in food security. Resilience is vital for sustainability, enabling the system to deliver key principles amid shocks. Local perspectives are crucial as sustainability efforts are context-specific, impacting metrics and analyses. Industrial farming leads to decreased biodiversity, excluding staple foods and increasing vulnerability to pests and diseases. Integrating advanced scientific methods with

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traditional knowledge can improve agricultural practices. The availability of seeds is essential for establishing local food systems, and seed-saving techniques tailored for hybrids and genetically modified seeds ensure diversity and cultural adaptation in crop selection [5].

#### Local Vs. Global Food Systems

A sustainable management and nutrition of the global food system is vital to the environment, social systems, and livelihoods of populations worldwide. However, conflicting with efforts to make food production efficient, affordable, and healthy, food systems are becoming recognized as a leading driver of global environmental degradation and threats to nutrition and food security. Moreover, trade and globalization increasingly bind diverse food systems to one another, such that local food systems are inherently connected to global food systems too. Currently, disparities within and between food systems are being exacerbated by environmental change and related effects on food production and food supply. A critical and oft-considered conflict is between arguments for supporting local food systems to reduce negative environmental impacts, related to long and polluting supply chains, and risks associated with climate change and, conversely, the argument that greater integration of food systems can, through trade networks, mitigate the effects of climate change on food security. To date, the debate has been conceptual and philosophical in nature, backed by models that implicitly or simplistically describe the contribution of food systems to broader aspects of human wellbeing. This paper reviews recent evidence that food systems can preserve or deteriorate ecological states and outlines general trade-offs between dimensions of food system performance in the environmental and supply chain domains relevant to the central debate about food system scales. To coordinate contributions to SDG achievement and to effectively balance considerations of local and global artisanal food systems, it is concluded that efforts to localize food systems may benefit from a nuanced approach in recognizing that local food alone is not necessarily more sustainable, and may be guided by a clearer discussion about what food security and resilience mean in the modern world. Whether one eats locally or globally sourced-foods is a question of balanced diets, local food deserts, and protection of the global goods equally  $\lceil 6 \rceil$ .

#### **Organic and Regenerative Agriculture**

Much discussion has been had in the last few decades over the appropriate scales, systems, and technologies for redesigning global food systems and attending to food security challenges. Taking on many rhetorical shin shapes, numerous strategies and solutions are being explored and promoted, among them organic production and regenerative agriculture. A challenge in these debates is that the arguments are not necessarily being made on the same terms: some emphasize the technology itself or the scale at which it is applied, while others focus on social and organizational matters. Moreover, the social and ecological outcomes of the various 'technologies' are mediated by the cultural and ecological characteristics of where and how these technologies are implemented. Consequently, it is inadvisable and naïve to hastily proclaim that any specific set of foods, food production technologies, or scales of operation are universally sustainable or not. On these fronts, much good work and valuable research is being carried out about the operational viability and socio-ecological outcomes of both organic and regenerative agriculture. There is no single, universal definition of regenerative agriculture, and therefore it behooves food system scholars to discuss their diverging understandings of regenerative agriculture practice, and hopefully reach some level of definitional consensus [7].

#### Food Waste Management

Food is something that everybody needs and produces. Due to the large scale of its production through the supply chain, the management of its by-products, co-products, and leftovers is a complex and increasingly important task. Although some issues have been solved, notable quantities of food waste are still being deposited in landfills each year. Food waste is produced at each stage of the food supply chain. It consists of raw materials, by-products, and uneatable or extra food, but only part of the generated waste can be used for composting biofuels and biofertilizers. An efficient methodology to manage it as the resource is proposed, focused on waste hierarchy. It should be applied to every type of food waste independently and an exhaustive analysis for each food waste is necessary. Management-related issues of sustainability have to be chosen according to this analysis. A series of detailed steps to be taken to choose a waste management method are reviewed. They provide a clear understanding of the main problems and opportunities within each supply chain. An approach is proposed based on a set of very simple figures of merit from which a comprehensive analysis of the overall environmental impact of food waste is made. Then, a layout is proposed to integrate the methodology into the Strategic Evaluation of Energy from Waste (SEEW). It is a platform developed to scrutinize an energy recovery route, and the results of its

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application to different food wastes at all tiers of the waste hierarchy are presented. Finally, conclusions about this approach are drawn, as well as recommendations for a more sustainable management of food waste  $\lceil 8 \rceil$ .

