Comparative Analysis of the Degree of Food Security Assurance at Global Level

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Abstract

The fundamental objective and role of any state in the world is to ensure the ability to provide to people with security and safety, namely to protect and maintain the rights of its citizens and to provide them with an environment conducive to the satisfaction of all their needs. Among the dimensions of national and international (collective) security, food security and safety represent the most important dimension of the internal security of any individual state.

The right to eat is a fundamental right, equivalent to the right to life, respectively to health. Food security and safety are closely related to economic development and social progress, to natural resources and environmental security, to individual security and demographic evolution, to international and geopolitical relations.

Key words: food security, food safety, agriculture
J.E.L. classification: F62, Q18

1. Introduction

According to Ion (2017), the main source for ensuring national food security is represented by domestic production, and the extent to which food security is achieved from own production shows the degree of food self-sufficiency. Globally, the food security situation is unstable as more than 861 million people suffer from undernourishment while 1.72 billion people suffer from overfeeding (according to Worldmeter). Among the causes and factors that influence food security can be mentioned:

- global warming, land degradation and desertification;
- reducing the use of own agricultural potential at the expense of excessive imports;
- the absence of a coherent national strategy for food security;
- the global economic crisis;
- the relatively low degree of national independence regarding food security;
- gaps in terms of development levels between regions and countries;
- high price volatility;
- lack of immediate actions;
- lack of coherent policies in the agri-food sector;
- lack of control and monitoring of traceability on the agri-food chain;
- lack of coordination and practical actions at the global level, etc.

Over time, a series of food crises have appeared in different areas of the world, both in underdeveloped and developed countries, and the main causes that have determined the occurrence of food crises are the following: poverty, lack of investment in agriculture, factors natural disasters, military conflicts and population migration, market instability, food waste (Ion, 2017). According to the

FAO, the global volume of food waste is estimated at 1.3 billion tonnes, directly affecting the food security of the population but also the environment through the carbon footprint, which is estimated at around 3.3 billion tonnes of CO2 equivalent of GHG released into the atmosphere per year.

2. Theoretical background

Already during the great crisis of the interwar period, the famous economist John Maynard Keynes stated and demonstrated the fact that the demand of the mass (population) is wrong - manifested intensively through an excessive consumption of goods and services, which led the market economy to increase the respective offers. In order to "educate the demand of the masses" and the orientation of the economy, the great professor suggested that the states should intervene in the internal/community market and use political-fiscal and monetary measures to guide the labor market and ensure socio-economic balance and an economy dynamics.

Statistics from developed and highly developed countries, from the last three decades, demonstrate the fact that, most of the time, among the masses, who do not have the culture of investments/savings, the structure of the demand, respectively of the "Consumption Basket" consists of 30% needs and 70% wants.

Although the states have been involved and are systematically involved in economic life by adopting different policies and legal measures of fiscal and social policy "orientation of the economic environment" respectively of the demand, the excessive consumption behavior of goods and services of the masses does not seem that it would have stopped, but on the contrary, it took on even greater valences that it affected and affects unprecedentedly, generating demo-socio-economic imbalances.

At the same time, since the 17th century, the great philosopher and economist Adam Smith, in his work "The Theory of Moral Sentiments" (1759) describes the social need of people to behave correctly, fairly in society and to overcome their selfishness, as beings with collective needs. This work, made more than 250 years ago, will never lose its exceptional value and topical character in exploiting the understanding of desire specific to human nature. The work presents a clear picture of human behavior in various situations, emphasizing reward and punishment, the meaning of duty, and the impact of several social and economic factors on the behavior of moral values.

3. Findings

According to the "Real-time World Statistics" data for the first 6 months of 2022, it presents the following information - 10.83% of the total global population are undernourished, 21.73% - overweight people, 10.21% - obese people, and the rate hunger mortality in this half of 2022 is 4 out of 10,000 deaths.

