

**Impact of Natural Resource and Resilience (Climate changes and resource depletion)  
on global Food Security challenges : A comparative study of  
emerging and developed economies of the world**

Tahir Ali

Faculty of Management and Administrative Sciences, University of Karachi, Pakistan  
ali2122@googlemail.com

**Abstract**

According to a recent survey from the UN Food and Agricultural Organization (FAO), an extra 35 m to 122 m people could fall into poverty and therefore become less food secure as a result of climate related risks(EIU, 2017). Furthermore, it is estimated that the world population will touch 10 billion mark by 2050, an addition of nearly 2 billion from today. These statistics indicate great challenge for the UN Sustainable Development Goal of ending hunger by 2030. Due to the current global environmental changes and its impact on food production, two new variables, namely climate changes and resource depletion, are included in computation of global Food Security Index, besides food availability, affordability and quality & safety. Introduction of these variables have made some drastic changes in food security index both for developed and emerging economies of the world. For instance, Ireland surpassed United States and become the most food secured country in the index, while Singapore due to its heavy dependency on food import and climate changes drop by 15 and Brexit reduces UK position by 2 points in the global food security index. Emerging economies have also been affected and their ranking slightly dropped in food security index. The study focuses on the importance of climate changes and resource depletion in computation of global food security index. Some of the less developed countries manage to maintain or increase their position in the GFSI, e.g. the ranking of Pakistan has improved by two points when climate changes and resource depletion are taken into account.

**Keywords:** GFSI, resource, resilience, climate, depletion

**1. Introduction**

Up to 19<sup>th</sup> century, world had witnessed power of countries on the basis of geographical coverage, conquering and ruling on larger areas and people and taking decisions for mass areas of the world. The 20<sup>th</sup> century focused on economic war and determinant of power shifted to economic and industrial development. The 21<sup>st</sup> century started with the revolution of Information Technology (IT) and it was expected that the century will focus on i=Intelligence – exploitation of Information Technology in the industries. Ironically, this , tot a larger extent, has been achieved in the first decade and now the world has been sensing the challenges in food security. Although the UN Sustainable Development Goal (UNSDG) focuses on eliminating hunger from the world by 2030, enormous increase in population rate and ineffective food security situations along with climatic changes & resource depletion create huge challenges to attain it successfully.

Although the world had started thinking on food security issues since the inception of this century, concrete analyses and reporting have been started since 2010. The Economic Intelligence Unit (EIU) had been initially focusing on three parameters for evaluating food security position in 113 countries of the world. These are affordability, availability and quality & safety of food. Considering the current environmental changes, the 2017 report of EIU has introduced two more variables – climate risk and resource depletion. This paper has been focusing on the impact of these two variables on the overall food security index of 2017 of developed and emerging economies of the world. Some drastic changes have been seen on some developed and emerging economies due to global environmental changes, high risk of resource depletion and dependency on other countries for food related items. The Singapore is the most affected country due to its climatic conditions and high reliance on food import. The ranking of Singapore has dropped by 15 points followed by Netherlands with 5 points in the global Food Security Index, after inclusion of impact of climate changes and resource depletion. Besides these two small countries, the United States and United Kingdom also declined in ranking, each by 2 levels. However, Australia, France and Germany have recovered their positions by 9, 5 and 2 points respectively. In the emerging economies, the major decline in food security index has been noted in Indonesia by 4 points followed by India, South Africa and Malaysia each with 2 points. The impact of climate changes and resource depletion positively affected Russia and Pakistan and their ranking in GFSI recovered by 4 and 2 points respectively.

The study concludes that, though affordability, availability and safety & quality are key elements in determining the Food Security status of a country, addition of two factors – climate changes and resource depletion have made it more effective. The notable changes occurred due to these factors reflect its importance and tool to foresee future developments in food security conditions throughout the world.

## **2. Research Methodology**

The study has mainly been derived from The Economist International EIU reports on Global Food Security Index and other related materials. This descriptive-secondary research provides a comparative study regarding the food security situation of some developed and emerging economies of the world. Traditionally food security index has been computed with three components – affordability, availability and quality & safety of food. In the recent EIU report (2017) two more components are introduced i.e., climate risk and resource depletion creating substantial impact on the index. This study is designed to evaluate the need, importance and impact of these new components on some developed and emerging economies of the world.