#### **Cultural Perspectives on Nutrition**

Abstract The overarching themes that link these 4 presentations are sustainability and food systems. The subjects range from newer definitions of healthy foods and healthy eating to linking sustainable production to sustainable consumption. Two of the papers discuss the importance of the cost of a healthy diet and information as facilitators or barriers to consuming a healthy diet. Some of the workshops emphasize that vegetables are not always as sustainable as they are often cracked up to be, some highlight the need for better methodologies to link food production with nutrition and health consumed, and that more attention is needed to the true sustainability of local versus global food systems. A methodology to optimally combine diverse aspects of food security, sustainability, and the physical and mental well-being of individuals into an overall score is discussed. Different food choices of individuals with varying degrees of environmental concern are modeled, concluding that transforming knowledge and belief in environmental cost could motivate increased consumption of sustainable foods, itemized or plant-based. On the other hand, overly restrictive campaigns on meat consumption could also have negative effects on health [9].

## **Traditional Diets and Sustainability**

The 2030 Agenda for Sustainable Development closely ties to traditional agriculture and food systems, recognizing that sustainable diets widely exist, often represented by traditional diets linked to local agrifood system sustainability. A shift is needed from merely producing sufficient food to addressing the health and environmental impacts of current food systems. Research suggests that aligning consumption patterns with national dietary guidelines could yield significant health, environmental, and economic benefits. However, urgent concerns arise from the harmful divergence from traditional diets. Detailed analyses across various locales are essential to explore the connections among dietary diversity, nutritional adequacy, landscape diversity, agroecological knowledge, and market potential of diverse foods. Furthermore, understanding how traditional diets can help preserve local biocultural heritage and confront the market's invasion by unhealthy products is crucial. Recent policy discussions emphasize integrating sustainability guidelines into dietary guidance. The UN adopted the 2030 Agenda for Sustainable Development in September 2015, which presents 17 Sustainable Development Goals (SDGs) related to sustainable agriculture and food systems. Although there isn't a dedicated goal for food, relevant aspects are noted in national food-based dietary guidelines (FBDGs) like Brazil's "Guia Alimentar para a População Brasileira" and the US guidelines for accessing healthful food. A comprehensive review presented at CFS 43 by the FAO highlights that health and nutrition dominated discussions, while environmental considerations were noticeably less prioritized. Among 85 countries assessed for health, environment, and societal aspects, only nine (11%) incorporated environmental sustainability into diet patterns, though both upper and lower-middle-income nations have made strides in this area  $\lceil 10 \rceil$ .

# Cultural Barriers to Sustainable Eating

The 2020-2025 Dietary Guidelines for Americans (DGA) lack emphasis on sustainability, focusing instead on nutritious diets that prioritize vegetables, fruits, whole grains, seafood, legumes, and nuts while recommending moderate dairy and alcohol intake and limiting saturated fats, sugars, and sodium. The European Union's Farm to Fork strategy aims for a fair, healthy, and eco-friendly food system, boosting farm resilience and providing safe, nutritious food without harming ecosystems. The energy system also significantly contributes to greenhouse gas emissions and resource consumption linked to food production. Given the implications for public health, urgent action is necessary. Sustainable eating involves healthier choices regarding environmental impact, including consuming minimally processed foods, reducing animal products, minimizing single-use plastics, and favoring seasonal foods. A European survey indicated that sustainability ranks as a major purchasing factor, especially among younger consumers who prioritize it. While awareness of food sustainability is rising, obstacles remain, rooted in the complex environmental, economic, and cultural factors that challenge sustainable dietary choices  $\lceil 11 \rceil$ .

#### Economic Aspects of Sustainable Nutrition

Countries are increasingly exposed to global trade volatilities in commodities that affect population sustainability in dietary patterns. Superfoods are typical examples of commodities subject to import price

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spikes correlated with obesity prevalence; knock-on effects are observed on countries-dependent products. Evaluating the global interdependence in the diet-induced sustainability challenges helps to assess the future demands robustness of the countries, emphasizing the role of agricultural policies. The Sustainable Development Goals design a blueprint for global commitments to stimulate action among developed and developing countries at large, with a significance in the bioeconomy sector that has reshaped the role of economic, social, and environmental management of the specific geographical contexts. Utilizing legitimate, non-market instruments drives the bioeconomy conversion into practice across countries by re-balancing wealth to generate and share sustainable pathways against limited resources from the business sector. Implementing a reliable bioeconomy information policy is crucial to ensure policy coherence among the countries that have implications for the availability, utilization, and trade in biomass with clear transboundary effects on the environment and climate systems. Bioeconomic interests may diverge among trade partners even in the ideal situation of perfectly functioning and competitive markets. The countries will continue to be exposed to the challenge of identifying the intentions and practices of trading partners concerning agricultural trade, production, and development [12].

