Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 24, Issue 2, 2024
PRINT ISSN 2284-7995, E-ISSN 2285-3952

ASSESSMENT AND IMPROVEMENT OF FOOD SUSTAINABILITY AND THE FACTORS INFLUENCING CONSUMPTION PATTERNS

Cătălin Răzvan VÎNTU[1], George UNGUREANU[2], Bianca Antonela UNGUREANU[2]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Management and Rural Development, 59 Marasti Blvd., Bucharest, Romania, E-mail: catalin.vintu@managusamv.ro
[2]Iasi University of Life Sciences, [*]Department of Agroeconomics, 3, Mihail Sadoveanu Alley, Iasi, Romania, E-mails: george.ungureanu@iuls.ro, bianca.ungureanu@iuls.ro

Corresponding author: bianca.ungureanu@iuls.ro

Abstract

This study focuses on the assessment and enhancement of food sustainability, exploring the multifaceted factors that shape consumption patterns. In a world marked by growing concerns about food security and environmental sustainability, understanding the dynamics of food consumption becomes paramount. Through a comprehensive analysis, this research delves into various dimensions of food sustainability, encompassing environmental impact, social equity, and economic viability.The methodology involved evaluating primary food sustainability indicators and concluded with a social survey analysis. Forecasts for the average daily food consumption per capita were interpreted. The study examined the Global Food Security Index (GFSI) in Europe, reflecting food access levels and the population's ability to secure adequate, safe, and nutritious food. The aim was to identify the most precise and statistically valid forecast method. Romania ranks 23rd in the GFSI overall score, which is improving. It stands 25th in accessibility, 21st in food availability, and also 21st in quality and security. While the overall score, accessibility, and availability show positive trends, quality and safety exhibit a decline. The critical analysis led to recommendations for a unified strategy to boost food sustainability.

***Key words*:** *assessment, enhancement, food sustainability, nutrition, consumption*

INTRODUCTION

The assessment and improvement of food sustainability in Romania, especially in comparison with other European countries, is a complex topic that involves examining various factors such as availability, accessibility, utilization, and stability of food. A comprehensive analysis would consider the impact of global events, social and economic inequalities, and climate change on food systems' stability.

Middle and lower-income families are thus forced to choose cheaper and lower-quality foods in order to make ends meet. This creates the perception of a more insecure environment regarding food [4].

For instance, a study from 2022 provides a detailed evaluation of Romania's food security status, comparing it with EU. The study also discusses the role of social and economic disparities in contributing to food insecurity and the effects of climate change on agricultural production.

Such analyses are essential for informing policy and decision-making processes aimed at achieving sustainable and resilient food security in Romania and the broader Eastern European region. They help in understanding how Romania can improve its food sustainability practices in line with other European countries and what measures can be taken to ensure a stable food supply in the face of global challenges [14].

Food security in Romania is closely linked to the European Union's Common Agricultural Policy (CAP), which aims to ensure food security for all European citizens at reasonable prices. Romania, as a member of the EU, contributes to and benefits from the CAP. The country has made progress in securing food security, influenced by various factors and risks. In the global context, challenges such as the Russian invasion of Ukraine have impacted food security, with the EU taking steps to restore it through international cooperation and humanitarian aid.

Romania's strengths in food security include its significant contribution to EU agriculture and the financial support it receives for its agricultural sector. However, there are also weaknesses and risks that need to be addressed, such as the impact of global crises on food availability and prices.For a detailed analysis, there are studies that reveal the progress made by Romania concerning food security, as well as the factors of influence and risk, and identify the strengths and weaknesses of Romania's food security in the European and global context. These analyses are crucial for Romanian decision-makers involved in devising policies and strategies in this field.

Essentially, food sustainability encompasses all the indicators related to how food reaches the population [6], while food security pertains more to aspects concerning product quality, sanitation, and safety. Based on this definition from the FAO, four food security dimensions can be identified: food availability, economic and physical access to food, food utilization and stability (vulnerability and shocks) over time (FAO). It is indeed true that without ensuring a minimum level of product quality, discussions about the economic aspect of ensuring access to food for individuals become futile. Food security, on the other hand, revolves around generating food at a productivity level sufficient to sustain the human population.

