



# INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume 3, Issue 6)

Available online at [www.ijariit.com](http://www.ijariit.com)

## Food Sustainability

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**Abstract:** *Food is life and the global food sustainability is essential to human being survival. The global food system is highly complex and is driven by various factors including environment, cultural, social and economic drive. It is vital to understand these drivers and their interaction in order to help to improve the public food sustainability policies. Global polices and projects desperately required in order improving the global food sustainability. Food sustainability is one of the unsolved global issues and great commitment is required starting from global policy makers, national governments, and every individual home. This research paper includes analysis and study of various elements such as global change science, policy, food crisis, factor affecting and challenging food security, data on status and future projection and potential ways of solving problems. The goal of food sustainability is to enable all people throughout the world to satisfy their basic needs and have a reasonable quality of life without compromising the quality of life of future generations. Agriculture sustainability is the best solution which can feed the world without compromising the environment or threatening human health. Scientific evidence that global environment has changed is overwhelming and indisputable. These phenomena have a direct impact on agriculture which in turn affects food sustainability. The food price is always toward upward trend which is validated by the periodic average global food price monitoring report released by the Food and agricultural organizations. The factors affecting and challenging the food security are many including increased food consumption due to population increase, uneven distribution, changes in living styles, limited resources, environmental problems, economic problems and others. The potential ways to solve food sustainability need to be established and implemented effectively across the world.*

**Keywords:** *Food-Sustainability, Agriculture, Environment, Food-Security.*

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### FOOD SUSTAINABILITY POLICY

The food sustainability is a philosophy focused all people throughout the world to satisfy their basic needs and have a reasonable quality of life without compromising the quality of life of future generations. Among so many possibilities, the agriculture sustainability is the best solution which can feed the world without compromising the environment or threatening human health. The agriculture sustainability policies and strategies focus on agriculture enterprise stability and adopting sophisticated approaches at the same time build on current agriculture achievements that can maintain high yields and farm profits without depleting the resources on which agriculture depends. Sustainable agriculture also focuses on understanding the long-term impact of our activities on the environment and on other species. Though the sustainable agriculture is not the main-stream at this point, this approach now being addressed by the agricultural community in significant ways. Over the period, the sustainable agriculture practice will drive meeting the human food needs, efficient use of non-renewable resources and enhance the farming operation viability. Development of sustainable food purchasing policy is an initiative which enables institutions focusing on major projects and involves people into the institutional framework in order to understand and committed towards more sustainable food systems (SFP, 2015). Adapting of sustainable food policy address various related issues such as controlling food price, volatility, food availability, better technical knowledge on the environmental impacts of food, stimulating sustainable food production, promoting sustainable food consumption, change of diet, reducing food waste, improving food policy coherence and losses, food supply chain, fisheries and biodiversity loss (Sustainability Table, 2015). Since the entire food production system totally depends on water resource, the water productivity ratio (food per unit of water) is a significant factor and this need to be achieved by various sustainable agricultural practice.

