



# Food Production, Availability, Agricultural Systems, and Food Security: A Detailed Review

Hub Bouxine

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## REVIEW ARTICLE

# Food Production, Availability, Agricultural Systems, and Food Security: A Detailed Review

Hub Bouxine

American University of Phnom Penh, Phnom Penh, Cambodia

\*Author to whom correspondence should be addressed; E-Mail: [bouxine.hub80@aupp.edu.kh](mailto:bouxine.hub80@aupp.edu.kh)

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**Abstract:** Food production, availability, agricultural systems, and food security are intricately linked components of the global food system. Ensuring food security, defined as the availability, access, and stability of sufficient, safe, and nutritious food for all, is one of the most pressing challenges faced by both developed and developing countries. This comprehensive review explores the relationship between food production and availability, the role of agricultural systems in ensuring food security, and the critical factors that influence these processes, including climate change, technological advancements, policy frameworks, and socioeconomic factors. Food availability is shaped by both the efficiency of agricultural systems and the effectiveness of food distribution networks. This involves addressing post-harvest losses, improving storage and transportation infrastructure, and managing global trade dynamics. The review also delves into the impact of climate change on food systems, highlighting the need for resilient agricultural practices and adaptive policies to ensure long-term food security. The review concludes by advocating for a holistic, interdisciplinary approach to food security that integrates sustainable agricultural development, policy interventions, technological innovation, and community-level resilience to ensure equitable and sustainable food systems for future generations.

**Keywords:** Food Supply Chain Logistics, Food Safety, Food Security, Food Waste, Supply Chain Management, Traceability, Food Loss, Sustainable Practices, Logistics Infrastructure, Consumer Education.

## INTRODUCTION

Food Security is essential for human purposes but because of pollution in the environment, the strategies have been made for making the food secure and healthy. There are about billions of people around the world who eat food daily but many of them will eat very little food as they will not fresh foods. This will lead to effect the economy and people will struggle with several factors. For making the economy better, it should have an improvement in the food and deliver the best quality of food, agricultural costs and better transportation costs. As a result, it will also increase global investment in agriculture and food development. There is a high demand for food but the men, women and the children generally want all the nutritious value in the food. The human beings will have the capability to study and learn in school which will also influence their health as well as earn a living. It will also help in reducing poverty.

In fact, poor people have more at stake in preserving the resources they depend on. It is short-sighted commercial exploitation by a few companies which is leveling the world's forests for commercial products such as timber, furniture and paper, or for the conversion of the land for growing commodities, plantation crops, and narcotics or for running livestock. Such practices supply the countries of the North with consumer goods while leaving all the environmental and social costs in the South. To preserve a common future the environment must take priority. They get help by encouraging environmentally sensitive commodity production and questioning our own consumption. The food and Agriculture Organization of the United Nations has discussed that the people have different taste for the food, but it should be healthy with all the nutritious value, so it is necessary to have the food security for the people. The food either gets imported or produced nationally or arrives through food support.

The data shows that people may get affected at the time of eating the food. In past Years, many people are not getting nutritious and safe food because of crises in the food and fuel leading to hunger. The human beings who are living in rural areas get limited food and limited to eat such as small-scale farmers including women and children. But on the other hand, there are millions of small-scale farmers who have control over the two billion individuals or one-third of all humanity. In many developing countries, the women are more than the men in producing food which is consumed by all the individuals. This happens mainly in the African and Asian region that the women are the small-scale farmers. It has been considered that if there is an increase in agriculture production, the reason behind is the women who are responsible for a large growing. They are important mediators for food security and economic development in the developing world. The rich world keeps the South wedded to commodity production by putting up tariff barriers to manufactured goods. Barriers to textiles and clothing alone cost poor countries \$53 billion a year in lost trade – this equals the total of all Western aid to the South. Ironically, maintaining poverty in the South means poor countries can buy less of the manufactured goods the rich are so eager to supply. There is no such thing as a 'free' market; what we must strive for is one that is fair. The first step is to become informed and make wise decisions as consumers and investors. As citizens suffer due to unfair trade and voice that opposition to our political leaders. There have been many questions which has been raised that what are the challenges and what consequences that the agriculture sector is facing for food security. The government plays a vast role to give strength and increase the ability of the food farmers in order to report food security. The government will offer schemes for the small-scale farmers that are important features for improvements in the food security are: The farmers should get new machines and use modern techniques and technology for higher productivity which should be provided by the government. The government should have all the resources so there should be control on the transportation costs and they get the proper land space for the food productivity otherwise, it will take high input costs and it will lead to evolving economic recession and financial crises that will continue to aggravate the constancy of food systems.