### **2.1 Hypotheses**

To study the role of two new components more specifically, the following two hypotheses have been developed:

- Computation of GFSI with climate risk and resource depletion gives more effective results / ranking of developed economies.
- Computation of GFSI with climate risk and resource depletion gives more effective results / ranking of emerging economies.

## 2.2 Literature Review

Following literature have been reviewed to get better understanding of the study;

Detailed critical, comparative analytical review of The Economist International EIU Reports from 2012 to 2016 reveal the importance of food security position in the future. Global Food Security has been marked as one of the great challenges of the next generations. The status of food security of a country is determined on the bases of affordability, availability and quality & safety of food. Affordability refers to ability of people to pay for food and relative costs. This is generally measured by status of food consumption in the country, number of people living under poverty line and the overall GDP and per capita position of the economy. Availability of food refers to capacity of the country to produce and distribute the food items. I also shows the supply of food from producers to consumers / people and the level of ease to access the food products. In order to evaluate the food availability position of a country, agricultural infrastructure and R&D conditions play vital role. These elements determine the food supply sufficiency in the country and also control food losses, both pre and post harvesting. Another important factor affecting food security status of a country is the nutritional quality of available diets and the safety environment in which it is stored. The safety and quality of food not only affect the affordability and availability of food security position but also health and socio-economic environment of the country. This can be measured by examining nutritional standards and food safety measures applied in the country along with nature of diet diversification and protein quality provided to people.

The overview of these EIU Global Food Security Index reports from 2012 to 2017 depicts concern over emerging economies due to high rate of population addition and less attention upon food security measures. The developed economies are though in better positions but some of them may face problems in the long run due to their dependency on other countries for food products.

The Global Food Security Index 2017 (EIU, The Economist International) introduced 'Natural Resource and Resilience as two additional factors in determining the food security position of a country, besides food affordability, availability and safety & quality, the impact of these elements on global food security ranking has been significant. For instance the developed economies like Austria and Denmark have managed to improve their positions by 9 and 7 points, while Singapore, due to high dependence upon food import and susceptibility to rising sea levels and extreme weather conditions resulting in high vulnerability of natural resources and climate risks dropped its ranking from 4<sup>th</sup> to 19<sup>th</sup> (15 spots) in GFSI. Emerging economies have not shown drastic changes due to inclusion of these two factors – climate risk and resource depletion- on

food security position. Some nominal increase and decline have been observed. For instance, in BRIC economies, Russia has improved its ranking by 4 points while India and Brazil dropped by 2 and 1 spots respectively. Ironically, China – the most populous country in the world- has not affected due to these factors and maintain its position at 45<sup>th</sup> rank.

Overall it can be said that addition of two variables - climate risk and resource depletion – in computation of food security level of a country, besides affordability, availability and quality & safety have made the index more rationale and effective.

“Water security threats demand new collaborations - Lessons from the Mekong River Basin” (EIU, 2017), an important publication of The Economist International having high proximity with food security position of a country. The term Water Security has been defined by UNESCO as “the capacity of a population to safeguard access to water resources in sufficient quantity and quality to sustain livelihoods and socioeconomic development”. The report indicates that food security has direct connection with water resource conditions in a country. Besides its impact on availability and quality of food, the resource depletion also has direct relation in determining the food security index position.

### **2.3 Subject and Sampling**

The EIU (2017) has provided analyses and ranking of 113 countries in the global food security index. out of these, 12 countries, six each developed and emerging economies have been selected for this study on the bases of comparatively higher impact of climate risk and resource depletion. The developed economies include USA, UK, Australia, Netherlands and France while emerging economies comprises BRICS and Mexico. It is expected that these 12 countries will give a good reflection of the impact of natural resource and resilience ( climate changes and resource depletion) of developed and emerging economies of the world.

### **2.4 Data Analyses**

Data relating to food security index from 2012 to 2017 have been categorized into developed and emerging economies and comparative analyses have been made on the ranking of countries in the index. Descriptive statistics has been applied to check the measure of improvement or decline of an economy during the past five years. In addition special comparative analyses have been done to check the impact of natural resource and resilience on food security index of 2017, with and without adjustment of these variables.

