Journal of Nutrition and Food Security
Shahid Sadoughi University of Medical Sciences
School of Public Health
Department of Nutrition
Shahid Sadoughi University of Medical Sciences School of Public Health

eISSN: 2476-7425 pISSN: 2476-7417 JNFS 2025; 10(1): 5-14 Website: jnfs.ssu.ac.ir

Agriculture Based Food Producing Countries Are Less Secured in Food

Jesmin Aktar; MS *[1] & Khan Md Shaiful Islam; PhD[1]

[1] *Department of Animal Nutrition, Bangladesh Agricultural University, Mymensinfg-2202, Bangladesh.*

ARTICLE INFO

ORIGINAL ARTICLE

Article history:
Received: 17 May 2022
Revised: 27 Aug 2022
Accepted: 27 Aug 2022

Corresponding author:
jesmin.an@bau.edu.bd
Department of Animal Nutrition, Bangladesh Agricultural University, Mymensinfg-2202, Bangladesh.

Postal code: 2202
Tel: +880 1715226510

Keywords:
Food security;
Food producing countries;
Global;
Income.

ABSTRACT

Background: Food security of a nation depends upon availability and access to agricultural safe products like grain, fishing, forestry, livestock, etc. Agricultural products cover a large part of national GDP in food producing countries but need to assess food security status of those nations. This paper intended to discuss the food insecurity paradox, which is more apparent in some agriculture-based countries around the globe where increased agricultural GDP shares correspond to negative levels of both food security and per capita income and give an overview on the global trends. **Methods:** Data was collected from the publication of EIU Global Food Security Index and World Bank. A total number of 113 countries were considered for the data on food security index (FSI), per capita income, and percent employment in agriculture. **Results:** Countries with higher GDP contribution in agriculture have negative correlation with FSI and per capita income but have a positive relationship with the employment rate in agriculture. That means people involved in production of food are not getting food as much and this is the reason not to access food as they have less per capita income. On the other hand, countries with much less GDP contribution in agriculture had an insignificant relationship with per capita income and employment rate in agriculture. **Conclusion:** Countries producing less food have access to food due to per capita income from sources other than agriculture. So, the nations that contribute to the production of food are less secured in food, which may be due to low per capita income of many people involved in agriculture sector but they make a great contribution to global food security.

Introduction

Food is a substance consisting essentially of protein, carbohydrate, fat, and other nutrients used in the body of an organism to sustain growth and vital processes, and its importance has been assessed at global, national and household levels. Availability of food has been regarded as 'Food Security', which concerns thousands of years ago in China and Egypt during famine but properly emphasized the term in 1974 (Hodson and Richard., 2017.). It has been defined by many organizations as "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (McGuire, 2015). According to Food and Agriculture Organization (FAO), food security has four pillars as availability, access, utilization and stability (Fan and Polman, 2014). It is a multidimensional concept which requires a range

This paper should be cited as: Jesmin Aktar, Khan Md Shaiful Islam***. Agriculture Based Food Producing Countries Are Less Secured in Food.*** *Journal of Nutrition and Food Security (JNFS),* 2025; 10 (1): 5-14.

[DOI: 10.18502/jnfs.v10i1.17750]

of factors to be considered to making it sustainable for healthy life (Ghose, 2014). Food comes mainly from agriculture and its contribution in a nation is measured as a percent GDP (Sen, 1999). Many countries base their economies on agriculture, raising questions about whether a nation with a high GDP contribution from agriculture is secure in its food supply.

Projected data says that world's population will increase from 7.7 to 9.2 billion in 2050. An estimated 98% increase could create significant challenges for food security (Mok *et al.*, 2020, Valin *et al.*, 2014). To feed this large population, food production must increase by 60-70% (Alexandratos and Bruinsma, 2012). The agricultural sector plays an important role in increasing availability of food and achieving food security (Smutka *et al.*, 2015, Wegren and Elvestad, 2018)**.** There is economic growth among nations as food security becomes a global issue (Díaz-Bonilla and Thomas, 2016, Diaz-Bonilla *et al.*, 2000, Jrad *et al.*, 2010). Given that food security is a global issue influenced by countries with a higher GDP in agriculture, it is crucial to understand the food security status of these food-producing nations.

