Title: Food system and Aquaponics

DOI: https://doi.org/10.59411/foodjournal.v2i2.24

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Summary

Introduction: The global food system faces numerous challenges, including population growth, climate change, and resource limitations. Ethiopia, a country with a rich agricultural heritage, is not exempt from these challenges. In recent years, the Ethiopian government and various stakeholders have recognized the need to transform the country's food system to ensure food security, improve nutrition, and enhance sustainability. This essay explores the drivers and challenges of the food system in Ethiopia, and highlights the potential of aquaponics as an innovative solution.

The Food System in Ethiopia: Ethiopia's food system is primarily characterized by small-scale, subsistence farming, with agriculture playing a crucial role in the country's economy and employment. The sector accounts for a significant share of the Gross Domestic Product (GDP). and employs the majority of the population. However, the food system faces several challenges, including low agricultural productivity, inadequate infrastructure, climate variability, and limited access to markets and technology.

Drivers for Change: Several factors have prompted the need for transformative change in Ethiopia's food system. Firstly, the rapidly growing population necessitates increased food production to meet the rising demand. Secondly, climate change poses a significant threat, leading to unpredictable weather patterns, recurrent droughts, and floods, which adversely affect agricultural productivity. Additionally, changing dietary preferences and nutrition concerns require a diversified and nutritious food supply. Lastly, the need to reduce poverty, enhance rural livelihoods, and foster economic growth are also crucial drivers for transforming the food system.

Challenges in the Food System: Despite its agricultural potential, Ethiopia faces numerous challenges in achieving a sustainable and resilient food system. These challenges include limited access to modern agricultural inputs, such as improved seeds, fertilizers, and machinery, which hampers productivity. Insufficient irrigation infrastructure and inefficient water management contribute to low crop yields and vulnerability to droughts. Inadequate post-harvest handling and storage facilities result in significant losses, reducing farmers' incomes. Moreover, limited access to credit, land tenure issues, and lack of market linkages further impede the development of the food system.

Aquaponics: A Potential Solution: Aquaponics, an innovative approach to food production, holds significant potential for addressing the challenges faced by Ethiopia's food system. Aquaponics combines aquaculture (fish farming). and hydroponics (soilless plant cultivation). in a symbiotic system where the waste generated by fish provides nutrients for plants, and the plants filter and purify the water for the fish. This closed-loop system utilizes water efficiently and maximizes productivity in a small footprint, making it suitable for urban and peri-urban areas.

Aquaponics offers several advantages for Ethiopia's food system. Firstly, it can produce a year-round supply of fresh vegetables and protein-rich fish, reducing seasonal limitations. Secondly, it requires significantly less water compared to traditional farming methods, addressing water scarcity concerns. Thirdly, aquaponics can be practiced in areas with poor soil quality or limited access to arable land, thereby expanding agricultural possibilities. Lastly, aquaponics can contribute to sustainable farming practices by reducing the need for chemical fertilizers and pesticides.

Conclusion: The transformation of Ethiopia's food system is imperative for ensuring food security, improving nutrition, and promoting sustainable agriculture. While the country faces numerous challenges, innovative approaches like aquaponics offer promising solutions. Aquaponics can enhance productivity, conserve resources, and provide a resilient and diversified food supply. To unlock its full potential, investments in research and development, capacity building, and supportive policies are essential. By embracing innovative solutions like aquaponics, Ethiopia can pave the way for a more sustainable and inclusive food system that benefits its population and contributes to global food security.

Key words: Food system, Aquaponics, Ethiopia, Food security

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Introduction

Food System

The food system refers to the interconnected network of activities, resources, and stakeholders involved in producing, processing, distributing, and consuming food. It includes agricultural production, transportation, storage, processing, packaging, retailing, and waste management. The food system also encompasses the social, economic, and environmental factors that influence food choices and access to food, such as food policies, food marketing, food culture, and food insecurity.

The food system is critical to human health and well-being, as well as to the sustainability of the planet. Sustainable food systems is one that is socially, economically, and environmentally sound, and that ensures access to healthy, affordable, and culturally appropriate food for all. It also supports the livelihoods of food producers and workers, promotes biodiversity and ecosystem health, and reduces the environmental impacts of food production and consumption, such as greenhouse gas emissions and water pollution.

Food system concept

The concept of a food system recognizes the interconnectedness of all aspects of the food chain, from agricultural production to consumption and waste management. It is an approach that looks beyond the production of food to consider the social, economic, and environmental impacts of the entire system.

The food system concept emphasizes the importance of sustainability, recognizing that the current system is often unsustainable due to issues such as food waste, environmental degradation, and social inequities. A sustainable food system aims to reduce waste, conserve natural resources, and support healthy food choices and access for all.

The food system concept also highlights the importance of collaboration and partnerships across all stakeholders involved in the food system, including farmers, food processors, retailers, policymakers, and consumers. By working together, these stakeholders can create a more sustainable and equitable food system that supports the health and well-being of individuals and communities, as well as the health of the planet.