## **3. Global Food Security Index – an overview**

Food security has been the point of concern for every economy. The growing rate of population, economic challenges and unprecedented global climate changes have made it one of the most crucial challenges in future. The components of food security computation can be divided into two categories, the core factors include affordability, availability and quality & safety of food while natural resources and resilience (climate changes and resource depletion) are added on 2017 to make it more rationale and future oriented.

### **3.1 Affordability, Availability, Quality and Safety of food**

Affordability is the most crucial element for determining the food security position in a country. Affordability refers to the capacity of people to buy good quality food, without undue stress. The country's population (in %0 living under global poverty line and the proportion of food consumption in total household expenditures are two main indicators of food affordability level in a country. Furthermore the GDP per head and agricultural import tariffs also reflect food affordability position. The country's capacity to produce and distribute food products and provide easy accessibility to food shows the food availability position. The level of food availability can be checked investment of the country on agricultural infrastructure and research & development. Furthermore the supply sufficiency of food and proportion of food loss also reflects the availability position of food products in a country.

Availability and affordability of food is not enough, the food security also demand the status of the available and affordable food products. This refers to nutritional quality of the food and the safety environment provided for protection of the quality of food. It is therefore, the quality and safety of food has been usually consider high impacting factor in determining food security ranking. The nutritional quality of available diets and its diversification along with nutritional standards provides the quality and safety level followed for food security position.

### **3.2 Natural Resources and Resilience – Climate changes and resource depletion**

Considering the present environmental changes, the EIU analysts for food security index realize the importance of climate changes and resource depletion as factors affecting food security position of a country. In 2017, these two variables have been incorporated in computation of food security index of a country. The sustainability of natural resources and threats of climate changes determine the country's future food security position. Higher temperatures, droughts, rising seas, and floods necessitate building resilience in the agricultural sector and managing disaster risks.

These five elements (affordability, availability, quality and safety, natural resources and climate changes) provide comprehensive insight to food security position of a country. The ranking of countries with these five factors not only provides true status of food security of a country today, but also reflects future stability in the index. Overall the inclusion of new factors have made the picture more realistic and dependable than positions calculated without these variables.

## **4. Global Food Security Index – 2012 to 2017**

During the past five years (2012 – 2017), most of the developed economies have shown considerable improvement in global food security index, while emerging economies have dropped in ranking. United Kingdom has achieved exceptional improvement of 17 points and managed to attain 3<sup>rd</sup> rank in the global food security index 2017, followed by Australia, Ireland

and Germany with increase in ranking by 9,6 and 3 spots respectively. However some of the leading countries, including the United States have shown slight decline in their position of Global food security from 2012 to 2017. For instance, Spain, France and Italy could not retain their status of 2012 and dropped by 8,4 and 3 points respectively. In addition a nominal fall of one point has been recorded in the leading developed countries , like the United States and Canada. On the other hand, no emerging or less developed economy managed to improve its ranking in the global food security index during the past five years. Considerable decline in food security positions has been noted in Mexico, Russia, India and China where the index dropped by 13,12,8 and 7 points respectively.

Table - 1

## Changes in Global Food Security Index , Developed Countries – 2012 to 2017

S. No.	Country	GFSI - 2012	GFSI - 2017	Change
1.	United States	1	2	( 1 )
2.	United Kingdom	20	3	17
3.	Singapore	5*	4	( 1 )
4.	Australia	14	5	9
5.	Germany	10	7	3
6.	France	4	8	( 4 )

## Changes in Global Food Security Index , Emerging Economies – 2012 to 2017

1.	China	38	45	( 7 )
2.	India	66	74	( 8 )
3.	Russia	29	41	( 12 )
4.	Brazil	31	38	( 7 )
5.	Mexico	30	43	( 13 )
6.	South Africa	40	44	( 4 )

Source ; EIU The Economist International (2912 – 2017) Global Food Security Index

\*Figure 2014

Table – 1 depicts summary of changes in food security index of six each developed and emerging nations from 2012 to 2017. It can be noted that half of the nations have gained considerable ranking, whilst the decline is nominal. United Kingdom has jumped from 20<sup>th</sup> to 3<sup>rd</sup> rank followed by Australia and Germany with 9 and 3 points improvement respectively. A slight decline of one point has been noted in the food security ranking of the United States and Singapore, while France registered a notable decline of 4 points. Overall the developed nations due to their better GDP per head and exploitation of advanced technology and R&D in agriculture sector. Although all emerging economies dropped their position in food security ranking during the past five years, drastic decline of 13 and 12 points have been recorded in Mexico and Russia respectively. During the year 2012, emerging economies had managed to attain position in first 30 ranking, but in 2017 no emerging economy is placed in top 40 positions. This overall declining situation coupled

with high population rate and low GDP per head further worsen socioeconomic condition of the countries.