Food sustainability, food security, and food safety are three critical concepts related to the production, distribution, and consumption of food. In summary, food sustainability focuses on the long-term environmental impact of food production, while food security emphasizes access to food for all, and food safety concerns the protection of consumers from foodborne illnesses [1]. Together, these concepts are essential for creating a healthy, equitable, and resilient food system that can meet the needs of the present and future generations[Food safety and security are two complementing elements of sustainable future [18]. This paper will argue that in the long run the aims of food safety and security must be aligned to achieve sustainability, and the trade-offs between these three goals must be managed carefully and based on evidence.

MATERIALS AND METHODS

The study relies on data gathered manually from the Eurostat European Statistics Institute, the National Institute of Statistics, and reports published on indicators related to agricultural sustainability, food security, and environmental sustainability over six years (2016-2022) [16]. Overall objective: - Establishing strategies to achieve a higher level of food security in Romania. In order to determine the factors influencing consumption patterns for certain agri-food products and to assess how the findings can be utilized in marketing activities, the method of sampling was chosen. In this research stage, a probabilistic, multistage stratified sampling model was employed to ensure the representativeness and accuracy of the data [8]. The survey was conducted through a carefully designed questionnaire, administered via the Google Forms platform and distributed through social media channels, including Facebook and WhatsApp.

The questionnaire comprised a predefined set of questions aimed at understanding consumer behaviour regarding agri-food products.

A maximum allowable error of +/- 5% and a probability level of 90% were established, and the number of respondents was determined based on this stratification, resulting in 274 participants.

This choice was justified by the preference for reducing the confidence level in favour of the standard probability level of 95%.

The questionnaire focused on product characteristics, personal requirements or needs, intrinsic and extrinsic motivational elements, and demographic characteristics. The first dimension, accessibility, assesses consumers' ability to purchase food, their vulnerability to price fluctuations, as well as government policies and programs that can shield them from excessive price fluctuations. Thus, following the calculation, it was determined that the sample size for the conducted survey is 326 people, at a confidence level of 95%. Applying the

formula for a confidence level of 90%, the resulting number of people to be surveyed for the entire county is 272.

Table 1. Contingency Table between Education Level and Place of Residence

Education level - last school completed * Place of residence (Urban / Rural) Cross tabulation			Residential environment (Urban / Rural)		Total
			Rural	Urban	
Education level	Only 10 classes	Count	34	7	41
		Expected Count	10	10	20
	Vocational school	Count	21	8	29
		Expected Count	20	10	30
	High school	Count	10	12	22
		Expected Count	25	30	55
	Post secondary school	Count	74	29	103
		Expected Count	25	25	50
	University studies (Bachelor)	Count	15	30	45
		Expected Count	40	60	100
	Post-graduate studies	Count	34	0	34
		Expected Count	40	40	80
Toatl		Count	188	86	274
		Expected Count	160	175	335

Source: Own calculations based on the questionnaire

This approach ensured both the statistical relevance of the data and the efficiency in collecting the necessary information for analysing consumers' purchasing and consumption decisions in the agri-food sector.All the data used were processed using a computer, using the Microsoft Office package.

RESULTS AND DISCUSSIONS

Romanian agriculture, which ensures the security and sustainability of food, is characterized by its highly polarized structure and a large number of small farms. Approximately 89% of Romanian farms (3.1 million) are less than 5 hectares, constituting 45% of the total Utilized Agricultural Area (UAA). This includes farms engaged in subsistence agriculture as well as those used for semi-commercial purposes. These farmers are generally older, use traditional farming methods, and often work part-time (i.e., in combination with other sources of income). Although the number of smallholder farmers is steadily declining, most continue to exist as stable rural households with diversified production and high consumption of home-grown food [12], all of which contributes to a significant degree of socio-economic resilience. In Europe, family farming is an umbrella concept that incorporates farms of many different types and sizes, with both full- and part-time farmers and farmers with and without other gainful activities, i.e., all activities other than those relating to farm work, carried out for remuneration. Some are specialized commercial operations, while others produce mainly to satisfy their own household food needs, the so-called semi-subsistence farms (SSFs).