World population	
7.958.024.912	Current world population
70.379.058	Births this year
160.118	Birthdays today
29.546.814	Deaths this year
67.221	Deaths today
40.832.244	Population growth this year

Food statistics	
861.897.725	Malnourished people in the world now
1.729.482.395	Overweight people in the world
812.494.911	Obese people in the world now
12.809	People who died of hunger today
$ 260.927.752	Money spent today on obesity-related diseases in the US
$ 79.177.826	Money spent on diets in the US today

Source: World statistics in real time, https://www.worldometers.info/ro/, accessed July 3, 2022

The objective of the modern economy aimed at the "Increasing Efficiency" dimension, which is based on the principle of "minimum effort - maximum effect", often having disastrous effects on the environment.

The impact on the environment is related to the dynamics and behavior of the population from several points of view, respectively: what resources do people use, how extensive is industrial production, how much energy is needed for heating, cooling and transport, etc. But population growth is only one factor influencing climate change. Consumption habits are another factor, and they are not globally uniform. "There is a significant disconnect between the places where population growth is very fast and the places where the greatest consumption is taking place," says Corey Bradshaw, director of the Global Ecology Laboratory at Flinders University.

Only in this half year (2022), the share of global forest loss is 6.7%, the share of agricultural land lost due to soil erosion is 0.223%, carbon dioxide emissions this year are 2.29 tons /capita, and the toxic waste released by industry into the air, land and water this year is 0.618 kg/capita.

Environment	
2.612.682	Forest losses this year (hectares)
3.517.377	Agricultural land lost this year due to soil erosion (hectares)
18.292.649.008	Carbon dioxide emissions this year (tonnes)
6.028.657	Desertification this year (hectares)
4.919.574	Toxic waste released by industry into air, land and water this year (tonnes)

Water	
2.262.406	Water consumed this year (billion liters)
423.032	Deaths from waterborne diseases this year
781.023.985	People without access to drinking water

Source: World statistics in real time, https://www.worldometers.info/ro/, accessed July 3, 2022

A principle of the current economy in order to increase production, consists in increasing consumption by stimulating consumer demand. They will consume more and more, so that the economy is set in motion, on the idea that "a dynamic economy needs sufficient demand". At first sight it doesn't seem anything unnatural, but this principle led very quickly to a linear economic model without successive restarts, which is based on the "use-produce-consume-dispose" principle, a model which led vectorially to a consumer society and enormously affected the quality of the environment by misbehaving towards it. From the point of view of production quality, much of this model involved programming wear - designing a product to have a limited lifespan to encourage consumers to buy a new one more often, or the manufacturer to decrease quality in order to increase this flow. In order to combat this practice, the European Parliament requested a series of measures, the most important of which aims to ensure the guarantee for the entire estimated life of the product. The purpose of these measures is to protect the environment.

As mentioned by Pătărlăgeanu et. al (2020), recently more environmental incidents occur worldwide, generating costs that are very difficult to reduce in the short and medium term.

However, it will be quite difficult to impose and educate among the masses, but especially among the producers, the "circular economy" model that involves sharing, reusing, repairing, renovating and recycling existing materials and products as much as possible. Through this model, the life cycle of the products is extended.

Currently, world socio-economic policies are fundamentally reorienting and are not limited to a blind concept of "economic growth", but are concerned with a qualitative and interdependent growth with all social dimensions, which equally regards social balance and sustainability. In this sense, a number of 17 Sustainable Development Goals were developed and pursued for implementation at the level of all the states of the world. Objective 2 entitled "Zero hunger" focuses on the analysis and monitoring of 3 major dimensions:

- **Ecological agriculture and healthy eating, currently characterized by a single economic indicator "The value of fruit and vegetable production";**

- **Supporting national production in the agri-food sector, characterized by 8 economic indicators:**

- Dynamics of land improvement arrangements - Irrigation.
- Budgetary allocation of amounts for research-development activity in agriculture.
- The volume of expenses from the business environment sector for research and development activity in agriculture, by funding sources.
- Commercial intensity of meat and meat products.
- The number of agricultural and food products (brands) recognized at European level.
- Traditional certified products.
- The value of investments intended to support the installation of young farmers.
- The agricultural area used and cultivated ecologically.
- The total number of operators certified in organic agriculture.