# **Cost of Sustainable Foods**

The following test presented to the respondents represents the first test of a trait-based measure of Sustainable Food Shopper Beliefs and intentions. To improve the measurement of these beliefs and intentions, screening questions were asked prior to presenting major scales. The screening items were not analyzed in the main text as part of the assessment; however, the results are presented to inform whether the respondents' sustainable food beliefs/intentions are or are not in line with their understanding of the concept. No current research was located to suggest how the general public mentally frames food choices as sustainable relative to other food-related goals, or what type of sustainable food-related goals are commonly incorporated into beliefs. Meta goals (or beliefs about goals) developed by. Building from the extant literature, some people may envision choices leading to comparatively less harm to the planet when thinking about sustainable foods. Specifically, options may be interpreted as improving upon traditional selections. In this mental model, the environmental benefit of sustainable food choices stems from the trade-offs with less sustainable alternatives. Importantly, another subset may instead consider experiential aspects of sustainability as the benchmark. Understanding societal factors that may impact health is important as it can inform how digital health technologies can be built and designed based on addressing these interdisciplinary social determinants of health. Externalities such as economic resources, the environment, and sociocultural aspects of class, gender, and education all play a role in shaping the ways communities can engage in healthcare. Attributes of digital technologies, in terms of their flexibility, routinization as new healthy habits, personalization of individual attributes such as diet and exercise, enhanced messaging of health tips, nudges, and strict reminders, and enhanced knowledge integration could further address these societal factors' social determinants of health. The new understanding is that digital technologies are helping to provide healthcare systems that are based both on the choices households make and the societal circumstances in which they are embedded  $\lceil 13 \rceil$ .

# **Economic Benefits of Sustainable Practices**

Addressing the interconnected challenges of sustainability and cost will require us to rethink our food systems. Over the last two decades, economic incentives for achieving high agricultural productivity have led to food system adaptations favoring mono-cropping and streamlining product quality, ultimately contributing to climate change and health issues. In response, the UK has considered indirect land use change and other suggestive benchmarks to ensure all domestically-produced vegetables comply with carbon stock thresholds. Despite concerns over equity and disproportionately impacting traditional markets and developing countries, the authors respond to such findings and explore how changes could be implemented in practice. As food industry professionals know, points are often those with the most impact. One of the principal practices of regenerative agriculture principles is to reduce chemical rock far beneath the surface. As organic matter is unearthed, soil health ensures its subsequent formation process, which leads to soil retention, drought resilience, and a continuous source of nutrients for plant growth. Such agriculturalist mimicry of natural evolution in England, systematically explains why regenerative agriculture is neither a return to the past nor a novel farming paradigm. Sustainability offset with regenerative principles can improve the profitability of farms, which increased by 78% in comparison to conventional practice whilst increasing wheat yields by 30%. Significantly regenerative accomplishment during programming could be enduringly higher from one to ten-fold healthier than the current concentration in multi-crop-food systems. Enforced standards on carbon sequestration upon entry to the

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commodity market will vitalize trade and interpolation assessment further corroborated the British government's stance that regenerative agriculture can feasibly coexist with its existing policy framework. Conversely, such advancements ultimately do not preclude the developmental expansion of a burgeoning sustainable development industry. It is possible to recommend, however, that the UK scheme will be progressively realized against existing surprises such announcement of a plan to reliably apply from 2026  $\lceil 14 \rceil$ .