Table 2. Number of small farms (size <5 ha) in the European Union (2022)

EU member	Total number of farms	Total number of small farms (farm size <5 ha UAA)	% of small farms (farm size <5 ha UAA)
State groups			
EU-27	10,487,780	6,648,580	64%
EU-15	4,217,650	2,096,350	50%
New Member States (NMS)	5,885,350	4,488,450	76%
Romania	2,890,350	2,254,473	78%

Source: Own calculation based on Eurostat statistical data from 2022 [9, 12].

In the Table 3 presents data of the sustainable performance of Romanian agriculture compared to the EU-28 and the individual countries analyzed. The value of total agricultural output is an indicator often used in international comparisons to express the performance of agriculture. This study aims to contribute to the current debate on improving diets with locally produced nutritious legumes and promoting greater food security and income generation among smallholder farmers [1]. In 2020, there were **2.89 million** agricultural exploitations in Romania, down by 25.2% compared to 2010, reveals the latest agriculture census carried out by the National Statistics Institute (INS) [15]. These trends have been supported by the EU funded programs for local farmers, which come with

certain requirements in terms of farm size and economic viability.

The agricultural holdings in Romania differ significantly from the EU ones, particularly manifested in the limited extent of utilized agricultural area, attributed to the fragmentation of land exploitation. Utilized agricultural area, abbreviated as UAA, is the total area taken up by arable land, permanent grassland, permanent crops and kitchen gardens used by the holding, regardless of the type of tenure or of whether it is used as a part of common land. Furthermore, diminished levels of technical equipment and resource consumption contribute to a markedly inferior economic performance [5]. A summary of indicators, referring to the inputs and outputs of Romanian farms compared to the EU farms is presented in Table 3.

Table 3. Economic, social and environmental capital of agricultural holdings, Romania and EU, 2022

No	Indicators	U:M	**Indicators/UAA 2022**		
			Romania	EU	RO/ EU %
1	Utilised agricultural area, ha	ha	60.4	80.77	74.8
2	Machinery, euro	Euro /ha	524.53	2907.4	18.0
3	Total livestock units, LU	Euro /ha	0.69	2.61	26.4
4	Consumption of energy, euro	Euro /ha	94.39	430.65	21.9
5	Consumption of fertilizers, euro	Euro /ha	72.15	349.96	20.6
6	Crop protection, euro	Euro /ha	40.08	219.7	18.2
7	Total labour input, AWU	Euro /ha	0.13	0.18	72.2
8	Environmental subsidies, euro	Euro /ha	6.25	96.2	6.5
9	Total output, euro	Euro /ha	1,307.7	6,028.3	21.7
10	Farm net value added, euro	Euro /ha	726.94	2,575.9	28.2

Source: Eurostat statistical database processing [9].

The Utilised Agricultural Area (UAA) is the total area taken up by arable land, permanent grassland and meadow, permanent crops and kitchen gardens that is used by the holding, regardless of the type of tenure or whether it is used as a part of common land.

Farmers need to strike a balance between crop protection and sustainable chemical management [11].

The comparative analysis of agricultural indicators between Romania and the European Union (EU) for 2022 reveals several key insights into the state of Romanian agriculture.

-*The utilised agricultural area* (UAA) in Romania is substantial, with 60.4 hectares, representing 74.8% of the EU's average, indicating a robust use of land for agricultural purposes.

-*Machinery Investment*: The investment in machinery per hectare in Romania is significantly lower than the EU average (524.53 Euro/ha vs. 2,907.4 Euro/ha), which could imply a potential gap in agricultural technology and mechanization.

-*Livestock Units*: Romania's total livestock units per hectare are about a quarter of the EU's average, which may reflect differences in livestock farming intensity or agricultural focus. Energy consumption in Romanian agriculture stands at approximately one-fifth of the EU average, which could reflect either more efficient energy use or a less intensive approach to farming. Similarly, expenditures on fertilizers and crop protection are considerably lower in Romania, which may have implications for agricultural yields and productivity.

-*Labour input* in Romania's agriculture is relatively high, at 72.2% of the EU average, hinting at a more labour-intensive sector, potentially due to lower levels of mechanization. Environmental subsidies per hectare are also notably lower in Romania compared to the EU, which could influence the adoption of sustainable farming practices.