Materials & Method

Source of data

Food Security Index (FSI) and related data have been collected from EIU Global Food Security Index. The 2020 Global Food Security Index (GFSI) assessed approximately 113 countries. (Economist Intelligence Unit, 2020). Data on contribution of agriculture to GDP have been collected from World Bank (World Bank, 2020). Data of employment in agriculture, per capita income has also been collected from World Bank and FAO (Food and Agriculture Organization, 2020, World Bank, 2020).

Data analysis

After collecting data from available sources, all data were inserted in Microsoft Excel Sheet chronologically for further processing and analysis. Regression and correlation value have been calculated to express the relationship between food production and food security.

Results

There is wide range of GDP rate in agriculture from 0 (Singapore) to 54.5 (Sierra Leone) in 2021, industry and service cover rest (**Table 1** and **2**). As the GDP in agriculture range a lot among the countries, the study was divided into lower and higher GDP contributing countries in agriculture (**Table 1** and **2**).

Status of countries with higher GDP contribution to agriculture

Foods are mainly from the agricultural sector, so higher GDP in agriculture of a nation reflects their contribution for food production in comparison to other sectors of that country. In this study 10 countries having higher GDP contributions to agriculture have considered knowing the trend and relation with relevant factors for food security.

When countries consider higher GDP in agriculture, overall food security index is lower in those countries (**Table 1**). Among 10 countries involved in higher GDP contribution in agriculture range from 54.3 (Sierra Leone) to 25.5 (Malawi, there is no trend of food security index which range from 36.7 (Malawi) to 52.7 (Mali). Benin (38.6) has lower involvement in agriculture with higher per capita income (1291 US$) and Burundi has higher involvement (92.0%) in agriculture with lower per capita income (274 US$). If interrelate three figures there is clear picture that FSI and per capita income follows similar trend, so both are negatively related to GDP contribution in agriculture (**Figure 1**). It is also clear that maximum employment involved in the agricultural sector and little income might be due to being involved in agriculture.

[DOI: 10.18502/jnfs.v10i1.17750]

Table 1. Food security and related factors of countries higher GDP contribution in agriculture.

Ranking	Country (higher GDP in agriculture)	% GDP in agriculture	FSI	% Employment in agriculture	Per capita income (US$)
1st	Sierra Leone	54.3	37.0	54.9	448
2nd	Chad	42.6	39.4	76.6	614
3rd	Niger	37.8	47.6	75.1	565
4th	Mali	37.3	52.7	62.6	858
5th	Kenya	34.1	49.0	54.4	1838
6th	Ethiopia	33.5	37.0	66.1	936
7th	Burundi	28.9	37.1	92.0	274
8th	Tanzania	28.7	47.1	65.0	1076
9th	Benin	26.9	46.2	38.6	1291
10th	Malawi	25.5	36.7	43.6	625

Source: Economic Intelligence Unit, 2020; World Bank, 2020; FAO, 2020; ***FSI****: Food security index.*

Countries having higher GDP in agriculture had a negative relationship at 1.5% for FSI and 8.8% with per capita income. On the other hand, positive relationship existed at 0.19% for employment with the GDP contribution in agriculture (**Figure 1**). In countries where agriculture's GDP contribution increased, per capita income was found to be lower.