### **GLOBAL ENVIRONMENTAL CHANGE**

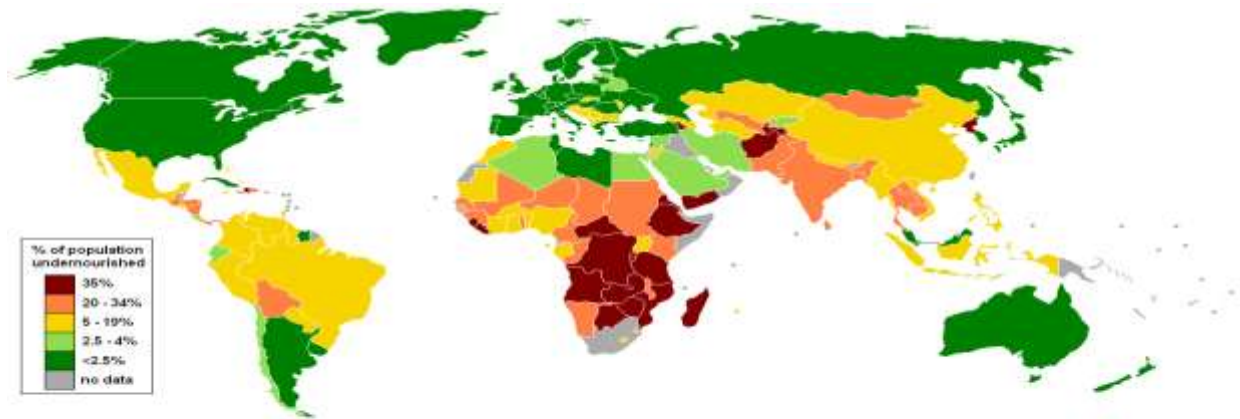
Food is a basic human need and it connects us directly to the environment and ecosystem. Scientific evidence that global environment has changed and continue to change significantly due to anthropogenic activities. These phenomena have a direct impact on agriculture which in turn affects food sustainability. The environmental impacts of the current form of agriculture are very great and much damage is done to the Earth in order to feed people well. Global environmental change impacts food sustainability and at the same time food industry itself one of large polluter and driver for global environmental change. Therefore, it will be a challenge to meet future food demands without compromising environmental resources. Agriculture sectors occupies 50 percentage of worlds vegetated land, accounted for 3 percentage of global energy consumption, however results 20 percentage of global Green House Gas emission (IPCC, 2001) According to DEFRA (2006), in United Kingdom the food industry is accounted for about 14% of energy consumption, about 10% of the public water supply, about 10% of the industrial and commercial waste stream, 25% of all logistic mileage and 12.5% of the workforce. According to USA Today Energy Article (2011), the U.S. food system accounted for nearly 16 percent of the nation's total energy budget which is an increase of 14.4 percent in 2002, and between 1997 and 2002, in fact, over 80 percentage of the increase was food related. The assessments of the effects of climate change (due to changes in temperature, rainfall, and extreme weather events) on the quantity and security of food supplies requires complex modelling, and the IPCC model predicts that by the year 2020, the climate change would result in agricultural a balanced result (20 percentage increase in East and southeast Asia but decrease up to 30 percentage in central and south Asia and rain dependent agriculture in Africa drop by 50 percentage) but with developing countries being more vulnerable (McMichael et al. ,2007).

### **FOOD CRISIS**

Global grain production has quadrupled in the last century and mostly happened in the latter half of the century from the year 1950 to the year 2000 and which was mainly due to the expansion of crop areas. However, in the last 40 years the crop production is increased largely based on the yield increase by science and technology without expanding the crop area; and the worldwide grain land productivity increases at a rate of 2.1% per year during 1950 to 1990 (Corke et al., 2015). Despite the yield increased, the recent food security is not sustainable and after 1990, the rise has slowed to 1.2% per year. Since the year 2005, the world had produced less grain, and the amount of grain storage capacity reduced from 1.2 years of global consumption to about 60 days only. Since the food production system has become globalized, the financial speculators heavily invested in food and raw materials trading markets which caused a rapid hike in food prices. The food price is always toward upward trend according to a monthly report released by Food and agricultural organization, e.g. the food price index (weighted average of global food price) rose by 9% in 2006, 23% in 2007 and 54% in 2008. Mexico is one of more than 20 countries with a corn-based diet, and the price of flatbread made from corn or wheat in early 2007 was up by 60 percent which made the angry Mexicans in crowds of up to 75,000 took to the streets in protest, forcing the government to institute price controls on breads (Corke et al., 2015). In the summer of 2007, Italian consumers organized pasta boycotts to protest soaring prices. Meanwhile, the British were worrying about rising bread prices. In 2008, in order to ensure that food remains available for their domestic populations and to combat dramatic price inflation, major rice exporters, such as China, Brazil, India, Indonesia, Vietnam, Cambodia, and Egypt, have imposed strict export bans on rice (Corke et al., 2015). In African countries, 50 percentage of food requirement depends on imports and the food prices in many are substantially higher than a year ago.

### **FOOD SECURITY**

There is enough food to feed everyone, but there are still many hungry people in the world. There are so many factors affecting and challenging food security such as increased food consumption due to population increase, uneven distribution, and change in living styles, limited resources, environmental problems, economic problems and others. The population factor, combined with rapid industrialization, poverty, political instability, and large food imports and debt burden, make long-term food security especially urgent. According to recent United Nations population projections, the world population will grow and projected as 9.4 billion in 2050, 10.4 billion in 2100, and 10.8 billion by 2150, and slightly fewer than 11 billion around 2200. The rate of population increase is especially high in many developing countries. Current projections suggest that an additional 120 million ha (an area twice the size of France) will be needed to support the traditional growth in food production by 2030 (FAO, 2015) and there is not enough land to do so. Due to many factors (political, economic, and technological), people in the poorest parts of the world still do not get enough food. The below figure indicates the percentage of population undernourished globally.