The lower consumption of energy, fertilizers, and crop protection products, as well as the lower livestock density in Romanian farms compared to the EU, indicate a lower environmental impact of the applied agricultural practices. Romanian agriculture has different results in terms of territorial performance [3]. Romanian agriculture is characterized by a multitude of small-sized agricultural holdings with an excessively fragmented agricultural area [20].

The Food Security indicator aims to comprehensively capture the intricacies of the domain, addressing the imperative of ensuring an ample agricultural supply and the economic accessibility of food to construct sustainable food systems. The primary responsibility for guaranteeing food availability lies with agriculture, which is tasked with meeting the nutritional needs of the population. Access to food is contingent on the socio-economic landscape, influenced by factors such as household income, represented by GDP per inhabitant (at CFP), reflecting each household's capacity to attain sufficient nutrition.

Table 4. Food Security Indicator in Romania, in 2022 compared to 2020

Category	Score	Change in 2022 versus 2020	RO place worldwide	Global score
Overall score	**69.11**	**+0.1**	**38.11**	**58.58**
1) ACCESSIBILITY	**67.5**	**0.7**	**43**	**56.3**
1.1) Food consumption (family expenses)	43.33	0.10	73.22	55.77
1.2) The poverty rate global	82.15	-1.91	33.10	75.63
1.3) Gross Domestic Product/ per capita	100	0	1	65.5
1.4) Food standards	100.00	0	1	62.6
1.5) Implementation of food safety programs	69.01	2.81	35.11	60.48
1.6) Access to funding for farmers	65.86	0.80	20.06	56.97
2) AVAILABILITY	**25.08**	**+0.3**	**19.06**	**15.65**
2.1) Adequacy of the supply	52.06	0.00	60.18	58.88
2.2) Sustainability programs	69.41	0.90	103.31	86.66
2.3) Infrastructure in agriculture	64.89	5.92	24.07	46.94
2.4) Sufficiency of production	85.6	-3.9	49.15	37.71
2.5) Risk of political instability	100	100	100	100
2.6) Corruption level	95.59	0.00	15.05	85.15
2.7) Urban absorption capacity	72.82	-1.8	32	58.2
2.8) Food waste	94.5	-2.21	55.17	56.17
3) QUALITY AND SAFETY	**100**	**-2.2**	**1**	**80.1**
3.1) Volatility of agricultural production	56,07	-2.7	37.11	44.03
3.2) Adherence to nutritional standards	65,90	-1.8	32.10	47.34
3.3) Protein Quality	74,7	-7.6	13	36

Source: Own calculation.

Comparing the level of the Food Security Indicator for Romania in 2022 with the one in 2020, there is only a slight increase (by + 0,1 point).

If we talk about the scores registered by Romania broken down on each component indicator of the global food sustainability index, the biggest improvements are important in terms of implementation of food safety programs (+2.81), infrastructure in agriculture (+5.92), urban absorption capacity (+5.8 and access to funding for farmers line (+0.8).

Instead, the quality of proteins (-7.6), the sufficiency of production (-3.9), the volatility of agricultural production (-2.7) and the adherence to nutritional standards (-1.8) decreased.

Romania's strengths in terms of ensuring food sustainability are the indicators that obtained the highest scores, namely: food standards (100), the share of the population below the food waste (94.5), sufficiency of production (85.6), food sustainability (85.3), the poverty rate global (82.15), import tariffs in agriculture (81.7), the presence of food sustainability programs (69.41 and farmers' access to finance (65.86).

Understanding these indicators helps policymakers, researchers, and organizations develop strategies to enhance food security. It involves addressing issues related to both the availability and accessibility of nutritious food. Moreover, considering the environmental impact of food production is increasingly crucial for ensuring sustainability in the long term. Subsequently, we made forecasts for the future evolution of Romania's population based solely on the previous population trends over time. Similarly, we followed the same approach for the sex ratio within the total population. After completing the population forecast, we presented the evolution of the average annual daily per capita food consumption for all nutrients.

In the first scenario, we made forecasts for the future consumption of nutrients based solely on the previous consumption trends for each type of nutrient individually. Since this was an empirical and crude estimation, we projected daily food consumption both in terms of total kilocalories and broken down by types of nutrients. In terms of calories 61% per person per day are lost or wasted by consumers and 81% per person per day are

lost or wastes in production, storage, transport etc [17].