#### Policy and Regulation

There is no such thing as one sustainable diet. A sustainable diet will be local, fresh, seasonal, and minimally processed. It will be diverse, nutrient-dense, culturally acceptable, economically fair, and affordable. It will ensure that resources are used and waste is managed for the benefit of the many and not the few. The concept of sustainable diets may be new, but the concepts of sustainability, diversity, and diets are not. The genesis of the nutrition portfolio began with a diverse diet, and so in a way, the diverse diet is the original diet. To this day traditional food systems reflect this, adapt, and are resilient to the conditions found in their environment. Traditional food systems can include both wild and cultivated plants and animals, and provide sustainable nutrition in a difficult environment. The food system today is just as dangerous to humans as it is to the environment. Food globalization has destroyed traditional diets and entire food systems. It has altered the way food is produced and consumed and the negative effects of this new food system have gone full circle and come back to hurt the environment. The commercial seeds and mono-culture have eradicated the genetic heritage of millennia. Hybrid and industrial farming need insects to be killed and the soils to be drenched in fertilizers, both of which are deadly for the environment. Modern life got disconnected from nature and the seasons and adopted a diet based on refined carbohydrates and processed food, sweeteners, and hydrogenated fats. Moreover, lifestyles and life expectancy have been negatively affected  $\lceil 15 \rceil$ .

#### **Government Initiatives**

As the UN holds the 2022 World Food Summit to promote Sustainable Development Goal 2, Zero Hunger, aligning US government policies with these goals is essential. Data from Congress can inform strategic decisions and budget negotiations to enhance the health and economic well-being of Americans and low- and middle-income countries, fostering global peace. The White House will also host a Conference on Hunger, Nutrition, and Health, focusing on proposals to improve federal investments in equitable, sustainable food systems. Educational interventions are vital for improving diet quality through nutritional education, as younger generations learn food habits from their families. Cultivating culinary skills through training supports health-conscious attitudes and effective dietary education programs, with interventions in schools encouraging long-term healthy eating behaviors [16].

# International Standards and Agreements

The UN Sustainable Development Goals (SDGs), launched in 2015, aimed to transform the global food system by 2030, ensuring a sustainable, nutritious, and equitable food supply. Key objectives include increasing nutritious diets and reducing food loss and waste. The 2021 UN Food Systems Summit further advanced gender equality, calling for cross-sector commitments to fulfill the SDGs. Yet, commitments often occur within isolated regions, lacking consensus on effective practices for measuring food systems transformation. Analyzing national and international commitments among 24 countries revealed Bangladesh and Chile leading with the highest scores of 59% and 58% for impactful commitments. Only one commitment area was shared by four countries, one continent by seven, and five continentcoordinated areas involved five or more countries. Barriers include insufficient monitoring and transparency regarding ongoing commitments to food and agricultural transformation. The FAO defines sustainable diets as those with low environmental impacts that ensure food and nutrition security for present and future generations. A successful framework for sustainable food systems encompasses four domains: environmental, nutritional/health, economic, and social, necessitating a multidisciplinary approach to balance various stakeholders. Decisions favoring one domain may result in unintended adverse impacts on others. To promote an integrated approach, the FAO will coordinate efforts as the secretariat for developing a CFS policy product while establishing an inclusive technical task force [17].

# **Technological Innovations in Food Systems**

Many factors hinder food systems from providing healthy diets and nutritious foods. Food insecurity affected another 1 million people due to global lockdowns, worsening the nutritional crisis. Nutritious diets remain unaffordable for three billion people, with a two billion-person gap to meet global nutrition

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targets. The triple burden of malnutrition is rising across all regions. While evidence for sustainable food system innovations (FSIs) is growing, a comprehensive framework for policymakers and implementors to design these innovations effectively is lacking. FSIs are frequently highlighted as key solutions to the root causes of inadequate healthy diets. They can also align with broader solutions, such as eliminating harmful subsidies. However, definitions of FSIs greatly differ. Eight core principles are essential for designing effective and sustainable FSIs. Six major challenges remain: (1) lack of data; (2) food safety restrictions; (3) unexpected outcomes; (4) power inequities; (5) ensuring long-term effects; and (6) sustainable finance. A new definition for FSIs aimed at healthier diets is proposed, informed by literature and expert feedback [18].