There have been two strong reasons that people are dying. The first reason is that the people are not getting the food and the second reason is that many of them are getting unsafe food which leads to death. The people are suffering from the disease like tuberculosis, malaria, etc. These things occurring because of unhealthy food which means that the food is not secure. When people want only the food and they don't demand healthy food that contributes to addressing food insecurity. There have been many food associations for making the strategies in food assistance.

- In developing countries, The UN World Food Program is responsible to meet the food needs of vulnerable populations.
- Food assistance and nutrition programming should also get explored from the innovative initiatives.
- The government of every country should examine the regional and national strategies in order to include nutrition reflections into larger food security initiatives.
- There is a need to involve with the national governments, international and multilateral organizations in order to grow micronutrient programming.
- The strategy should be made to strengthen and support national and local food crises and food reserves alert and anticipation systems.

Many countries are working on improving the quality and effectiveness of nutrition programming and food assistance so that the people will be able to live a long life and improvement in their overall health. It is necessary to test the food sample and check that the food should have enough nutrition in the right manner. The Green Revolution was often hijacked by rich elites who priced small farmers out of the market. In many countries, commercial farming, propped up with subsidies, continues apace with its arsenal of polluting chemicals, its pesticide-resistant pests, and declining yields. The real answers lie elsewhere, with the farmers who make the best use of their lands, fighting pests with natural biological control methods, growing a variety of crops to keep the soil fertile, and by saving the best seeds for future crops. For their efforts to succeed they must be able to make their own decisions. Too often governments, agribusiness companies, and policymakers, on the other side of the globe, control the agriculture agenda. The people who are poor may earn income while working in the agriculture sector. According to the World Development Report, there is an improvement in reducing the poverty and agriculture is getting more sustained as the strategies that have made in the past years has now become successful. There is a need for high investment for making the agriculture developed and sustained. It is necessary to make the strategies to support national and regional agriculture. These procedures and actions may help for addressing the sustainable agricultural development that will convert into development and growth on many heads. The partner's government should make effective strategies and strong policies so that the small rural farmers will increase their agricultural production. This approach should be more practical that will help in making the establishments more accountable. The agriculture process should be designed in such a way that every food variety should have proper nutritious value. The food will provide maximum profit to the people and the investment is also necessary for the agriculture sector. The strategy is made, and the budget has been decided earlier that how to develop and grow the agriculture sector. It is essential if production is to keep stride with the rise in demand.

The strategy should be made that there should be a high percentage of food that should be produced and consumed equally and not being wasted. The strategy should be made for controlling the wastage of the food and people should also be aware that it should not make a negative impact on the environment. This means that wasting includes great commercial pressure to sell large amounts of food and lack of knowledge to distribute well this food until the population. Yet, they do most of the farming in many parts of the world. They work more hours than men – yet 70% of the world's adult poor are women. Four hundred million women of child-bearing age weigh less than 45 kilograms their poor health is a major contributing factor in the health problems suffered by their children. The best way to attack women's hunger is by improving access to fairly-paid work and to land. In 'developed' countries many women earn half as much as men. Often their work may not even be counted as work. Women produce half the world's food but own only 1% of its farmland. Education also improves women's control over their fertility, health, and standard of living. Everything is getting updated with the technology along with the time. The government partners should make the strategy that some food will not need selling where the environment is polluted. The foods get destroyed if it has not been put in a packet. The small-scale farmers also learn the new methods or techniques for producing food that will give benefit to the agriculture sector. There is a great demand for food in every country and immediate strategies should be taken to solve the food supply chain. Human beings still face suffering from hunger and have healthy and long lives. For Example, Canada's food security for many developed countries will be tricky by using every dollar to bring long-lasting profits to those who need help of shortage and consultation basic needs. In many cases, the effective strategy will make the food more secure as this will result in improving productivity along with the high nutritious value. The purpose of the food associations is to provide the actual food which should be safe with the proper nutrition so the agriculture sector will grow, and this cycle continuously moves.

## FOOD PRODUCTION

There has been extra stress and pressure for the cities where there has been continuous rain or stormy weather. The strategies fail in food security as it also affects food production in various ways. In many cases, there may be a significant increase in the intra-seasonal and inter-annual inconsistency of monsoon rainfall. It has been noticed that the many children are underweight as they did not get the proper food or the food which they have absorbed are lacking in the proper nutrition value. The people who are poor and cannot afford to purchase the food product will suffer from the malnutrition. Sometimes, the supply of the food will get stopped due to bad weather conditions and the people suffer to have nutritious food in their area. There may be a shortage of food when there is heavy rainfall, or the food gets costly and the government hasn't found the solution to this problem.