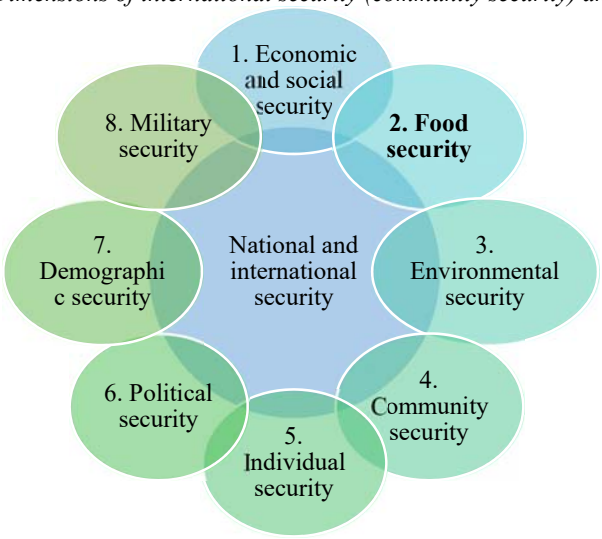
- **Preventing and combating soil pollution characterized by 2 environmental indicators:**

- The share of the ecological agricultural area in the total agricultural area.
- The surface of the lands arranged with improvement works, to combat soil erosion and desertification, by land use category.

4. Global Food Security Index - Food security balances and imbalances

According to the definition of the World Food Summit in 1996, food security is defined as the state in which people have at all times physical, social and economic access to sufficient and nutritious food that meets their nutritional needs for a healthy and active life. According to the Report presented within the UN Development Program there are 8 dimensions of international security (community security) and national security:

Figure 1 Dimensions of international security (community security) and national security

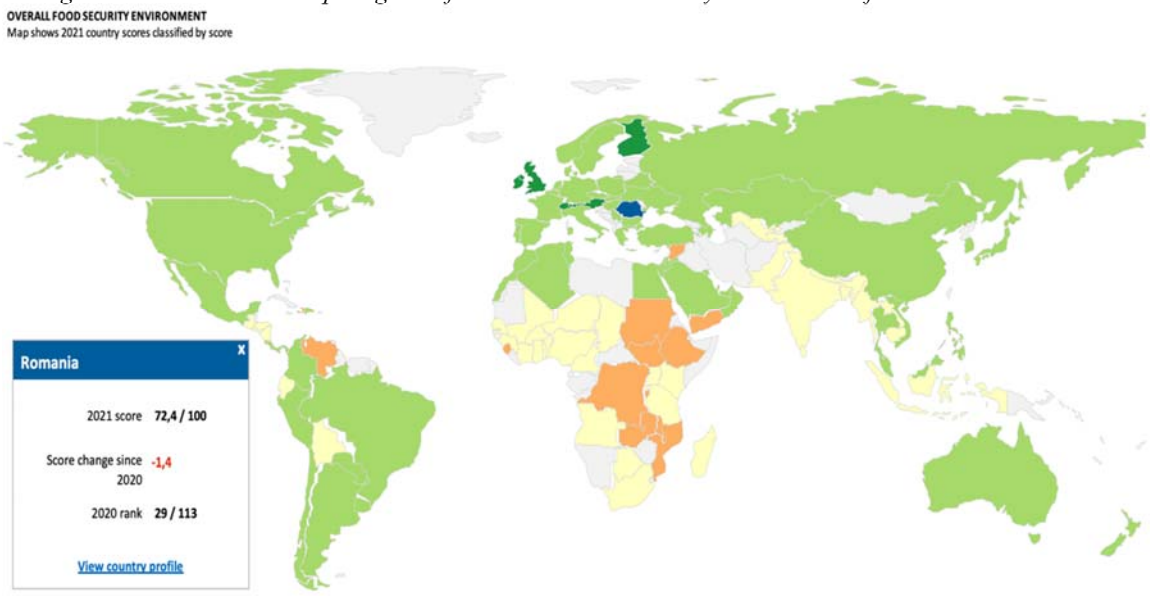


Source: data processing by authors according to the Report presented within the UN Development Program

The Global Food Security Index (ISAG) has been developed in international literature and practice. It is calculated at the level of 113 countries of the world and is a composite indicator that takes into account the basic problems that countries face in terms of food accessibility, availability, quality and safety, along with natural resources and resilience. The index is a dynamic quantitative and qualitative scoring model, constructed from 59 unique indicators, that measure factors driving food security in developing and developed countries. The overall goal of the ISAG study is to assess and identify which countries are most and least vulnerable to food insecurity through the categories of affordability, availability, quality and safety, and natural resources and resilience.