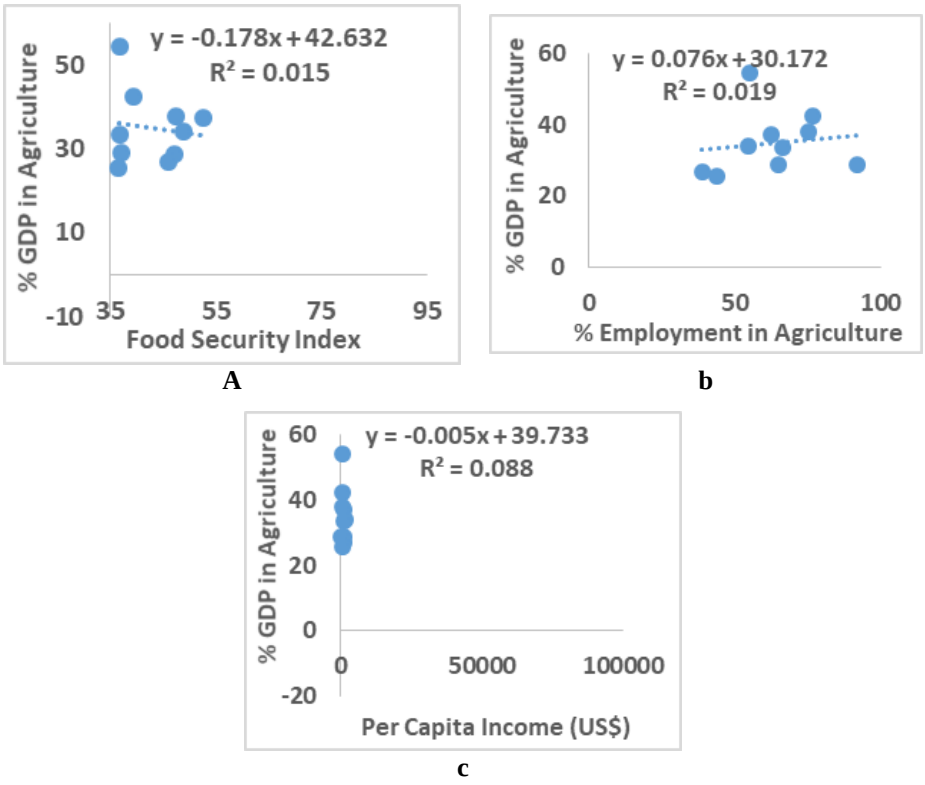

Figure 1. Food security index, employment in agriculture and per capita income, and their relation with GDP in agriculture.

[DOI: 10.18502/jnfs.v10i1.17750]

Status of countries with lower GDP contribution in agriculture

Several countries have found that agriculture's GDP is low or zero, yet they remain highly secure in food (**Table 2**). Countries with varying contributions of agriculture to their GDP range from zero (as in Singapore) to 1.1 (as in Australia). Despite having a low GDP contribution from agriculture, the food security index varies significantly, falling between 64.6 (in Bahrain) and 83.8 (in Ireland). Notably, even in Singapore, where the agricultural GDP contribution is zero, the food security index stands at 75.7. In general, countries highly secured in food but contributing less for food production as reflected GDP contribution in agriculture of those countries.

Table 2. Food security index, per capita income and population density of countries having less GDP contribution in agriculture.

Ranking	Countries (lowest GDP in agriculture)	% GDP in agriculture	FSI	%Employment in agriculture	Per capita income (US$)
1st	Singapore	0	75.7	0.7	59797
2nd	Qatar	0.2	69.6	1.2	50805
3rd	Bahrain	0.3	64.6	1.0	23443
4th	Kuwait	0.5	70.7	2.0	32373
5th	United Kingdom	0.6	78.5	1.0	40284
6th	Belgium	0.6	75.2	1.0	44594
7th	Switzerland	0.7	78.1	2.9	86601
8th	Germany	0.7	77.0	1.2	45723
9th	Ireland	0.9	83.8	4.6	83821
10th	Australia	1.1	79.4	2.6	48105

Source: Economic Intelligence Unit, 2020; World Bank, 2020; FAO, 2020; ***FSI****: Food security index.*

In developed countries, where the GDP contribution from agriculture is minimal, the food security index is found to be higher (**Figure 2**) (R^2=0.43). A strong positive relationship existed between GDP in agriculture and employment in agriculture (R^2=0.45) in those countries, although they had very limited contribution in agriculture in relation to other sectors. But, there was a negative relationship between per capita income and GDP in agriculture (R^2=0.07).