The strategies have been formed and farmers have done different kinds of farming like subsistence farming, shifting agriculture, Extensive agriculture, dryland farming, plantation agriculture etc. Different strategies have been made for doing a different kind of farming. The farmers must change the techniques in the climate changing environment so the individuals will get proper quality of food. The government may ban the food products if the food that has produced has been dirty or may be affected by some chemicals than the steps are taken but the time has been wasted and strategies will be failed when the food products get banned due to some reason. The climate change will stop the stability of supply as there may be a shortage of food and water also which will affect the active life of the people. Amaranths and quinoa, two crops are traditionally grown in Peru and Mexico are examples. Both grains are versatile, well adapted to local soils and climatic conditions, and provide more high-quality protein than most commercial grains, including rice, wheat, and corn. The food that the human beings are consuming has been the gift of the agricultural activities and problem will be resolved when the agriculture sector offers various opportunities as a large labor force which is essential for making the process smooth and better functioning of various agricultural activities.

The strategy should be made for transporting the food products from one place to another which will also support the transport department. There may be direct or indirect opportunities, but the people should be aware of these things and have the proper knowledge to fit for themselves. The demand and supply will not be mismatched otherwise; there may be large implications in food production and food security. The agriculture sector is different in every country. The food is not only the source which has been produced in the agriculture sector but the industries including cotton textiles, oil, tobacco, rubber, and jute are also dependent on the agriculture sector. Foreign trades also depend majorly on the agriculture sector. If there is no proper food security, then human beings will suffer from various diseases and may have a serious illness. Sometimes, the season is off for producing a variety of foods but if there is demand for that food, then people will not get better quality in the food. The sudden change in the climate will not give the surety that the food is secure and healthy to eat. People suffer from bad food which will lead to death. So, it is necessary for the food authorities to provide packet food products which should also be quite healthy to eat.

## FOOD ABSORPTION

The weather conditions are not good in many countries as there have been several impacts of climate change on food absorption. The climate has become a threat for food security. The fish or meat is also consumed by the people and there has been a lot of complaint by human beings for this kind of food. People have believed that this food is not fresh and can cause health problems. This thing generally happens because of the change in the climate. The fruits, vegetables as well as wild food will not become fresh anymore the people see dirt on these foods. It has been observed that there is a reduction in the nutritional quality of foods when there is some change in the climate conditions. It will also decrease absorption in proteins and minerals like iron and zinc because of high carbon dioxide levels. In a few countries, the pulses have been more absorbed by the people rather than the meat or fish. The strategy should be made when it comes to absorbing the pulses and ensure that they become the rich source of proteins because many people will not eat fish, chicken or meat. Everybody knows that fish has been the quality of food because of protein and it is more costly than pulses. According to the experts, there has been an increasing risk of getting an infective disease when there is a shortage of micronutrient in the food. This problem will make the situation even more badly with the under nutrition that will make a nasty cycle. The studies show that the nutrition value will decrease when there is a sudden increase in temperature and decrease in rainfall that is linked with an increase in diarrheal disease. This disease happens mainly to the children.

It has been observed that the children's and young people need more food because at this stage they have been growing so they can absorb more food rather than others. On the other hand, people living in the urban slums or in poor rural areas are in the danger of getting the diarrheal disease. The rivers get affected when there is a change in the climate so the strategy should be made for reducing the diarrhea-related health problems. Many people suffer from vector-borne diseases when climate change occurs in the states. Many states have been known for its development of food products but when there is a change in the climate that is unpredictable can create problems for the farmers. As a result, they must follow an alternative strategy and develop new patterns of making the food otherwise, they must wait. But the cycle will be unbalanced which will lower the capacity to utilize food effectively and affect human health. For example, there have been many people who have been majorly exposed to vector-borne diseases including dengue, malaria and chikungunya.

The food security should also get improved in the rural areas because the basic facilities are not there such as clean drinking water, drainage systems, sanitation, piped water and health facilities. High occurrence of undernutrition due to lack of disclosures the urban poor to illnesses connected to climate impacts, which in turn worsens undernutrition and ill-health and decreases the capability to acclimatize and build flexibility to climate change. Opposing effects of diseases like malaria, diarrhea and undernutrition have been found to be focused among families and kids due to physical vulnerability. Families have been created to be at greater risk when food supplies are limited.