The index comprehensively examines food security in four internationally established dimensions.

Figure 2. Author extract Map diagram of the Global Food Security Index in 2021 for Romania



Source: https://impact.economist.com/sustainability/project/food-security-index/Index

To capture the heterogeneity of food security, the ISAG is grouped into 5 equal intervals. In the first interval - very good level (80-100%) there are only 5 states of the world, in the Good interval - 59 of the states (interval in which Romania is also found - located between Chile and Kuwait), in the category of Moderate we have 37 of states, and in the low one 12 states (the minimum level being registered in Burgundy).

Table 1. Grouping of the Global Food Security Index into 5 equal intervals

Level	Interval	Number of states
Very good	Over 80 %	**5** countries (Irland - 84%; Austria – 81,3% Great Britan – 81%, Finland – 80,9%, Sweeden, 80,4%)
Godd	79,9-60,0%	**59 countries** (Netherlands – 79,9% Romania -72,4%... Philippines – 60,0%)
Moderate	59,9-40,0%	**37 countries** (Bolivia – 59,9 %...Rwanda – 40,3%)
Low	39,9-20,0%	**12 cuntries** (Venezuela 39,4% ... Burgundia 34,7)
Very low	Under 19,9 %	**0 countries**

Source: Systematization of authors by: https://impact.economist.com/sustainability/project/food-security-index/Index

The level of the Global Food Security Index (ISAG) of Romania, in 2021, was 72.4% located in the 29th position in the 113 countries of the world and in the 26th position in Europe, with a decrease compared to the previous year 2020 of 1, 4 percentage points and with an increase of 6.2 percentage points in the last 10 years. Analyzing the level of the ISAG index on each dimension, the situation is as follows:

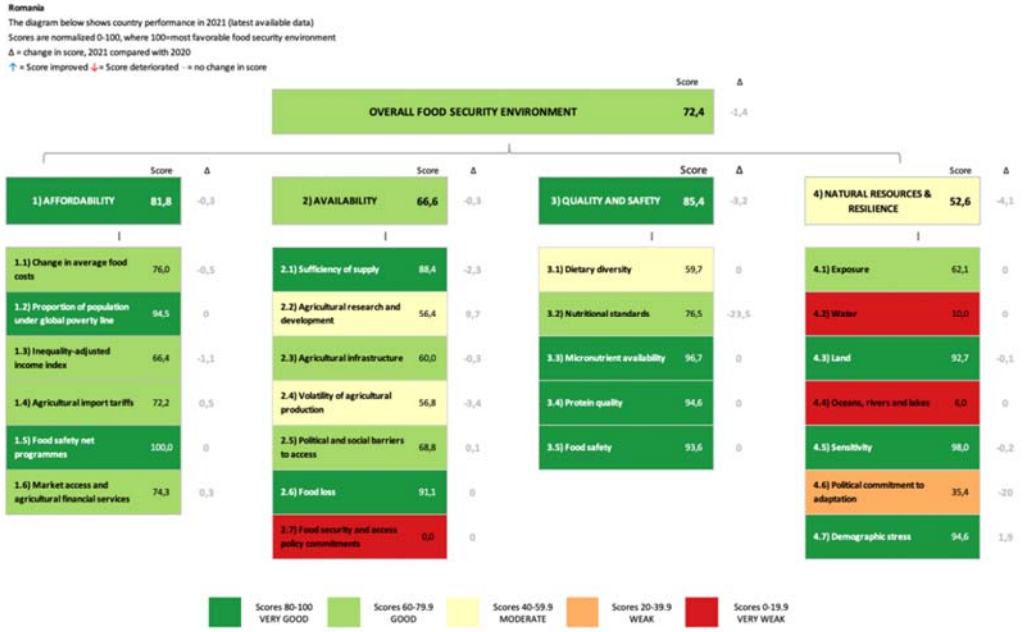
a) from the point of view of Accessibility (Affordability), which measures consumers' ability to buy food, their vulnerability to price shocks and the presence of programs and policies to support customers when shocks occur, Romania ranks 40th , in 2021, being 81.8%. It should be noted that Food safety net programs have an index of 100%, while Agricultural import tariffs have a level of only 72.2%.