**Figure. 1 Percentage of Population Undernourished**

While the world has had many years of experience in feeding an additional 70 million people each year, it has no experience with some 5 billion people (the number of people in developing countries) striving to move up the food chain at the same time. In India, where people consume just less than 200 kilograms of grain per year or roughly a pound per day, nearly all grain is eaten directly to satisfy basic food energy needs unlike in the United States. Roughly 800 kilograms of grain consumed per person each year in the United States, about 100 kilograms is eaten directly as bread, pasta, and breakfast cereals, while the bulk of the grain is consumed indirectly in the form of livestock and poultry products. Diverting the resources to non-food crops (e.g. productions of paper, wood, cotton; and biofuel) is another significant factor affects food security.

#### **AGRICULTURAL SUSTAINABILITY WORKS**

The authors Pretty et al. (2006) evaluate 286 various sustainable agricultural projects since early to mid-1990s in 57 poor countries covering 37 M ha (3% of the cultivated area in developing countries) and show increased productivity on 12.6 M farms while improving the supply of critical environmental services. The average crop yield increase was 79% (geometric mean 64%) and all crops showed water use efficiency gains, with the highest improvement in rainfed crops. This result proves sustainable agriculture projects are feasible with increased crop yield.

#### **RECOMMENDED FARMING PRACTICES**

Food sustainability is one of the unsolved global issues and great commitment is required starting from global policy makers, national governments, and every individual home. Resource conserving agricultural practices and methods are the best recommended practice to be promoted in order to achieve food sustainability without compromising environmental sensitivity. In order to achieve the sustainable agriculture various alternative practices, management and technologies to be analyzed and implemented. Individual families should be motivated, self-committed and avoid dependency on others and conventional farming products. There are multiple existing alternative methods and practices in place such as biophysical and socio-economic practices and new technologies including integrated pest management, integrated nutrient management, conservation tillage, agroforestry, hydroponics, vertical agriculture, aquaponics, water harvesting, livestock integration and organic farming. In order to make the food sustainable, farming efficiency needs to be improved and such efficiency gain can help reduce agriculture's dependence on various resources. Example, just ploughing the crop land only when required, in the United States, the combined direct use of gasoline and diesel fuel in farming fell from its historical high of 7.7 billion gallons in 1973 to 4.2 billion in 2005 which is 45 percent decline. Broadly calculated, the gallons of fuel used per ton of grain produced dropped from 33 in 1973 to 12 in 2005, an impressive decrease of 64 percent. Currently, some 37 percent (about 740 million tons) of the world grain harvest used to produce animal protein, even a modest gain in efficiency can save a large quantity of grain. Another way to raise efficiency is to produce animal protein using crops that are not mainly consumed by humans instead of grains, such as soybeans or roughages. Example, the milk producing industry in India almost entirely built on roughage such as wheat/rice straw, corn stalks and grass gathered from plain lands. The average worldwide consumption level of animal products and the intensity of emissions from livestock production need to be reduced to prevent increased greenhouse-gas emissions from food production sector. There are multiple new technologies in place to grow food crops more and efficient without comprising environmental interest.

#### **HYDROPONICS FARMING**

Hydroponics is a growing industry that has yet to reach its full potential. Hydroponics forming is a greenhouse method (Figure.2) of growing plants using mineral nutrient solutions without soil. The advantages of Hydroponic are much higher crop yields in limited space in all seasons, can also be done indoor with artificial lighting, consume 50 percentage less land compared to conventional farming, consume less than 10 percentage of water of conventional farming, 60 percentage less fertilizer required, less pesticide and reduced fossil fuel consumption (Ecopost, 2014).



**Figure.2 Hydroponics Farming**

### **VERTICAL AGRICULTURE**

Vertical Farming is a smart technology and revolutionary approach to producing high quantities of nutritious and quality fresh food all year round, without relying on skilled labor, favorable weather, high soil fertility or high water usage (VFS, 2012). The vertical agriculture (farm-scraper) systems are fully enclosed and can be suitable for urban high rise building area. The benefits are economic and environmental due to reliable harvest, increased growing area, minimum overheads, low energy usage, low labor cost, low water usage, reduced washing and processing, reduced waste, reduced transport cost and increased crop yield. This farming method suitable for wide range of crops including baby spinach, baby rocket, loose leaf lettuce, fruits, edible mushrooms, basil, and algae year-round. One indoor acre is equivalent to 4-6 outdoor acres or more, depending on the crop; and for strawberries, one indoor acre may produce yield equivalent to 30 acres (Bareja, 2015).