#### Agri-Tech Solutions

Much has been written about improving our stressed food systems by producing food sustainably. This includes efforts to enhance ecosystem resilience and nutritional quality, along with an interest in adding value through innovative products and technologies. However, many discussions overlook the fundamental logic of industrial food systems, which rely heavily on conventional meals mainly composed of freshly prepared plant-based items. A more comprehensive approach to urban food systems is needed, especially in rapidly growing cities in developing countries. It's time to question the assumptions of current discussions and recognize the need for radical changes toward a healthier future. Important actions are required, even if they challenge existing power dynamics in global society. This analysis builds on scientific evidence and acknowledges knowledge gaps and constraints. Positive note: integrating available technologies and societal choices can significantly reduce the environmental burden of food systems without depleting essential natural resources. However, to ensure a sustainable future by 2050, food consumption patterns must drastically change. Present models, which favor affordability and availability, may not be viable for a growing population that can only tolerate small price increases. The nature of food consumed must differ greatly from today, potentially consuming more resources and being accessible primarily to wealthier populations, leaving many in developing countries unable to afford it [19].

#### Food Processing Technologies

Lately, food processing technologies have received considerable interest concerning improvements in the integration of sustainable food systems. Several technological concepts have been proposed as innovations, including smart food systems and higher automation in food industries, Pan-European harmonized applications of refrigerated display cabinets, advanced fat manufacturing equipment for food ingredients, bio-preservation techniques capable of increasing the safety and extending the shelf-life of fresh and ready-to-eat, minimally processed foods, and improvements in food packaging. Further, additional functional food processing technologies, including novel food formulations, in novel physical states and nutritional/functional food modifications, based on hydrocolloid food matrix interactions, have been recently introduced to the market, additionally affecting overall food portion quality. There are adequate new processing technologies to assist food chains in achieving the food chain objectives. Promising technological dispositions, such as High-Pressure Processing and Radio Frequency Techniques, have also been recommended concerning food supply chain issues [20].

# **Consumer Behavior and Sustainable Choices**

This year, parents and children alike will kick off the 2021-2022 academic year. Regardless of grade level or location, the shift from home life to school life affects the daily eating habits of students, parents, teachers, and school staff. Wildly tasty meals packed with brain-boosting foods are beneficial to all parties involved, but what food choices have the smallest environmental impact and are the healthiest to consume? Many new consumer behaviors place a growing interest in various diet options for personal health, well-being, and the health of the environment. Trendy diets, lifestyle choices, and cuisines are often as impactful as the foods themselves due to their wider implications on food systems and production, yet they are often grounded in scientific research and can transform the production of crops and livestock. When selecting the best options for personal health, environmental health, and public health, consumers need to understand the deeper context of these food systems and production. Most widely recognized sustainable diets, such as vegetarianism, flexitarianism, or the planting of new seeds are improperly or overly implemented. However, a more educated and broad understanding of these diets, their benefits, and commonalities should be encouraged within education, campaigns, and media. The current global climatic and biotic crisis underscores the importance of acting now. Some sweeping reforms and alterations within the agricultural and culinary world are necessary to meet the Paris Agreement and the

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Sustainable Development Goals. With these fundamental refits in consumer habits, tastes, and behavior, food consumption has the potential to be one of the strongest tools available for this planet's survival  $\lceil 21 \rceil$ .

# **Strategies For Promoting Sustainable Diets**

In the past decade, interest in the area of food sustainability has grown rapidly as a result of an increasing realization of the interlinked problems facing the planet: food & climate systems, unhealthy and inequal diets, and food & nutrition security. This has led to a range of new questions and research priorities, including how to design and test policies effectively and how to promote more sustainable diets, as well as concerns about which metrics to use and their implications for social justice and equity. Moreover, the pursuit of food sustainability is tightly linked to various other sectors and activities, such as industry, agriculture, and the environment more broadly; creating further interdisciplinary demands on researchers, policymakers, and key stakeholders. Today the United Nations will aim to deliver the latest evidence and propose solutions in the ongoing debate about the systemic changes needed for the transformation of food systems worldwide. Initiatives in the UK aim to encourage consumers to think about the sustainability of the food they eat. The growing public interest in minimizing the impact of food consumption on the environment is hopefully going to act as a strong driver for change. The European initiative aims to use data from shoppers to help retailers test the effectiveness of different product-level decisions on healthfulness and sustainability. A new software tool contains data on 107,000 food items across 190 countries. This tool combines a user-friendly interface with highly detailed background data and is designed to help food industry users develop more sustainable supply chains. Meanwhile, more companies are also working hard to implement the recommendations made by the Advisory Committee to the Dietary Guidelines for Americans, to improve the national quality of diet and the environment; both these goals are the premise for better public health  $\lceil 22 \rceil$ .