b) Food Availability (which synthetically expresses the sufficiency of the national food supply, the risk of supply interruption, the national capacity to disseminate food and research efforts to expand agricultural production has an index of 66.6%, where the Sufficiency of supply = 88.4%, and Food security and access policy commitments = 0%;

c) The variety and nutritional quality of average diets, as well as food safety called Quality and Safety (Quality And Safety) is estimated at a level of 85.4%, in which Protein quality = 94.6%, and Dietary diversity = 59, 7%

d) Natural resources and resilience (natural resources & resilience), which assesses a country's exposure to the impact of climate change, its susceptibility to risks related to natural resources and how the country adapts to these risks, has a level of 52.6 %.

Figure 3 Author extract, Profile of Romania by dimensions and indicators of ISAG in 2021



Source: https://impact.economist.com/sustainability/project/food-security-index/Index

In order to better capture Romania's situation and gaps, we compare the dimensions and composite indicators of Romania's ISAG with Ukraine, Poland and Germany in 2021. Ukraine - as the country with the largest grain exporter in Europe, Poland - a benchmark in development and economic policies, Germany – as the main importer of food production and benchmark of economic power.

Table 2. Score and rank of Global Food Security Index dimensions of Romania, Ukraine, Germany and Poland

Dimension	Country/Score of dimension				Rank			
	Romania	Ukraine	Polond	Germany	Romania	Ukraine	Poland	Germany
Global Food Security Index (100%)	72,4	62,0	74,0	78,7	29	58	22	11
Accessibility (32,4%)	81,8	73,9	87,0	90,1	40	58	25	10
Availability (32,4%)	66,6	51,8	65,0	69,3	27	74	30	18
Quality and safety (17,6%)	85,4	71,9	80,5	87,8	24	55	40	18
Natural resources and resilience (17,6%)	52,6	49,3	65,0	66,0	41	56	14	11

Source: Author data systematization according to: https://impact.economist.com/sustainability/project/food-security-index/Index

In 2021, from the point of view of the Global Food Security Index, Ukraine is in the second half of the ranking (position 58), Germany in the first 11, Poland in position 22, and Romania 7 positions lower than Poland.

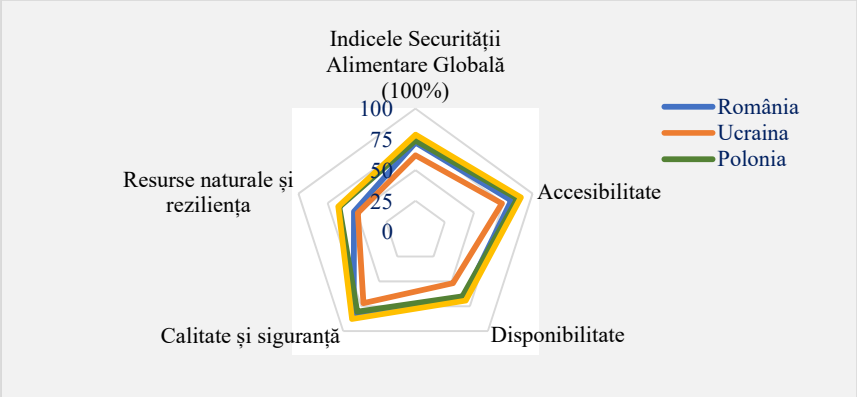
The ranking of the Accessibility of food products (expresses the ability of consumers to buy food, their vulnerability to price shocks and the presence of programs and policies to support customers when shocks occur), for Germany it is 10, for Poland it is 25, Romania by a wide gap the 40th place , and Ukraine the 58th position.