Food system challenges

There are many challenges facing the food systezam, including:

1. Food insecurity: According to the Food and Agriculture Organization of the United Nations, over 800 million people worldwide are currently experiencing food insecurity, and this number is expected to rise due to factors such as climate change, conflict, and economic instability (FAO, 2021).
2. Environmental degradation: The current food system contributes to environmental degradation through deforestation, greenhouse gas emissions, water pollution, and other factors. A study by the Intergovernmental Panel on Climate Change found that food systems are responsible for up to 37% of all greenhouse gas emissions (IPCC, 2019).
3. Food waste: An estimated one-third of all food produced for human consumption is lost or wasted each year, representing a significant loss of resources and contributing to greenhouse gas emissions (FAO, 2019).
4. Public health: The current food system contributes to diet-related diseases such as obesity, diabetes, and heart disease, which are major public health challenges around the world (WHO, 2021).
5. Social inequities: The food system is characterized by social and economic inequities, including unequal access to healthy food, exploitation of farm workers, and concentration of power and profits in the hands of a few large corporations (Oxfam, 2020).

Food system in Ethiopia

Ethiopia's food system faces several challenges, including food insecurity, environmental degradation, and low agricultural productivity. Some key issues in the Ethiopian food system are:

1. Food insecurity: Ethiopia has experienced recurring food crises due to factors such as drought, conflict, and poverty. According to the Global Hunger Index 2021, Ethiopia ranks 101 out of 116 countries in terms of hunger and malnutrition (Global Hunger Index, 2021).
2. Low agricultural productivity: Despite its rich agricultural potential, Ethiopia's agricultural productivity is low, with smallholder farmers facing challenges such as limited access to inputs, poor infrastructure, and weak market linkages (IFPRI, 2020).
3. Environmental degradation: Agricultural practices such as overgrazing and deforestation have led to soil erosion, desertification, and other forms of environmental degradation (FAO, 2019).
4. Climate change: Ethiopia is particularly vulnerable to the impacts of climate change, which can lead to droughts, floods, and other weather-related disasters that affect food production and availability (World Bank, 2020).
5. Nutrition: Malnutrition remains a significant challenge in Ethiopia, with high rates of stunting, wasting, and micronutrient deficiencies (UNICEF, 2021).

Black soldier fly role on food system

Black soldier fly larvae (BSFL). have been proposed as a potential solution to some of the challenges facing the food system, particularly related to food waste and animal feed production. Some of the roles that black soldier fly can play in the food system are:

1. Food waste management: Black soldier fly larvae can efficiently convert organic waste into a high-quality protein source for animal feed. This can help reduce the amount of waste sent to landfills and contribute to a more circular food system (Diener *et al*., 2011).
2. Sustainable animal feed production: Black soldier fly larvae are a nutritious and sustainable source of protein and fat for animal feed, and can replace more resource-intensive feed sources such as soybean meal and fishmeal (Spranghers *et al*., 2017).
3. Biowaste valorization: The use of black soldier fly larvae in waste management and animal feed production can also generate other valuable byproducts such as fertilizer and biofuel (Lalander *et al*., 2015).
4. Climate change mitigation: The use of black soldier fly larvae can also contribute to climate change mitigation by reducing greenhouse gas emissions associated with landfills and traditional animal feed production (Surendra *et al*., 2016).

Food system and aquaponics

Aquaponics is a food production system that combines aquaculture (fish farming) and hydroponics (soil-less plant production). in a symbiotic relationship. Aquaponics has the potential to address some of the challenges facing the food system, particularly related to sustainable food production and resource conservation. Some of the potential benefits of aquaponics for the food system include:

1. Resource conservation: Aquaponics uses water more efficiently than traditional farming methods, as water is recirculated between the fish tanks and the plant beds. This can help reduce water consumption and minimize the environmental impacts of agricultural runoff (Love *et al*., 2015).
2. Sustainable food production: Aquaponics can provide a sustainable source of fresh produce and fish protein, with lower carbon and water footprints than traditional agriculture (Goddek *et al*., 2019).
3. Climate change resilience: Aquaponics can be a more resilient food production system in the face of climate change, as it is less vulnerable to weather extremes and natural disasters than traditional farming methods (Endut *et al*., 2010).
4. Urban agriculture: Aquaponics can be an effective way to produce food in urban areas where land is limited and contaminated, providing fresh produce and fish to urban communities (Goddek *et al*., 2019).

Food policy in Ethiopia

Ethiopia has implemented several food policies and strategies aimed at improving food security and nutrition, reducing poverty, and promoting sustainable agriculture. Some of the key policies and strategies include:

1. The Agricultural Development Led Industrialization (ADLI) strategy: This strategy was launched in 1994 and aimed to promote agricultural productivity, diversification, and commercialization. The strategy focused on improving infrastructure, increasing access to credit and markets, and strengthening extension services to improve the capacity of smallholder farmers.
2. The National Nutrition Program: This program was launched in 2008 and aimed to address malnutrition in Ethiopia, particularly among women and children. The program included interventions such as promoting breastfeeding, improving access to nutrient-rich foods, and providing nutrition education.
3. The Productive Safety Net Program (PSNP): This program was launched in 2005 and aimed to provide food and cash transfers to vulnerable households in exchange for participation in public works programs. The program aimed to improve food security and reduce poverty in Ethiopia.
4. The Climate Resilient Green Economy (CRGE) strategy: This strategy was launched in 2011 and aimed to promote sustainable agriculture, forestry, and fisheries practices to address climate

change and promote economic growth. The strategy focused on increasing the resilience of smallholder farmers to climate change and promoting sustainable land use practices.