[DOI: 10.18502/jnfs.v10i1.17750]

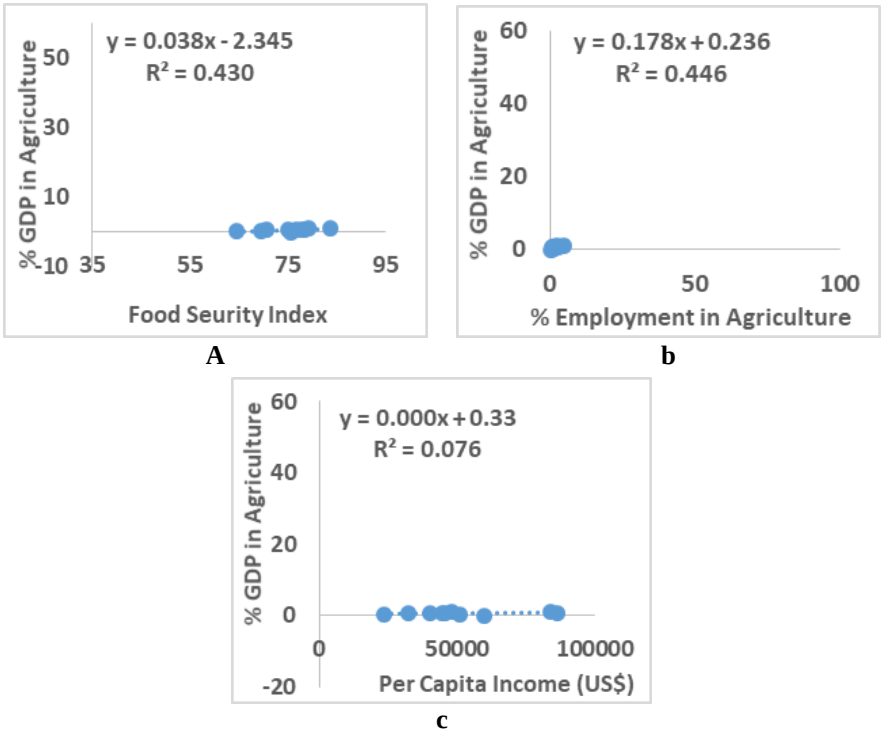

Figure 2. Food security index, employment in agriculture, and per capita income of countries those GDP in agriculture was lower.

Overall, the trends in the food security index, agricultural employment, and per capita income exhibit different patterns between agriculture-based countries and non-agricultural countries. This indicates that sectors outside of agriculture also influence parameters such as the food security index (comparing **Figures 1** and **2**).

Global food production and food security index

In 113 countries, the GDP contribution from agriculture has a negative relationship with the food security index and per capita income, but a positive relationship with employment in agriculture (**Figure 3**). Data fitted in the regression line was 57.4% and negatively related to GDP in the agriculture sector and food security index of a nation. Alternatively, percentage of employment in agriculture had a positive relationship with the GDP contribution in agriculture (70.6%). On the other hand, per capita income was reduced when the percentage of GDP contribution in agriculture increased (8.8%). More employment was related to agriculture when GDP contribution in agriculture was higher, that means per unit production cost involved more people involved who cause lower per capita income.

[DOI: 10.18502/jnfs.v10i1.17750]