Food availability (this quantifies the sufficiency of the national food supply, the risk of supply disruption, the national capacity to disseminate food and research efforts to expand agricultural production), shows a more significant gap between countries, as follows: Germany petition 18, Romania surpasses Poland with 3 positions (27th place) and Ukraine is only in 74th place.

It is worth noting that the most appreciated dimension for Romania belongs to Food quality and safety (it measures the variety and nutritional quality of average diets, as well as food safety): the position of our country is in 24th place, relatively close to Germany - position 18 , Poland = 40, and Ukraine 55.

While Natural resources and resilience (evaluates a country's exposure to the impact of climate change; its susceptibility to risks related to natural resources; and how the country adapts to these risks), show very low values Romania 52.6% (41st place), Ukraine – 49.3%, Poland - 65.0% and Germany 66%.

Figure 4 Comparative analysis of the dimensions of the Global Food Security Index of Romania, Ukraine, Germany and Poland



Source: data processing by authors

Figure 5 Comparison of the dimensions of the Global Food Security Index of Romania with Ukraine in 2021

Series	Romania Score	Δ	Rank	Δ	Ukraine Score	Δ	Rank	Δ	Average score (all countries)
OVERALL FOOD SECURITY ENVIRONMENT	**72,4**	**-1,4**	**29**	**-2**	**62,0**	**3,2**	**58**	**9**	**60,9**
1) AFFORDABILITY	81,8	-0,3	=40	1	73,9	5,7	58	8	66,8
2) AVAILABILITY	66,6	-0,3	27	-2	51,8	6,2	=74	16	56,7
3) QUALITY AND SAFETY	85,4	-3,2	24	-4	71,9	-3,5	55	-7	68,0
4) NATURAL RESOURCES & RESILIENCE	52,6	-4,1	41	-16	49,3	0,2	56	-2	50,8
1) AFFORDABILITY	**81,8**	**-0,3**	**=40**	**1**	**73,9**	**5,7**	**58**	**8**	**66,8**
1.1) Change in average food costs	76,0	-0,5	69	5	86,5	26,5	=38	57	70,4
1.2) Proportion of population under global poverty line	94,5	0	54	-2	99,8	0,2	=9	9	73,9
1.3) Inequality-adjusted income index	66,4	-1,1	35	-2	67,5	0,6	33	2	54,5
1.4) Agricultural import tariffs	72,2	0,5	=32	1	77,4	0,2	15	1	63,3
1.5) Food safety net programmes	100,0	0	=1	0	50,0	0	=74	-1	72,1
1.6) Market access and agricultural financial services	74,3	0,3	50	1	60,0	0,7	67	-1	63,8
2) AVAILABILITY	**66,6**	**-0,3**	**27**	**-2**	**51,8**	**6,2**	**=74**	**16**	**56,7**
2.1) Sufficiency of supply	88,4	-2,3	=10	-3	62,8	18,6	55	20	58,7
2.2) Agricultural research and development	56,4	9,7	19	18	36,8	12,6	65	34	42,1
2.3) Agricultural infrastructure	60,0	-0,3	=34	-2	42,2	2,2	66	6	47,5
2.4) Volatility of agricultural production	56,8	-3,4	=74	-5	72,8	-1	=49	0	61,0
2.5) Political and social barriers to access	68,8	0,1	38	0	26,3	-0,3	104	1	58,7
2.6) Food loss	91,1	0	=12	0	83,2	0	41	0	73,7
2.7) Food security and access policy commitments	0,0	0	=77	-8	0,0	0	=77	-8	43,8
3) QUALITY AND SAFETY	**85,4**	**-3,2**	**24**	**-4**	**71,9**	**-3,5**	**55**	**-7**	**68,0**
3.1) Dietary diversity	59,7	0	35	0	47,8	0	=59	0	48,3
3.2) Nutritional standards	76,5	-23,5	=27	-26	47,1	-26,4	=93	-51	62,1
3.3) Micronutrient availability	96,7	0	13	0	87,0	0	46	0	78,3
3.4) Protein quality	94,6	0	26	0	81,6	0	41	0	68,4
3.5) Food safety	93,6	0	=22	2	84,3	0	67	-2	80,1
4) NATURAL RESOURCES & RESILIENCE	**52,6**	**-4,1**	**41**	**-16**	**49,3**	**0,2**	**56**	**-2**	**50,8**
4.1) Exposure	62,1	0	=78	0	52,8	0	99	0	65,0
4.2) Water	10,0	0	=52	0	0,0	0	=78	0	19,7
4.3) Land	92,7	-0,1	2	0	67,4	0	72	0	70,3
4.4) Oceans, rivers and lakes	6,0	0	=99	0	19,7	0	=66	0	27,4
4.5) Sensitivity	98,0	-0,2	=11	-2	92,6	0,6	26	-1	69,6
4.6) Political commitment to adaptation	35,4	-20	=64	-32	47,2	0	51	-2	45,3
4.7) Demographic stress	94,6	1,9	1	0	94,2	2,1	=2	2	59,9