Food system change and climate change

The food system and climate change are closely intertwined, as the food system is a significant contributor to greenhouse gas emissions and climate change impacts can have significant effects on food production and availability. Therefore, changing the food system is an essential aspect of addressing climate change. Here are some of the ways that food system change can help address climate change:

1. Reduce greenhouse gas emissions: The food system is a significant contributor to greenhouse gas emissions, with estimates suggesting that up to 37% of global emissions are associated with food production, transportation, and waste (IPCC, 2019). Therefore, changing the food system to reduce emissions can help mitigate climate change. This can include reducing meat consumption, promoting plant-based diets, reducing food waste, and promoting more sustainable agriculture practices.
2. Increase resilience to climate change: Climate change is expected to have significant impacts on food production, with changes in temperature, precipitation patterns, and extreme weather events affecting crop yields and livestock production. Changing the food system to promote more resilient agriculture practices, such as agroforestry, crop diversification, and improved irrigation techniques, can help farmers adapt to changing climate conditions.
3. Promote biodiversity conservation: Biodiversity loss is both a cause and consequence of climate change. The food system is a significant driver of biodiversity loss, with monoculture farming practices, deforestation, and overfishing all contributing to biodiversity loss. Changing the food system to promote more diverse and sustainable agriculture practices can help conserve biodiversity and promote ecosystem resilience.
4. Improve food security: Climate change is expected to increase the prevalence of food insecurity, with changes in temperature and precipitation patterns affecting crop yields and food production. Changing the food system to promote more sustainable agriculture practices and reduce waste can help improve food security and reduce vulnerability to climate change.

Gender and food system

Gender plays a critical role in the food system, including food production, processing, distribution, and consumption. Gender inequalities in access to resources, decision-making power, and labor opportunities can affect food security, nutrition, and the sustainability of food systems. Here are some of the ways gender intersects with the food system:

1. Women's role in food production: Women play a significant role in food production, particularly in smallholder farming systems. However, they often have limited access to land, credit, and agricultural inputs, which can limit their productivity and income.
2. Gendered division of labor: Women and men often have different roles and responsibilities in the food system, with women more likely to be involved in food processing, preparation, and marketing, while men are more likely to be involved in agricultural production. Gendered division of labor can limit women's access to resources and decision-making power.
3. Women's access to markets: Women often face constraints in accessing markets and selling their products, including limited mobility, lack of market information, and discrimination.
4. Women's nutritional status: Women and girls often have lower nutritional status than men and boys, due to gender discrimination, limited access to food, and limited decision-making power over household food consumption.
5. Gender and climate change: Climate change affects men and women differently, with women often more vulnerable due to their roles in food production and limited access to resources. Climate change can exacerbate gender inequalities in the food system, as women are more likely to experience food insecurity and have limited adaptive capacity.

Addressing gender inequalities in the food system is essential for promoting sustainable, resilient, and equitable food systems.

Food system and poverty

Food systems and poverty are deeply interconnected. Poverty can affect access to food and nutrition, and the food system can contribute to poverty through its impact on livelihoods and income.

Table 1: Food system drivers

Driver	Description
Population growth	As the world's population grows, demand for food increases, which can put pressure on food systems to produce more food, often with negative environmental and social impacts.
Urbanization	Urbanization can lead to changes in food demand and consumption patterns, as well as changes in the way food is produced and distributed.
Globalization	Globalization has led to increased trade in food products, which can have both positive and negative impacts on food systems and local food economies.
Technology and innovation	Technological advances in food production, processing, and distribution have led to increased productivity and efficiency, but can also have negative impacts on environmental and social sustainability.
Climate change	Climate change can affect food production, distribution, and consumption, and exacerbate existing challenges in the food system, such as food insecurity and malnutrition.
Land use change	Land use change, such as deforestation and conversion of natural ecosystems to agriculture, can have negative impacts on the environment and biodiversity, as well as on food production and livelihoods.
Policy and governance	Government policies and regulations can affect the way food is produced, distributed, and consumed, as well as the economic and social aspects of food systems.
Consumer preferences and behavior	Consumer preferences and behavior can influence food demand and consumption patterns, which in turn affect food production and distribution.
Socio-economic factors	Socio-economic factors such as income, education, and gender can affect food access, nutrition, and health, as well as the way food is produced and distributed.