## **Case Studies of Successful Sustainable Food Systems**

Meeting the Enormous Challenge of Food Systems for Healthier Nutrition will be a formidable task for international organizations and, equally, for national-level governments. They will have to change the trajectories of food and agriculture systems to have the greatest possible impact on food security and nutrition. The strategies required should be both facetted and holistic, comprehensively confronting the range of sustainability challenges, from environmental degradation to the consequences of agrarian change, including poverty, vulnerability, lack of empowerment, and hunger. In essence, the challenge for changes in the food systems is to make them more efficient and more inclusive. A wide array of public policies will be needed, including, critically, reducing income inequality, so that the poor can be given the capacity to earn more, creating conditions for well-nourishing access to food, water, and sanitation, ensuring that risk is exported, allowing for more individual choice and securing sufficient job satisfaction, respect, and protection. Food production, as a major driver of environmental degradation, carries with it an enormous burden of responsibility. In this respect, many hopeful signs can be reported. A great deal of technological advancement has taken place over the past four decades, allowing the cropping of fields and animal production to be intensified; a body of (socio-) economic expertise has been gathered proposing improved ways of organizing farming; finally, in many parts of the world agriculture is undergoing a structural adjustment process, where widespread land use and technology changes can shorten the time frame needed for marine practices to emerge. Significantly in some places, almost any crop can now be grown at almost any time of the year. The challenge of these changes will be twofold. First, the need for food security has to be met. This means that all scenarios of dietary change have to fulfill the requirement of basic nutrient supply. Furthermore, the whole exercise is subtle. Food provision is not just another field of public sector concern, but a prevailing, cross-cutting issue [23].

# **Community Initiatives**

Adopting a plant-based diet is a widely accepted personal lifestyle choice to reduce an individual's carbon footprint that is gaining in popularity in some quarters. However, alongside the severe environmental degradation of global agriculture, even much organic food production shares in many of the sustainability issues so the kind of food produced and the food system need drastic change. Food sovereignty campaigns promote local food systems as a strategy to prevent globalized food production and market activities causing a broad spectrum of socio-economic, medical, and environmental harm. Local food systems share in the increase of the ecological and temperate climate conditions that food requires in their socially and ecologically specific environments, benefiting the capacity of the ecosystem to sustain responsible agriculture. The benefit of such local food systems is also enhanced local self-sufficiency concerning food

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supply, strengthening at the local level a community's capacity to assert their rights to the mandate of direct participation in controlling their environment and the well-being of their population. In the Toronto strategy of the edible food, a long-term local food initiative in the Caledon town of Ontario, Canada [24].

#### **Corporate Sustainability Efforts**

Sustainability initiatives are being created and communicated by nearly all sectors and members of the food industry. Targeted efforts are now needed to ensure that the most impactful and able initiatives can reach their goals. Opportunities for informed action were discussed by an expert panel group, comprising members from the private sector, civil society organizations, scientific research institutions, and the United Nations, that were compendiously summarized. Internally motivated and developed in response to external pressures, sustainability commitments continue to drive food systems transformation between now and the end of the Decade of Action. With more than 11 years left to realize the Sustainable Development Goals (SDGs) by 2030, an updated audit of country-level food systems commitments was reviewed to understand how countries and regions are aligning progress on planetary sustainability with SDG targets. Instrumental domain analysis was additionally conducted on 11 of the most prominent third-party frameworks for the food industry, agriculture, and health most likely to guide action. An expert panel comprising members from the private sector, civil society organizations, scientific research institutions, and the United Nations was convened to discuss how the current landscape of sustainability commitments can best be supported by implementing consistent and holistic metrics. Key insights from expert group dialogue were documented here in a Summary of Expert Dialogue with Stakeholders to Support the Development of the Billions to Trillion Object and the Food Systems Summit. Broadening the dialogue between stakeholders remains a key priority to develop further the process of, eliciting suggestions and perspectives to guide the development of proposed objectives and targets to be endorsed by the UN Secretary-General  $\lceil 25 \rceil$ .