## POLICIES IN FOOD AVAILABILITY

The strategy of every country is to increase productivity which can be performed with the moisture conservation techniques and using innovative soil. For Example, instead of doing farming all day, they use the double plantation techniques which can be easily adopted by the farmers. Green Revolution has been started very early which is beneficial for the human beings so that they can get enough food and it also helps in raising production in cereals in some regions along with the modern technologies which have their own boundaries. The World Commission on Rivers reported in 1999 that more than half the world's major rivers are going dry or are severely polluted. Contamination of rivers and river basins displaced 25 million environmental refugees in 1998 – for the first time exceeding the 21 million refugees from armed conflicts around the world. Based upon United Nations projections, 4 billion people will be affected by water shortages by 2050. By then, Nigeria, for example, will have only about 900m<sup>3</sup> of water per person compared with 3200 m per person in 1990 (nearly a 75% reduction in available water).

Governments and communities need to develop plans for managing rivers at the catchment or watershed scale and involve local people in their and implementation. Nowadays, the population has been increased and there is a demand for more food in many regions with the highest economic growth. The government should be responsible to provide all the facilities but first, focus on food security. The regions like Africa are completely being focused on food imports. Food Production for many regions has been covered because investing in the agriculture sector and solving problems of the farmers so that they use the proper input in the production cycle. The technology and science haven't reached in many of the regions for promoting agriculture productivity for reducing hunger and poverty to achieve proper food security. It has been observed that where the technology has been reached, the productivity has increased in many developing countries and it has happened with the investment in the agriculture sector that is united with improved rural infrastructure and human capital. The regions also get compared with the food security as African regions are lacking behind in terms of growing in the agriculture sector and slower than Asia.

The crop production will increase by making the effective strategies and applying it in the right time and various food associations are involved for increasing the use of mineral fertilizers and the food organization has set the target to increase the level of fertilizers. The strategies have worked when they have found ways to fertilize crop production that will be beneficial to smallholders at reasonable prices. The different approaches have been applied for the soil fertility management that holds the complete series of driving issues and values of soil degradation. This would contain the mixing of mineral and organic causes of nutrients which will provide good quality and safety of food. The government partners are working on reducing addition upon rates of commercial pesticides and fertilizers. There are ways to increase nutrient availability and enhance pest control and water availability with the use of intercropping, agroforestry systems and perennials. It can be done in a more sustainable manner. After 1980, progress in the increase of wet area reduced and it is expected this tendency will continue soon. One of the details is that the area's most appropriate for irrigation is already cast-off, leading to higher building costs in new areas. Current irrigation systems could be better-quality by capitalizing in water control and transfer, automation, monitoring and staff training.

In many regions, it has become a challenge when there is continuous rainfall that will cause crop failure. On the other hand, the rain is not happening in the dry spells may also cause crop failure. The variability and uncertainty affect the risk of opposing behavior of smallholder farmers. More labor is required for food security. The planning and strategies might get fail with the unpredictable weather conditions and farmers fail to save the crops and there is a loss of investment done. There should be an alternative method for saving the crop facilities and the space that the water will move to dumps. This will result in preventing crop failure or reducing the risk of total crop failure and the government may not fail in investing in these sectors. For Example, the cycle should be more stable with the efficient use of labor, fertilizers and crop varieties. Growing crop cover attention decreases evapotranspiration from the soil, cultivating soil moisture and the establishment of water for the crop.

## AGRICULTURE POLICIES AND FOOD SECURITY

The attention is to be paid on the major crops like wheat, rice and maize in order to tackle hunger. The government may decide to get the food from the outside and follow the outside agriculture strategies which may not be fully successful in their areas. But the trend has been changing and more attention is on the nutrition balance of the crops grown and consumed. The strategy will be developed for improving malnutrition and create a balance between the research and development of horticultural crops and staple crops.

It has been observed that sometimes underutilized or ignored local varieties of food can also provide a good source of nutrition. The farmers may develop new strategies in order to grow new and different crop mixes. The farmers should have practiced enough in food security, but the strategy is to provide all the right

information so that they manage the unfamiliar pests and diseases that can attack the growing plants. Everybody knows that the Fish, animals and poultry are a major source of proteins needed by the human body more and it is necessary to take care of these sources and proper testing should be done. Sometimes, the chemicals have been added to the fruits and vegetables to give colors and the people purchase by looking at them and seem that this will be fresh and healthy for them. The growth and development of a more varied and inexpensive private seed sector, as well as size building exertions help growers recover soil health. The planning will be more successful when they offer a better quality of food lead to better quality produce. The rural farmers may not use the right techniques for doing farming, but they want to understand and learn the new approaches because many people are dependent on these farmers. The government has made the planning to provide training programs for the farmers to transfer knowledge which will help in giving more quality of foods.