Table 2: Food system dynamics in Ethiopia

Dynamics	Description
Production	Agriculture is the backbone of the Ethiopian economy, with over 70% of the population engaged in smallholder farming. However, agricultural productivity is low due to factors such as poor soil fertility, limited access to inputs and credit, and climate variability.
Processing	The food processing sector in Ethiopia is small and underdeveloped, with much of the food produced consumed in its raw form. This limits opportunities for value addition and income generation.
Distribution	The food distribution system in Ethiopia is characterized by limited infrastructure, including inadequate roads and transportation, which can result in food waste and limited access to markets.
Consumption	Despite being an agricultural country, Ethiopia faces high levels of malnutrition and food insecurity, with over 20% of the population experiencing chronic food insecurity. Poor access to diversified diets and limited awareness of nutrition contribute to this challenge.
Policy and governance	Government policies and programs aimed at improving food security and nutrition have been implemented in Ethiopia, but challenges remain in areas such as improving access to inputs and credit, building infrastructure, and addressing market inefficiencies.
Climate change	Climate change is a major challenge in Ethiopia, with erratic rainfall, droughts, and floods affecting food production and food security. Adaptive measures, such as promoting climate-resilient crops and improving water management, are needed to address these challenges.
Gender	Women play a significant role in the Ethiopian food system, particularly in smallholder agriculture. However, they face significant barriers to access to inputs and credit, as well as limited decision-making power and control over resources. Gender-sensitive approaches are needed to address these challenges and promote equitable food systems.
Land tenure	Land tenure is a critical issue in the Ethiopian food system, with the majority of land owned by the government and managed through communal land tenure systems. This can result in limited access to land for smallholder farmers and a lack of incentives for sustainable land management practices.
Livestock	Livestock play a significant role in the Ethiopian food system, with the country having the largest livestock population in Africa. Livestock provide a critical source of food and income for rural households, but also contribute to environmental challenges such as overgrazing and soil degradation.
Food safety and quality	Food safety and quality is a growing concern in Ethiopia, particularly in urban areas where there is increasing demand for processed and packaged foods. Lack of regulation and enforcement, as well as limited consumer awareness, contribute to food safety and quality challenges.
Informal food systems	Informal food systems, such as traditional markets and street vendors, play a significant role in the Ethiopian food system, particularly in urban areas. However, these systems often lack regulation and infrastructure, leading to challenges such as food safety concerns and limited access to credit and financing.
Globalization	Globalization and the increasing integration of Ethiopia into global food markets has both positive and negative impacts on the food system. While it provides opportunities for trade and income generation, it can also lead to competition with local producers, price volatility, and challenges in maintaining food security.

Table 3: Population growth and food system Ethiopia

Interactions	Description
Increased demand for food	As the population grows, there is an increasing demand for food in Ethiopia. This puts pressure on the food system to produce more food to meet the needs of a growing population.
Pressure on natural resources	Population growth can also result in pressure on natural resources such as land, water, and forests. In Ethiopia, this can lead to deforestation, soil erosion, and overgrazing, which can negatively impact the productivity of the food system.
Need for increased productivity	To meet the demand for food from a growing population, there is a need for increased productivity in the food system. This can include investing in technologies and practices to improve soil fertility, water management, and crop yields.
Opportunities for income generation	A growing population can also create opportunities for income generation in the food system, such as through increased demand for food processing and packaging, or through the expansion of markets to meet the needs of a growing population.
Risk of food insecurity	If the food system is unable to keep pace with population growth, there is a risk of food insecurity and malnutrition. In Ethiopia, this is a significant challenge, with over 20% of the population experiencing chronic food insecurity.

Food system change trend with economic growth

The relationship between food system change and economic growth is complex and multifaceted. Generally speaking, economic growth can drive changes in the food system through its impact on factors such as income, urbanization, and globalization. Here are a few examples of how economic growth has impacted the food system in Ethiopia:

1. Income and dietary patterns: As the Ethiopian economy has grown over the past few decades, per capita income has increased, which has had an impact on dietary patterns. As people have more money to spend on food, there has been a shift towards more diverse diets that include a greater variety of fruits, vegetables, and animal-source foods. This has led to changes in the food system, as producers and processors have had to adapt to meet the changing demand.
2. Urbanization and food processing: Ethiopia's urban population has grown rapidly in recent years, which has created new opportunities and challenges for the food system. Urbanization has led to an increased demand for processed and packaged foods, as well as more formalized retail channels such as supermarkets. This has created new opportunities for food processors and retailers, but has also put pressure on smallholder farmers who may struggle to access these new markets.
3. Globalization and export-oriented agriculture: As Ethiopia has become more integrated into the global economy; there has been a shift towards export-oriented agriculture, particularly in the horticulture and coffee sectors. This has created new opportunities for smallholder farmers who are able to participate in export markets, but has also led to concerns about land tenure, labor rights, and environmental sustainability.

The relationship between food system change and economic growth is complex and context-specific. While economic growth can create new opportunities for the food system, it can also exacerbate existing inequalities and environmental challenges. Therefore, it is important to consider the broader social, economic, and environmental impacts of food system change as the economy grows and evolves.

Table 5: Food system relation with child malnutrition in Ethiopia add reference

Factors	Description
Food availability	A lack of food availability is a key factor contributing to child malnutrition in Ethiopia. While the country has made progress in increasing food production, many households still struggle to access sufficient quantities of nutritious food. This is due in part to limited access to inputs such as improved seeds and fertilizers, as well as the impact of climate-related shocks such as droughts and floods.
Dietary diversity	The quality of the diet is also an important factor in child malnutrition in Ethiopia. Many households rely heavily on staple crops such as maize and teff, which are often not supplemented with enough fruits, vegetables, and animal-source foods. This can lead to micronutrient deficiencies and stunting.
Food safety	The safety of the food supply is also a concern in Ethiopia, particularly in informal markets where food may be contaminated with harmful bacteria or toxins. This can lead to illnesses such as diarrhea, which can contribute to malnutrition.
Health and sanitation	Poor health and sanitation practices can also contribute to child malnutrition in Ethiopia. Diseases such as diarrhea and respiratory infections can lead to poor nutrient absorption, while poor hygiene practices can increase the risk of infections.
Poverty and inequality	Poverty and inequality are underlying factors that can impact all of the above factors, as households with limited resources may struggle to access nutritious food, safe water, and health services. Children from marginalized communities such as rural and pastoralist areas are particularly vulnerable to malnutrition.