# Challenges In Implementing Sustainable Nutrition

One of the most important global goals to ensure a healthy planet is the U.N. Sustainable Development Goal 2, which calls for ending hunger in all its forms by 2030 and striving for sustainable food systems. Current food systems are transforming under pressure from unsustainable practices, changing crop and livestock demands, population growth, and increasing urbanization. A recent commentary identified some of the priority actions deemed critical for the transition of food systems toward more sustainable and healthy diets. Issues around reforming food systems to make them sustainable and healthy have gained unprecedented political traction. A baseline assessment of public and private sector understanding of the current food system is crucial to identify the most effective intervention points, especially when consensus on the definition does not hold. The importance of the upcoming global debates suggests the need for a new body dedicated to providing clear guidelines informed by the latest multidisciplinary knowledge and evidence available. While efforts to reform global food systems are slow, it is hoped that upcoming debates to be convened by the U.N. will be guided by principles based on scientific evidence. For U.N. Food Systems Summits, a common understanding of the "food systems" term will be vital to move on to concerted actions. As coordinated, cross-sector approaches are increasingly called for, considerable confusion remains about what "food system" means, how to address it, and pinpoint where to intervene. A brief look at the Food and Agriculture Organization of the United Nations, World Health Organization, and International Model for Policy Analysis of Agricultural Commodities and Trade models illustrates the range of understanding of the food system concept. Recent calls point to the need for an integrated, whole-systems approach beyond traditional agriculture or health concerns [26, 27, 28].

#### **Barriers To Adoption**

Findings reveal a complex set of economic, social, spatial, and cultural constraints limiting the transition to healthy and sustainable food systems in the study area. Further research on these interconnected factors is vital for developing effective strategies that promote national dietary guidelines compatible with ecological limits. Implementing evidence-based recommendations for future policy is crucial. Urban food security must be viewed through a complex lens that considers the interplay of factors affecting food access and availability. There is an urgent need for targeted interventions to address the root causes of food insecurity and encourage sustainable eating practices. Results may assist policymakers in developing comprehensive strategies to tackle food insecurity in Noreste's urban areas, paving the way for a multidimensional approach to promote healthier diets while addressing sustainability challenges. Addressing concerns about transforming the food and nutrition system is key to meeting the needs of a

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growing population while ensuring sustainability. Projections of population growth highlight increased pressure on ecosystems and resource security, emphasizing the need to consider the environmental impact of food systems. Notably, statistics indicate that in 1961, the North produced 730 million metric tons of cereals, while in 2011, production increased to 2.3 times greater, with the North overproducing. The overarching issue remains how to feed the population within planetary boundaries while mitigating the environmental damage caused by current food systems. Additionally, increasing physiological crop tolerance is essential due to water scarcity and drought [29, 30].

## **Addressing Misinformation**

Global food systems are at a pivotal turning point, with increasing attention on transforming them to benefit nature, ensure healthy diets, provide fair wages, and foster prosperity. Despite record lows in malnutrition and hunger globally, many regions remain affected by various forms of malnutrition. The UNFSS aims for measurable commitments from nations, donors, and private sectors by the end of 2021. This ambitious push is intensified by alarming risks such as climate change, growing inequities, and the global pandemic, which reveals vulnerabilities in our interconnected food systems. A clarion call for sustainable food systems has emerged, emphasizing higher agro-biological diversity and less reliance on finite resources to double growth to feed the additional 2 billion people anticipated in the next 30 years. Sustainable food systems must be inclusive, equitable, and resilient, ensuring pathways to prosperity while regenerating resources like trees, soil, and climate. Although "food systems" may evoke images of grocers or complex supply chains, they encompass all aspects of food production, distribution, and consumption, including the annual 1.3 billion tons of food waste. It is critical to understand that food systems impact everyone, revealing disparities through metrics like undernourishment and inflation. These systems are globally connected, playing a significant role in shaping societies at all levels, from local markets to global trade dynamics, influencing resource access and local opportunities amidst scarcity and abundance  $\lceil 31, 32 \rceil$ .

#### CONCLUSION

A sustainable and resilient food system is critical for ensuring a healthier planet and population. The integration of sustainable agricultural practices, improved food policies, and interdisciplinary collaboration can drive transformative change. Local food systems must be supported while recognizing the benefits of global trade networks in addressing food security challenges. Addressing food waste and promoting regenerative agriculture can mitigate environmental impacts while enhancing economic viability. A balanced approach, incorporating economic, environmental, and cultural considerations, is necessary to shift towards a sustainable food system that supports human health and planetary wellbeing. As stakeholders continue to innovate and invest in sustainable solutions, collective action is required to create a food system that is equitable, nutritious, and environmentally responsible.

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