Scores 80-100 VERY GOOD | Scores 60-79.9 GOOD | Scores 40-59.9 MODERATE | Scores 20-39.9 WEAK | Scores 0-19.9 VERY WEAK

Source: Extract authors https://impact.economist.com/sustainability/project/food-security-index/Index - September 2021, accessed June 2022

5. Conclusions

Currently, several crises are simultaneously manifesting worldwide, respectively: the crisis caused by the COVID-19 pandemic, the crisis caused by the military conflict in Ukraine, the food crisis and the crisis caused by climate change. Under these conditions, the dimension of food security must be addressed both at the national and global level. All these crises are putting pressure on food chains around the world and, implicitly, on national and global food security. That is why ensuring food security represents a challenge for all states and a major objective that should be included in all the sustainable development strategies of the states of the world.

According to FAO (2016), food security is an indicator of human well-being and development. The governments of all the countries of the world must develop programs aimed at increasing the degree of food self-sufficiency, this being achieved from their own production, and, where the national agri-food sector cannot provide the necessary food from domestic production, then the food deficit is ensured from imports.

Given that Romania has a very high production potential, our country can and must become an important supplier of agri-food products both for the domestic market and for the European and world markets.

6. References

- Cohen, J., 1995. *How many people can the earth support?* New York: W. W. Norton & Co.
- Deaconu A., Gogu E., Radu C., Tudor M., 2018. Sustainable economic development, economic equilibrium and work productivity on industries of the Romanian national economy. *Economic Computation and Economic Cybernetics Studies and Research,* Issue 1/2018; Vol. 52 pp.. 25-42, DOI 10.24818/18423264/52.1.18.02
- Ehrlich, P., Erhlich, A., 1990. *The Population Explosion*. New York: Simon and Schuster.
- Gallant, R. 1990. *The Peopling of the Planet Earth*. New York: Macmillian Publishing Company.
- Gore, A. 1992. *Earth în the Balance*. New York: Houghton Mifflin Company.
- Ion, R.A., 2017. *Securitate și siguranță alimentară [Food security and safety]*. Bucharest: ASE Publishing House.
- Keynes, J.M., 1963. *Essays în Persuasion.* New York: W.W.Norton & Co.
- Pătărlăgeanu, S.R., Negrei, C., Dinu, M., Chiocaru, R., 2020. Reducing the Carbon Footprint of the Bucharest University of Economic Studies through Green Facades in an Economically Efficient Manner. *Sustainability* no. 12, p. 3779, DOI:10.3390/su12093779
- Săvoiu Gh., Gogu E., Țaicu M., 2017. Hierarchies of Asociative Dynamics, Starting From Romania's Macro-Economic Imbalances in the EU-28. What Does Romania's Economic Evolution in the EU-28 Look Like? *Romanian Statistical Review* no. 3, pp. 35-46, WOS:000423922600003
- Smith, A., 2017. *Teoria sentimentelor morale [Theory of moral sentiments]*. Bucharest: Publica Publishing House
- * * * Sustainable Development Goals
- * * * Report of UN Development Program
- * * * Global Food Security Index 2021
- https://www.eea.europa.eu/ro/publications/state_of_environment_report_2007_1/file
- https://cdn4.libris.ro/userdocspdf/827/Teoria%20sentimentelor%20morale%20-%20Adam%20Smith.pdf