Food system and value chain market chain in Ethiopia

The food system and value chain market in Ethiopia is complex and diverse, with a wide range of actors involved in the production, processing, and distribution of food. Here are some key features of the food system and value chain market in Ethiopia:

1. Smallholder agriculture: Smallholder farmers play a significant role in the food system in Ethiopia, producing a wide range of crops including staple grains such as maize, teff, and wheat, as well as high-value crops such as coffee, sesame, and horticultural products. These farmers often face challenges in accessing inputs such as improved seeds and fertilizers, as well as markets for their products.
2. Informal markets: The majority of food transactions in Ethiopia take place in informal markets, which can range from small street vendors to large open-air markets. These markets are an important source of food for many households, particularly in rural areas, but can also present challenges in terms of food safety and quality.
3. Food processing: Food processing is an important sector in the value chain market in Ethiopia, with a wide range of products being produced including flour, oil, dairy products, and packaged foods. While many processors are small and medium enterprises, there are also large-scale processors who export their products to regional and international markets.
4. Retail and distribution: The retail and distribution sector in Ethiopia is evolving rapidly, with the growth of formalized retail channels such as supermarkets and online shopping platforms. However, these channels are still relatively small in comparison to the informal market, and many households continue to rely on small-scale retailers such as kiosks and street vendors.
5. Export markets: Ethiopia is an important exporter of agricultural products, particularly coffee and horticultural products. The country has made efforts to develop value chains for these products, including investing in infrastructure such as airports and cold storage facilities, and promoting quality standards.

The food system and value chain market in Ethiopia is complex and evolving, with a wide range of actors involved in the production, processing, and distribution of food. There are both opportunities and challenges in the sector, including the need to address issues of food safety and quality, and to ensure that smallholder farmers have access to markets and inputs.

Food system types in Ethiopia

There are different types of food systems in Ethiopia, depending on factors such as the agroecology, socio-economic conditions, and cultural practices of different regions. Here are some examples:

1. Smallholder food systems: Smallholder farmers produce the majority of food in Ethiopia, using traditional practices and low-input agriculture. These systems are often characterized by diverse cropping systems, with farmers growing a range of staple crops and cash crops to meet their own household needs as well as to sell in local markets.
2. Industrial food systems: There are also some large-scale agricultural enterprises in Ethiopia that produce crops for the domestic and export markets. These systems often rely on mechanized farming, modern inputs, and advanced processing technologies.
3. Pastoralist food systems: In the arid and semi-arid regions of Ethiopia, pastoralists rely on livestock for their livelihoods and food security. These systems involve seasonal movement in search of grazing land and water sources, and often involve trading livestock for other goods and services.
4. Urban food systems: Urban areas in Ethiopia have their own unique food systems, with a mix of formal and informal markets, street vendors, supermarkets, and restaurants. These systems are often characterized by high levels of food waste and a reliance on imported food products.
5. Indigenous food systems: Ethiopia has a rich diversity of indigenous crops and food practices, which are an important part of the food system in many regions. These systems often involve the use of traditional knowledge and techniques, and prioritize biodiversity and environmental sustainability.

The food systems in Ethiopia are diverse and complex, reflecting the country's varied agroecology, culture, and socio-economic conditions. Each of these food systems has its own strengths and challenges, and understanding them is important for developing policies and interventions to support food security and sustainability.

Factors that sift food system

There are a number of factors that can shift the food system in a particular direction, including:

1. Demographic changes: Changes in population size, age structure, and migration patterns can all have a significant impact on the food system. For example, urbanization and population growth can increase demand for food, while aging populations may have different dietary needs and preferences.
2. Climate change and environmental degradation: Changes in climate patterns, soil degradation, and water scarcity can all affect food production, distribution, and consumption. These environmental changes can lead to shifts in crop yields, changes in the types of crops that can be grown in certain regions, and altered patterns of food consumption.
3. Technological advances: Innovations in agricultural technology, such as improved seeds, mechanization, and precision farming, can have a significant impact on the food system. These advances can increase yields, reduce post-harvest losses, and improve food safety and quality.
4. Economic forces: Economic trends such as globalization, trade liberalization, and changes in consumer preferences can also shift the food system. These forces can affect the types of crops that are grown, the types of food products that are consumed, and the ways in which food is produced and distributed.
5. Policy and institutional changes: Government policies, regulations, and institutional arrangements can also have a significant impact on the food system. For example, subsidies for certain crops can influence production decisions, while food safety regulations can affect the processing and distribution of food products.

Understanding these factors and how they interact with each other is important for developing policies and interventions that can promote a more sustainable and equitable food system.

Ethiopia food system dynamics relationship with consumer's behavior

The food system dynamics in Ethiopia can have a significant impact on consumer behavior and dietary patterns. Here are some ways in which the food system dynamics can influence consumer behavior:

1. Availability and accessibility of food: The availability and accessibility of different types of food can affect what consumers eat. For example, if certain crops are not grown in a particular region or are too expensive to purchase, consumers may not have access to them and may have to rely on other types of food.