Many countries have also been lacking behind as they are not following the new technologies but now the mobile technologies are getting more useful and this would be working in the development of the countries especially in the agriculture sector. The new technology has changed the way of doing the farming with some innovative ideas. The voice messages have helped to deliver the knowledge to the small-scale farmers. It will help to overcome language barriers and literacy with this innovation and the farmers will get full support with this kind of services.

The strategy is to deliver the knowledge in the food security so the food production cycle will start again. Sometimes, the cycle gets unbalanced when the food produced is lost to plants diseases and pests and even beyond. The individuals interact with the others located in a different area by using mobile technologies where they can get more knowledge and information and generate regular incomes. The strategy is to extend the mobile services to contain market information like how to access microfinance and what to charge per crop. For making planning or strategies, this will help in achieving the sustainable development goals which create positive impacts on the environment. This can be done by focusing on food security. The farmers may get into some difficulty to choose between the two things. The farmers should only look for the income from tourism activity or preserve their land for the sake of food production. Agriculture has been considered as a profitable sector and important than other industries. The strategy for every government is to achieve the right balance in food security. The government has started the food security program to overcome hunger, prevent disease and reduce poverty in this sector. If the strategy works and there is a profit in the agriculture sector than the government introduces new schemes for the homeless people, slum clusters, daily wage earners, rag-pickers, etc. The department of food will be linked with the state or country's development for making the new strategy in the food security which involves maintenance of food stocks, good grains, delivery and movement to the distribution agencies and monitoring of stock, production and price levels of food grains.

#### IDENTIFYING THE PROBLEMS AND MAKING THE SUCCESSFUL APPROACHES

Each research theme will be coordinated jointly by a research council and a government department, but will involve all relevant funders and main stakeholders, and will be coordinated with the other themes. The lead organizations will be responsible for:

- identifying and leading on activities to define the scope of the themes in more detail; • identifying and refining priorities (particularly in areas of interdisciplinary research) taking into account, for example, the output from Foresight projects;
- mapping existing research and related activities across the funders and more widely to identify and address gaps and overlaps;
- Actively ensuring strong engagement with all other relevant funders and interested parties including users and the public, and with the other themes within the program;
- bringing together and promoting new interactions
- Transfer of new technologies among researchers currently supported by all the funders, wherever relevant to their theme.

In the following sections, some immediate cross-cutting priorities are identified within each theme, where there are leading topics of clear importance and/or pressing urgency. These may be refined and further priorities will be identified in due course as the detailed plans for research under each theme are developed: Sustainable ecosystems, greenhouse gas emissions, and waste. A sustainable food supply system depends critically on maintaining ecosystem services and preserving biodiversity. These help ensure (for example) healthy soils that can provide essential nutrients, a sufficient and clean water supply, pollination services and good air quality. It is imperative that the food system minimizes any negative impacts on such essential services and resources. In addition, there is a clear and pressing need to reduce greenhouse gas emissions and to reduce waste throughout the food supply chain. These centrally important considerations will be considered across and within all the themes: research under each of the themes will address relevant aspects.

#### CONCLUSION

In conclusion, the global food production and availability landscape is deeply interconnected with agricultural systems and food security. Over the past decades, advancements in agricultural technologies, such as genetically modified crops, precision farming, and enhanced irrigation systems, have significantly boosted food production. However, these gains are not uniformly distributed across regions, and disparities persist, particularly in low-income countries where access to resources and technologies remains limited. The shift towards more sustainable agricultural practices, including agroecology and climate-resilient farming systems, is essential to address the challenges of environmental degradation, climate change, and resource depletion. The over-reliance on industrial agricultural practices has led to significant ecological imbalances, including soil erosion, loss of biodiversity, and water scarcity, which threaten the long-term viability of food systems.

Food security is a multifaceted issue that encompasses availability, accessibility, utilization, and stability of food supplies. While global food production is generally sufficient to feed the world's population, access to nutritious food remains a critical challenge. Economic inequality, political instability, and inadequate infrastructure continue to contribute to hunger and malnutrition, particularly in vulnerable populations. To improve food security in a sustainable manner, policy interventions must prioritize the development of resilient food systems that are equitable, environmentally sustainable, and capable of adapting to future challenges. Investments in smallholder agriculture, improvements in food distribution systems, and greater international cooperation are critical to reducing food insecurity and ensuring that everyone has access to nutritious and culturally appropriate food. Ultimately, achieving global food security will require a coordinated approach across sectors, including agriculture, health, economics, and the environment, to create systems that are not only productive but also inclusive and sustainable for generations to come.

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#### CONFLICTS OF INTEREST

"The authors declare no conflict of interest".

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