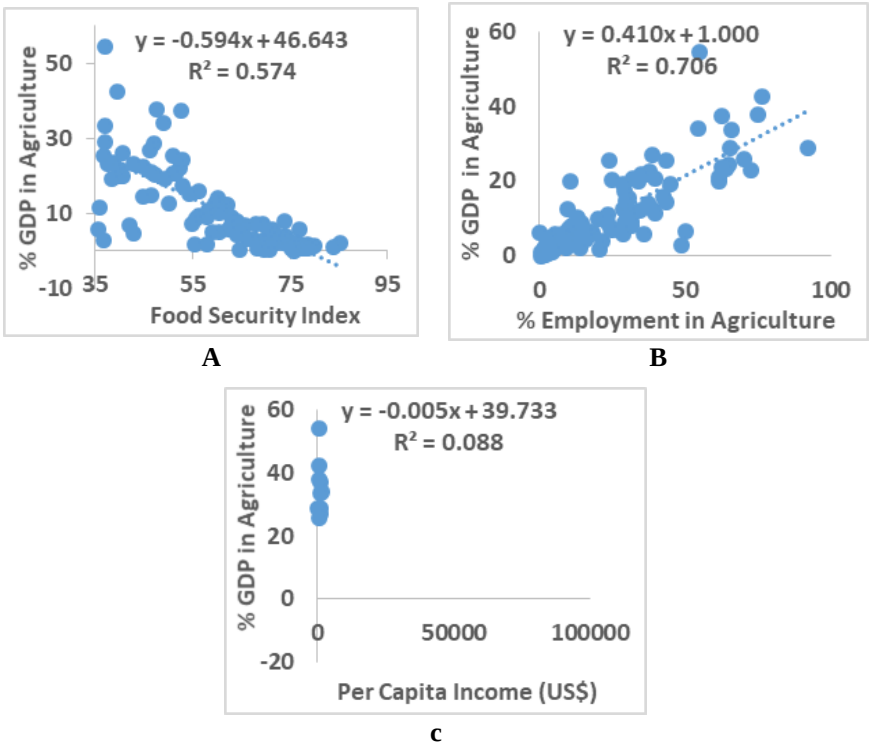

Figure 3. Food security index, employment in agriculture, and per capita income of 113 countries.

When analyzed for correlation coefficient (r-value) among the parameters, it was found that FSI had a negative correlation with GDP in agriculture and employment in agriculture. On the other hand, it had a positive correlation with PCI. There is a strong correlation between GDP contribution in agriculture and employment in agriculture, while per capita income has a negative relationship with both GDP contribution and employment in agriculture. All the relationships were shown in the **Table 3**.

Table 3. Correlation (r-value) between GDP in agriculture, food security index, and employment in agriculture for 113 countries (year 2020).

Parameters	FSI	Employment in agriculture	Per capita income
GDP in agriculture	-0.76	0.84	-0.56
Food security index(FSI)	-	-0.80	0.72
Employment in agriculture		-	-0.60

***FSI**: Food security index.*

Discussion

Countries with a higher GDP contribution to agriculture were less secure in food, which is true for at least developed countries as well as all over the world (**Table 1** and **Figures 1** and **2**). Those countries are related to high engagement of manpower in agriculture sector. Higher manpower engagement in food production system with higher GDP contribution lowers per capita income, alternatively higher GDP in food production causes lower per capita income in those countries shown as per the result. As per history, most of the people were involved in agriculture which was about 105,000

[DOI: 10.18502/jnfs.v10i1.17750]

years ago (Jrad *et al.*, 2010). Later on, people worked for other fundamental needs like cloth, house, treatment and education, which changes the economic condition of a country and causes variation among the sectors; and other sectors, involve more money flow, which is not for agriculture sector (Maisonet-Guzman, 2011).
Researchers observed that the main reason for undernourishment was insufficient income (Poleman, 1981) which was further agreed on by numerous studies, showing a positive relationship between income and food security (Cirera and Masset, 2010, Rask and Rask, 2011, Skoufias *et al.*, 2011). Some studies showed that food insecurity is a global issue, but the situation of food insecurity and hunger is acute in food producing countries which have higher GDP in agriculture (Khan *et al.*, 2014, Webb *et al.*, 2006, Yengoh and Armah, 2015). Few researchers find some reasons for causes of food insecurity in those countries like poor crop yields, post-harvest losses, weather conditions associated with climate change, agricultural pests, weak institutions, and political instability (Food and Agriculture Organization, 2014, Khan *et al.*, 2014, Kimatu *et al.*, 2012), Despite being a food producing country, people in other sectors do not care about the status of farmers, they only focus on buying food. The current findings suggest that a significant number of people in the agricultural sector may experience limited development in other areas. This situation contributes to a very low per capita income, primarily due to traditional farming practices and the associated limitations mentioned above.

According to several researchers, one way to eradicate poverty and ensure food security is enhancing the households 'purchasing power in developing countries (Sen, 1999) because, as income grows in poorer households, large portions of their income are used for food consumption (Cirera and Masset, 2010). However, the way per capita income will increase was not explained. It was found that when per capita income is higher, countries do not fall into the category of agricultural countries.

Food secured countries are trying to increase productivity of food using technology because the land and water allocated to agriculture is rapidly declining due to urbanization and industrialization (Mok *et al.*, 2020). That means food secured countries further have increased food production which will be more capable to be secured in food. Although there is often only 1.0% of land available, it may sometimes have no arable land at all developed countries can ensure food security by trading food from food producing countries. In 1965, with approximately 25.0% farmland, Singapore was partially self-sufficient in food. However, in 2014, only 1.0% land was used as farmland in Singapore, and the country depended on 160 countries for food and imported 90% from abroad (Deakin *et al.*, 2016), but now the position is top for FSI.