2. Cultural and social norms: Cultural and social norms can also influence what people eat. For example, in Ethiopia, there are traditional dishes that are commonly consumed in different regions, and these dishes may be prepared differently depending on local customs and practices.
3. Food safety and quality: Concerns about food safety and quality can also influence consumer behavior. If consumers perceive that certain types of food are unsafe or of poor quality, they may avoid them or seek out alternatives.
4. Marketing and advertising: The marketing and advertising of food products can also influence consumer behavior. For example, if certain types of food are heavily promoted and marketed, consumers may be more likely to purchase them.
5. Income and affordability: Income and affordability are also important factors that influence consumer behavior. Consumers with higher incomes may have more choices in terms of what they can purchase and may be more likely to purchase higher quality or more expensive food products.

Understanding these dynamics is important for developing policies and interventions that can promote healthier and more sustainable food systems in Ethiopia. By addressing the drivers of consumer behavior, such as availability, affordability, and marketing, it may be possible to encourage healthier and more sustainable dietary patterns.

Ethiopia food system relationship with transport

Transportation is an important aspect of the food system in Ethiopia, as it affects the movement of food products from farms to markets and ultimately to consumers. Here are some ways in which the food system in Ethiopia is related to transportation:

1. Infrastructure: The availability and quality of transportation infrastructure, such as roads and bridges, can have a significant impact on the food system. Poor infrastructure can limit access to markets and increase transportation costs, which can affect the prices and availability of food products.
2. Logistics and supply chain management: Effective logistics and supply chain management are essential for ensuring that food products are transported efficiently and safely. In Ethiopia, there are challenges related to logistics and supply chain management, such as inadequate storage facilities and inefficient transportation systems.
3. Post-harvest losses: Transportation can also affect post-harvest losses, which occur when food products are damaged or spoiled during transportation. In Ethiopia, post-harvest losses are a significant problem, with estimates suggesting that up to 50% of some crops are lost during transportation and storage.
4. Food safety: Transportation can also affect food safety, as food products that are not transported and stored properly can become contaminated with harmful bacteria or other pathogens.
5. Market access: Transportation also plays a key role in providing farmers with access to markets. Improved transportation infrastructure and logistics can help farmers reach new markets and expand their customer base.

Transportation is an important factor in the food system in Ethiopia. Addressing challenges related to transportation infrastructure, logistics, and supply chain management can help to improve the efficiency and sustainability of the food system, and increase access to markets for farmers and consumers.

Ethiopia food systems relationship with producers

Producers play a critical role in the food system in Ethiopia, as they are responsible for growing crops and raising livestock that ultimately provide food for consumers. Here are some ways in which the food system in Ethiopia is related to producers:

1. Agricultural production: Agriculture is the backbone of the food system in Ethiopia, with over 80% of the population engaged in agriculture. The food system depends on producers to grow crops and raise livestock that are then processed, marketed, and consumed.
2. Access to inputs: Producers require access to a range of inputs, such as seeds, fertilizers, and equipment, to produce food. In Ethiopia, smallholder farmers often have limited access to these inputs, which can limit their productivity and ability to generate income.

3. Market access: Producers rely on access to markets to sell their products and generate income. However, smallholder farmers in Ethiopia often face challenges related to market access, such as poor transportation infrastructure and lack of information about market prices and demand.
4. Food safety: Producers also play a key role in ensuring the safety and quality of food products. They must follow good agricultural practices and adhere to food safety regulations to minimize the risk of contamination and ensure that their products are safe for consumption.
5. Sustainability: The food system in Ethiopia is closely linked to sustainability, as it relies on natural resources such as water and soil. Producers have a responsibility to manage these resources sustainably to ensure that they can continue to produce food in the long term.

The relationship between the food system and producers in Ethiopia is complex and multifaceted. Addressing challenges related to access to inputs, market access, and sustainability can help to improve the livelihoods of producers and promote a more sustainable and resilient food system in Ethiopia.

Food system in Ethiopia relationship with policy

The food system in Ethiopia is closely linked to policy, as government policies and regulations can have a significant impact on the production, processing, distribution, and consumption of food. Here are some ways in which the food system in Ethiopia is related to policy:

1. Agriculture policy: Agriculture policy plays a key role in shaping the food system in Ethiopia, as it governs issues such as land use, crop selection, and access to inputs. Policies that support smallholder farmers and promote sustainable agricultural practices can help to improve the productivity and resilience of the food system.
2. Trade policy: Trade policy also affects the food system in Ethiopia, as it regulates the import and export of food products. Policies that support domestic production and protect local markets can help to promote food security and reduce dependence on imported food.
3. Food safety regulations: Food safety regulations are essential for ensuring that food products are safe for consumption. In Ethiopia, the government has established food safety regulations to protect consumers and promote the safety and quality of food products.
4. Nutrition policy: Nutrition policy is also closely linked to the food system in Ethiopia, as it governs issues such as food fortification and nutrition education. Policies that promote healthy diets and address malnutrition can help to improve the health and well-being of the population.
5. Climate change policy: Climate change is a major challenge facing the food system in Ethiopia, and policies that address climate change can help to promote a more sustainable and resilient food system. Policies that support sustainable agriculture practices and promote the use of renewable energy can help to reduce greenhouse gas emissions and mitigate the impacts of climate change on the food system.

Policy plays a critical role in shaping the food system in Ethiopia. Policies that support sustainable agriculture practices, promote food safety and nutrition, and address the impacts of climate change can help to promote a more resilient and sustainable food system in Ethiopia.