### **AQUAPONICS FARMING**

Aquaponics (Figure. 3) is another greenhouse planation method where the water is collected and plants are grown in a way that enables them to utilize the nutrient-rich water. The plants take up the nutrients, reducing or eliminating the water's toxicity for the aquatic animal and the cleaned water is returned to the aquatic animal environment and the cycle continues.



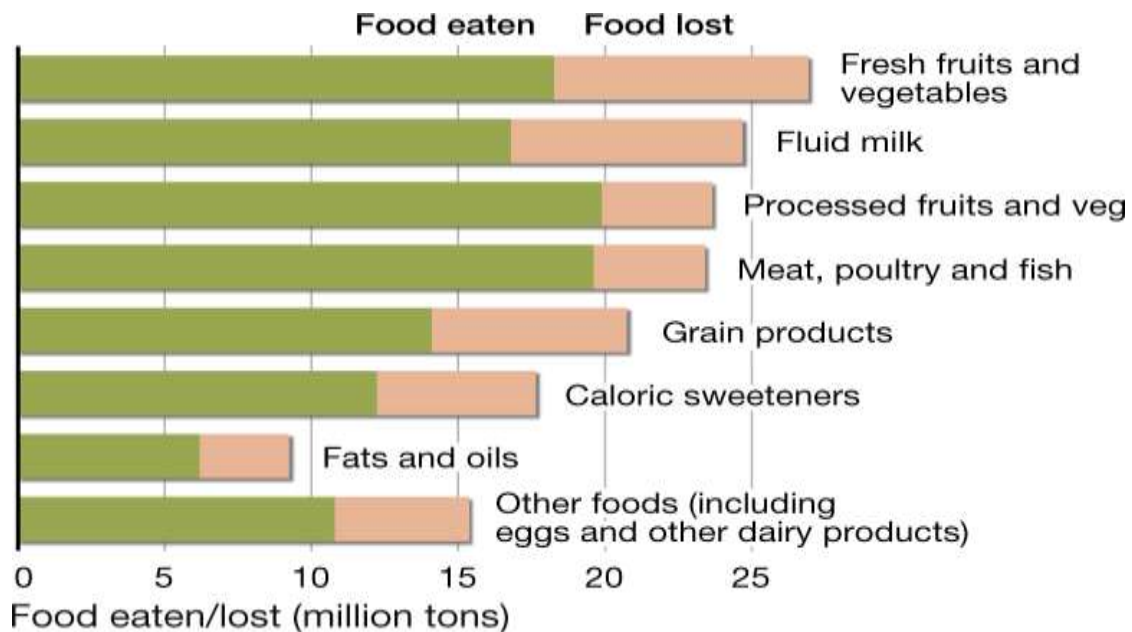
**Figure. 3 Aquaponics Farming**

Aquaphonics forming technique use 90 percentage less water than traditional farming method and does not need farmland with fertile soil like conventional farmland (V.V.2015)

### **ORGANIC FARMING**

In organic farming, crop rotation, green manure, compost, biological pest control, mechanical cultivation, etc. are used to maintain soil productivity and control pests. Any artificial fertilizers, pesticides, and additives are prohibited in organic farming which limits toxins in a human being and improves health. Reducing food consumption of carbohydrates, meat and processed foods decrease resources and that can be used to produce foods that feed other people on the world.

Reducing the food waste is a great philosophy which significantly reduces the millions of tons' resource and energy consumption at various stages of food production process. By reducing the food waste, the saved food will be available to other people and every year \$43 billion worth of edible food is thrown away in the United States.



**Figure. 4 Benefits of Reducing Food Wastes**

Reducing meat consumption and replacing with non-meat protein significantly saves natural resources. It is estimated that if all people over the world adopt a non-meat diet, the crop production can feed twice as many people than a world which have diet including meat.

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### CONCLUSION

The result of sustainable agricultural projects proves food sustainability can be achieved by collective factors and commitments. Individual families should be motivated, self-committed and encouraged to play their roll by doing own crop farming. Conventional farming cannot feed the exploding world population without compromising the sensitive environment and ecosystem. Developed countries cannot produce food and supply to poor countries forever because global climate change affects western world agriculture as well. Environmental friendly modern farming technology to be imparted to developing countries so that they can create own food sustainability and food crisis can be solved. Who can feed the world; it is not someone other than ourselves.

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