Maximum food secured countries adopted some technologies including vertical farming, aquaponics and internet-driven agriculture, and technology driven food waste management that are key to enhance food security (zero waste food processing) as well as platform technology to develop alternative and unconventional food sources (Mok *et al.*, 2020). In general, developed countries are secure in food due to higher per capita income, which are further improved due to adopting a high level of technology. Hence, the global food production capacity is no longer the main limitation of ensuring food security due to development of technology (Hazell and Wood, 2008) but developing countries still lack adopting those technologies which will keep them behind for financial development indirectly related to food security of those countries. But, there is another limitation to adopting a high level of technology, because the technology needs to be imported from abroad which is again costly.

In food producing countries, maximum numbers of farmers are smallholders and the amount of food they produce cannot ensure their

[DOI: 10.18502/jnfs.v10i1.17750]

basic needs as per capita income is very low (Corsi *et al.*, 2017). On the other hand, those countries are not involved in food production, have higher per capita income, and are engaged in non-farming a activity that provides additional income, and enables them to spend more money on their basic needs including food, education, cloth and health care services (Adem *et al.*, 2018). As per capita income is high in developed countries, these countries import maximum agricultural products from food producing countries (Mok *et al.*, 2020). In the mid-1980s, about 15 percent of world food production was traded internationally, but in 2019 the amount reached 23 percent (D'odorico *et al.*, 2014). Another research finding says that about 16% of the global population depends on international food trade (Fader *et al.*, 2013). Hence, through globalization, developed countries are ensuring food security, but losing the status of food security in countries where food has been produced.

Food is a basic need and essential from birth to death for every person. But according to globalization food has been ensured to those countries where people are less involved in food production and deprived countries are involve in food production system. As it is a basic need for living, it is recommended to cooperate with food producing countries for their development.

Conclusion

Many people are involved in agriculture for production of food in a nation where GDP contribution in agriculture is high. When many people are involved in agriculture, their per capita income is very low, because per capita production of food becomes less. Due to low per capita income people have low purchasing ability and lack access to food. On the other hand, industrialized countries have the capacity to import food from other countries, because they have higher per capita income. Alternatively, agriculture-based countries need to buy other services from industrialized countries, so they export food to those countries. In this connection, food producing countries suffer from lack of availability of food, less access to food, and lower purchasing ability. Ultimately, food producing countries are less secure in food, but contribute to global food security. The situation further was polarized due to globalization and easy access of commodities to global market.

Funding

This research did not receive any specific financial support from funding agencies in the public, commercial, or not-for profit sectors.

Conflict of interest

The authors declared no conflict of interests.

Authors' Contributions

KMS Islam and J Aktar designed the research; J Aktar conducted it and analyzed data; KMS Islam and J Aktar wrote the paper. KMS Islam had primary responsibility for final content. All authors read and approve the final manuscript.

Acknowledgement

Not applicable.

References

Adem M, Tadele E, Mossie H & Ayenalem M 2018. Income diversification and food security situation in Ethiopia: A review study. *Cogent food & agriculture.* **4 (1)**: 1513354.

Alexandratos N & Bruinsma J 2012. World agriculture towards 2030/2050: the 2012 revision. Agricultural Development Economics Division, Food and Agriculture Organization of the United Nations.

Cirera X & Masset E 2010. Income distribution trends and future food demand Philosophical Transactions of the Royal Society B. *Biological sciences.* **365 (1554)**: 2821-2834.

Corsi S, Marchisio LV & Orsi L 2017. Connecting smallholder farmers to local markets: Drivers of collective action, land tenure and food security in East Chad. *Land Use Policy.* **68**: 39-47.

D'odorico P, Carr JA, Laio F, Ridolfi L &

[DOI: 10.18502/jnfs.v10i1.17750]

Vandoni S 2014. Feeding humanity through global food trade. *Earth's future.* **2 (9)**: 458-469.

Deakin M, Borrelli N & Diamantini D 2016. Governance of city food system. Case Studies from around the world.

Díaz-Bonilla E & Thomas M 2016. Why some are more equal than others: Country typologies of food security.