Food system in Ethiopia relationship with education

Education is an important factor that influences the food system in Ethiopia in several ways:

1. Agricultural education: Education in agriculture plays a key role in promoting sustainable agricultural practices and improving the productivity and efficiency of the food system. Agricultural education programs can help farmers learn about new technologies and practices that can increase their yields and income.
2. Nutrition education: Education on nutrition is crucial for promoting healthy diets and reducing malnutrition in Ethiopia. Nutrition education programs can help to raise awareness about the importance of consuming a diverse range of foods and how to prepare and store food to maintain its nutritional value.
3. Food safety education: Education on food safety is important to ensure that consumers are aware of the risks associated with consuming contaminated food and know how to store and prepare food safely. Food safety education programs can help to reduce the incidence of foodborne illnesses in Ethiopia.

4. Entrepreneurial education: Education on entrepreneurship can help to promote the development of small and medium-sized enterprises (SMEs). in the food system in Ethiopia. Entrepreneurial education programs can help individuals to acquire the skills and knowledge needed to start and run a successful business.
5. Research and development: Education plays a critical role in supporting research and development in the food system in Ethiopia. Research institutions and universities play a key role in developing new technologies and practices that can improve the efficiency, productivity, and sustainability of the food system.

Education is an essential factor that influences the food system in Ethiopia. Education programs that promote sustainable agriculture practices, healthy diets, food safety, entrepreneurship, and research and development can help to promote a more resilient and sustainable food system in Ethiopia.

Ethiopia food system relationship with health

The food system in Ethiopia has a significant impact on public health, both directly and indirectly. Here are some ways in which the food system is related to health:

1. Malnutrition: Malnutrition is a significant public health problem in Ethiopia. The food system is a major contributor to malnutrition, as it determines the availability, accessibility, and affordability of nutritious foods.
2. Foodborne illness: Foodborne illnesses are a major public health concern in Ethiopia. Poor food handling and storage practices, as well as inadequate food safety standards, can contribute to the spread of foodborne illnesses.
3. Non-communicable diseases: The rise of non-communicable diseases (NCDs). such as diabetes, heart disease, and cancer is also a concern in Ethiopia. The food system can contribute to the development of NCDs by promoting unhealthy diets high in salt, sugar, and fat.
4. Access to healthcare: The food system can also impact access to healthcare in Ethiopia. The income and nutritional status of households can influence their ability to access healthcare services, as well as their ability to afford healthcare costs.
5. Environmental health: The food system can also impact environmental health in Ethiopia. Agricultural practices such as the use of chemical fertilizers and pesticides can have negative impacts on soil and water quality, as well as the health of farmers and their families.

The food system in Ethiopia is closely linked to public health outcomes. Improving the sustainability, efficiency, and resilience of the food system can help to promote better health outcomes for the Ethiopian population.

Ethiopia food system relationship with security

The food system in Ethiopia is closely linked to food security, which refers to the availability, accessibility, and affordability of sufficient and nutritious food for all people. Here are some ways in which the food system is related to food security:

1. Agricultural productivity: The productivity of the agricultural sector is a critical factor in ensuring food security in Ethiopia. The food system depends on the productivity of farmers and the availability of inputs such as land, water, seeds, and fertilizers.
2. Climate change: Climate change is a significant threat to food security in Ethiopia, as it can affect crop yields, water availability, and the spread of pests and diseases. The food system is vulnerable to the impacts of climate change, and efforts to adapt to these impacts are necessary to ensure food security.
3. Market access: Access to markets is important for ensuring that farmers can sell their produce and earn a sustainable income. The food system depends on the availability of markets and the infrastructure to transport food from rural areas to urban centers.
4. Food prices: Food prices can have a significant impact on food security in Ethiopia. High food prices can make it difficult for households to afford sufficient and nutritious food, while low food prices can reduce the income of farmers and impact agricultural productivity.
5. Conflict and displacement: Conflict and displacement can also have a significant impact on food security in Ethiopia. Displaced populations often struggle to access sufficient and nutritious food, while conflict can disrupt agricultural productivity and access to markets.

The food system in Ethiopia is closely linked to food security, which is a critical issue for the country. Improving the productivity, sustainability, and resilience of the food system can help to ensure that all people in Ethiopia have access to sufficient and nutritious food.

Urbanization and food system

Urbanization can have a significant impact on the food system, particularly in developing countries like Ethiopia. Here are some ways in which urbanization is related to the food system:

1. Changes in demand: As people move from rural to urban areas, their dietary patterns often change. Urban populations tend to consume more processed and high-calorie foods, which can have negative impacts on health. The food system must adapt to changing demand patterns to ensure that nutritious and diverse food is available and accessible to all people.
2. Market access: Urbanization can increase demand for food and create new market opportunities. However, it can also make it difficult for small-scale farmers in rural areas to access urban markets. The food system must ensure that small-scale farmers have access to urban markets and the infrastructure to transport their produce.
3. Food waste: Urbanization can also contribute to food waste, as the supply chains and distribution systems become more complex. Addressing food waste is an important part of ensuring the sustainability of the food system.
4. Land use: As urban areas expand, they often encroach on agricultural land, leading to a loss of biodiversity and a reduction in the availability of agricultural land. The food system must address the issue of land use to ensure the sustainability of food production.