### 5. Impact of Natural Resources and Resilience (Climate changes and resource depletion)

The agricultural need of the growing global population has been threatened by sustainability of country's natural resources and risk of climate changes. In order to protect agricultural sector, effective climate risk management is inevitable. Keeping in view the importance of these two elements, the EIU of The Economist International had adjusted the global food security index 2017 with status of climate changes and resource depletion in the 113 countries of the world. Overall it has been noticed that inclusion of these variables provide more realistic information about the present and future standing of countries in relation to food security conditions.

Table – 2

Adjusted Global Food Security Ranking – inclusion of Natural Resources and Resilience  
Developed Economies

S. No.	Country	GFSI – 2017	GFSI - 2017	Change
<b>1</b>	United States	2	4	( 2 )
<b>2</b>	United Kingdom	3	5	( 2 )
<b>3</b>	Singapore	4	19	( 15 )
<b>4</b>	Australia	5	14	( 9 )
<b>5</b>	Germany	7	5	2
<b>6</b>	France	8	3	5
<b>Emerging Economies</b>				
<b>1</b>	<b>China</b>	<b>45</b>	<b>45</b>	<b>0</b>
<b>2</b>	India	74	76	( 2 )
<b>3</b>	Russia	41	37	4
<b>4</b>	Brazil	38	39	( 1 )
<b>5</b>	Mexico	43	43	0
<b>6</b>	South Africa	44	46	( 2 )

Source ; EIU The Economist International (2012 – 2017) Global Food Security Index

Comparative analyses of indices of developed and emerging economies obtained with and without the two new variables (climate changes and resource depletion) reveal substantial changes in countries' ranking. Ironically, developed countries affected more than emerging economies, due to this adjustment. Table 2 depicts an exceptional decline, from 4<sup>th</sup> to 19<sup>th</sup> position of Singapore can be noted due to adjustment in ranking with climate changes and resource depletion. This was followed by Australia, USA and UK, showing a notable decline of 9

and 2 each points respectively. This shows that these countries have high climatic risks in terms of rising temperature followed by drought and rising sea levels followed by flood which ultimately affect the production and distribution of agricultural produce. Furthermore such risks also indicate low sustainability of natural resources, again affecting food security condition of the country. However adjustment of these variables have improved the ranking of France and Germany by 5 and 2 points, reflecting control of these countries upon climate risks and resource resilience.

It is interesting to note that adjustment of natural resources and resilience (climate changes and resource depletion) have not much affected emerging economies and a slight decline of 2 points in India and South Africa followed by one point reduction in Brazil have been noted. Russia has improved its ranking from 41<sup>st</sup> to 37<sup>th</sup> position (increase of 4 points) while the rank of China and Mexico remain unchanged. This comparatively better situation in emerging economies shows less exposure of these countries to climate risks and high sustainability of natural resources. Emerging economies are usually agricultural based and are therefore less vulnerable to climate changes and resource depletion for food security positions.

## **6. Conclusion**

Analyses of developed and emerging economies with the core elements of affordability, availability and quality and safety and after adjustment with two more factors of climate changes and resource depletion to evaluate the food security level reveal different picture of the index. Although developed economies, in the sample, show more impact than emerging economies, overall all countries reflect more realistic position of food security after adjustment with climate changes and resource depletion. This also endorses the two hypotheses, which may be accepted without any doubt. The study also recommend that in future computation of Global Food Security Index must be calculated with these new variables – natural resource and resilience.

## **References**

- An outlook for key emerging Asian economies (2015) Economic Intelligence Unit, The Economist International.
- Global food security index, (2012 – 2017), Economic Intelligence Unit, The Economist International.
- Water security threats demand new collaborations - Lessons from the Mekong River Basin (2017) Economic Intelligence Unit, The Economist International.