Diaz-Bonilla E, Thomas M, Robinson S & Cattaneo A 2000. Food security and trade negotiations in the World Trade Organization: A cluster analysis of country groups.

Economist Intelligence Unit 2020. Global Food Security Index. The Economist Intelligence Unit Limited 2020, Regional.

Fader M, Gerten D, Krause M, Lucht W & Cramer W 2013. Spatial decoupling of agricultural production and consumption: quantifying dependences of countries on food imports due to domestic land and water constraints. *Environmental research letters.* **8 (1)**: 014046.

Fan S & Polman P 2014. An ambitious development goal: Ending hunger and undernutrition by 2025. Intl Food Policy Res Inst.

Food and Agriculture Organization 2014. State of Food Insecurity in the World 2013: The Multiple Dimension of Food Security.FAO.

Food and Agriculture Organization 2020. World Food and AgriculturE- Statistical Yearbook.

Ghose B 2014. Food security and food self-sufficiency in China: from past to 2050. *Food and energy security.* **3 (2)**: 86-95.

Hazell P & Wood S 2008. Drivers of change in global agriculture. *Philosophical Transactions of the Royal Society B: Biological sciences.* **363 (1491)**: 495-515.

Hodson & Richard. 2017. Food security. *Nature.* **544 (7651)**: S5-S5.

Jrad S, Nahas B & Baghasa H 2010. Food security models. *Ministry of Agriculture and Agrarian Reform, National Agricultural Policy Center. Policy Brief.* **33**: 32.

Khan ZR, et al. 2014. Achieving food security for one million sub-Saharan African poor through push–pull innovation by 2020. *Philosophical Transactions of the Royal Society B: Biological sciences.* **369 (1639)**: 20120284.

Kimatu JN, McConchie R, Xie X & Nguluu SN 2012. The significant role of post-harvest management in farm management, aflatoxin mitigation and food security in Sub-Saharan Africa. *Greener journal of agricultural sciences.* **2 (6)**: 279-288.

Maisonet-Guzman OE 2011. Food security and population growth in the 21st century. *E-International relations.* **18**: 1-10.

McGuire S 2015. FAO, IFAD, and WFP. The state of food insecurity in the world 2015: meeting the 2015 international hunger targets: taking stock of uneven progress. Rome: FAO, 2015. *Advances in nutrition.* **6 (5)**: 623-624.

Mok WK, Tan YX & Chen WN 2020. Technology innovations for food security in Singapore: A case study of future food systems for an increasingly natural resource-scarce world. *Trends in food science & technology.* **102**: 155-168.

Poleman TT 1981. Quantifying the nutrition situation in developing countries. *Food research institute studies.* **18 (1)**: 1-58.

Rask KJ & Rask N 2011. Economic development and food production–consumption balance: a growing global challenge. *Food policy.* **36 (2)**: 186-196.

Sen A 1999. Development as freedom. Oxford: Oxford University Press.: Oxford University Press.

Skoufias E, Di Maro V, Gonzalez-Cossio T & Ramirez SR 2011. Food quality, calories and household income. *Applied economics.* **43 (28)**: 4331-4342.

Smutka L, Steininger M, Maitah M & Škubna O 2015. The Czech agrarian foreign trade-ten years after the EU accession. In *Global Agribusiness and the Rural Economy*: Prague, Czech Republic.

[DOI: 10.18502/jnfs.v10i1.17750]

Valin H, et al. 2014. The future of food demand: understanding differences in global economic models. *Agricultural economics.* **45 (1)**: 51-67.

Webb P, et al. 2006. Measuring household food insecurity: why it's so important and yet so difficult to do. *Journal of nutrition.* **136 (5)**: 1404S-1408S.

Wegren SK & Elvestad C 2018. Russia's food self-sufficiency and food security: An assessment. *Post-Communist Economies.* **30 (5)**: 565-587.

World Bank 2020. GDP Per Capita (Current Us$), https://genderdata.worldbank.org/en/indicator/ny-gdp-pcap-cd. The World Bank.

Yengoh GT & Armah FA 2015. Effects of large-scale acquisition on food insecurity in Sierra Leone. *Sustainability.* **7 (7)**: 9505-9539.

[DOI: 10.18502/jnfs.v10i1.17750]