Urbanization is a complex issue that has significant implications for the food system. It is essential to take a holistic approach to address the challenges and opportunities presented by urbanization and ensure that the food system is sustainable, resilient, and equitable for all people.

Aquaponics and food system

Aquaponics is a sustainable farming method that combines aquaculture (fish farming) with hydroponics (growing plants in nutrient-rich water). It is a closed-loop system where fish waste is converted into nutrients for plants, and the plants filter the water for the fish. Aquaponics can have a significant impact on the food system in several ways:

1. Local food production: Aquaponics can be done in urban areas, providing a source of fresh, locally grown food. This can reduce transportation costs and increase access to fresh produce.
2. Water use efficiency: Aquaponics uses less water than traditional farming methods, making it an efficient way to produce food. In water-scarce regions, aquaponics can be an effective way to grow food with minimal water use.
3. Nutrient-dense food: Aquaponics can produce nutrient-dense food, including fish and vegetables, which can improve food security and nutrition.
4. Climate resilience: Aquaponics is a climate-resilient farming method that can be used in areas with extreme weather conditions and limited access to resources.
5. Job creation: Aquaponics can create employment opportunities, particularly in urban areas where there is a need for sustainable food production.

Aquaponics can play a crucial role in creating a sustainable and resilient food system. It has the potential to increase access to fresh produce, improve food security and nutrition, and create employment opportunities, while using fewer resources and reducing the environmental impact of food production.

Black soldier fly and food system

Black soldier fly (BSF) larvae are increasingly being recognized as a sustainable source of protein and other valuable nutrients in the food system. Here are some ways in which BSF can impact the food system:

1. Alternative protein source: BSF larvae are a rich source of protein and can be used as a substitute for fishmeal and soybean meal in animal feed. This can reduce the pressure on traditional protein sources and provide a more sustainable alternative.

2. Waste reduction: BSF larvae can consume organic waste such as food waste, manure, and agricultural waste, converting it into valuable protein and other nutrients. This can reduce the amount of waste going to landfills and provide a more sustainable way of managing waste.
3. Nutrient recycling: BSF larvae can be used to recycle nutrients from food waste, producing a valuable fertilizer for crops. This can reduce the reliance on synthetic fertilizers, which can have negative environmental impacts.
4. Climate resilience: BSF larvae can be grown in a variety of environments and can help to diversify the food system, making it more resilient to climate change.
5. Local food production: BSF larvae can be grown locally, providing a source of fresh and sustainable protein and nutrients in areas where traditional protein sources are not available or too expensive.

BSF has the potential to play a significant role in creating a sustainable and resilient food system. It can provide an alternative protein source, reduce waste, recycle nutrients, and create new opportunities for local food production, while reducing the environmental impact of food production.

Hydrofoder and food system

Hydroponics is a method of growing plants without soil, using nutrient-rich water instead. Hydro-fodder, on the other hand, is a type of hydroponics that is specifically designed for livestock feed production. Here are some ways in which Hydro-fodder can impact the food system:

1. Reduced reliance on traditional feed sources: Hydro-fodder can be used to grow high-quality, nutrient-rich feed for livestock, reducing the reliance on traditional feed sources such as pasture and hay.
2. Increased feed efficiency: Hydro-fodder allows for precise control of nutrient delivery, resulting in more efficient use of feed and reduced waste.
3. Consistent feed quality: Hydro-fodder provides a consistent supply of high-quality feed, which can improve animal health and productivity.
4. Climate resilience: Hydro-fodder can be grown in a controlled environment, reducing the impact of extreme weather events on livestock feed production.
5. Local food production: Hydro-fodder can be grown locally, providing a source of fresh and sustainable feed for livestock in areas where traditional feed sources are not available or too expensive.

Hydro-fodder has the potential to play a significant role in creating a more sustainable and resilient food system. It can reduce the reliance on traditional feed sources, improve feed efficiency and consistency, and create new opportunities for local food production, while reducing the environmental impact of livestock feed production.

Food system and economic growth

The relationship between food systems and economic growth is complex and multifaceted. On one hand, a well-functioning food system can contribute to economic growth by providing employment opportunities, generating income, and contributing to food security. On the other hand, economic growth can also have a significant impact on food systems, both positive and negative.

Here are some ways in which economic growth can impact food systems:

1. Increased demand for food: Economic growth can lead to increased demand for food as incomes rise and populations grow. This can create opportunities for food producers and suppliers, but can also put pressure on food systems to increase productivity and efficiency.
2. Changes in dietary patterns: As incomes rise, people may change their dietary patterns, consuming more meat, dairy, and processed foods. This can impact food systems by increasing demand for certain types of foods, changing supply chains, and affecting the sustainability of food production.
3. Urbanization: Economic growth often leads to increased urbanization, which can impact food systems by changing consumer demand, creating new supply chains, and affecting the availability of land for agriculture.

4. Technological advancements: Economic growth can also drive technological advancements in agriculture, such as precision farming and genetic engineering. These advancements can improve efficiency and productivity, but can also have environmental and social implications.
5. Income inequality: Economic growth can exacerbate income inequality, which can impact food systems by limiting access to food for low-income populations and creating social and political instability.

The relationship between food systems and economic growth is complex and depends on a variety of factors, including consumer demand, technological advancements, and income inequality. A well-functioning food system can contribute to economic growth, but economic growth can also impact food systems in both positive and negative ways.

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