From the analysis of the 274 surveyed subjects, it is evident that income plays a pivotal role in accessing higher-quality food products. Individuals with higher incomes tend to have a broader array of options at their disposal, allowing them to select foods that are not only nutritious but also of superior quality, including organic products.

Romanian consumers have started to buy and consume more organic products [10]. Conversely, individuals with lower incomes may find themselves restricted to cheaper alternatives, which often lack nutritional value and are of inferior quality.

This observed income disparity in food access can significantly contribute to public health issues, such as obesity and malnutrition. When individuals are constrained to opt for cheaper, less nutritious foods due to financial limitations, their overall health can suffer. Moreover, the prevalence of these health issues can exacerbate existing societal inequalities.

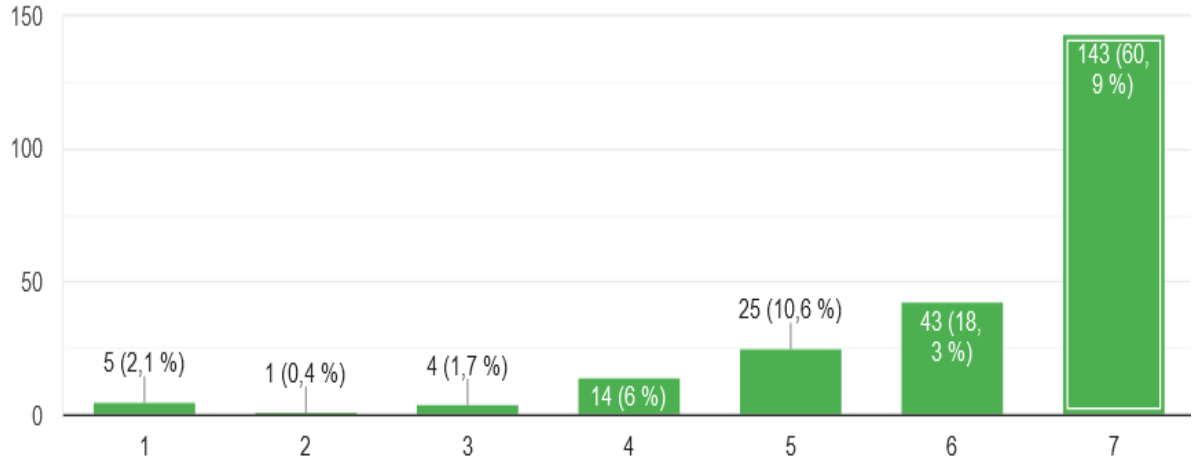

Fig. 1. The influence of income on access to higher-quality food products
Source: Own calculations based on the questionnaire.

Figure 1 reflects responses to the question regarding the extent to which income influences access to higher-quality food products. A significant majority believe that there is a strong influence. This underscores the common perception that income plays a crucial role in determining the quality of food individuals have access to. It is a relevant aspect in discussions concerning food security and social equality.

Therefore, it is imperative for public policies to address these disparities comprehensively. By implementing measures that ensure equitable access to healthy and quality foods, regardless of income level, policymakers can work towards mitigating the adverse health effects associated with socioeconomic inequalities. Initiatives such as subsidies for nutritious foods, community food programs, and educational campaigns on healthy eating habits can help bridge the gap and promote a more inclusive approach to food access and nutrition [11]. Ultimately, by prioritizing such policies, societies can strive towards a healthier, more equitable future for all individuals.

In the study conducted on a sample of 274 subjects, we assessed various community-related variables such as safety and trust, freshness, taste and appearance, accessibility, availability, and quality.

The solution for the factorial analysis consisted of three separate factors that partially met the Kaiser-Guttman Rule for retaining factors with eigenvalues greater than 1 (KMO=0.86), explaining 75.6% of the total variance of the model. The first factor in this solution included three items and individually explained 52.9% of the model's variance

(eigenvalue=4.23). This factor was labeled "Accessibility, Availability, and Quality and security." The second factor included three items and individually explained 12.6% of the model's variance (eigenvalue=1.00) and was labeled "Fresh, Taste, Appearance." The third factor included two items and individually explained 10.1% of the model's variance (eigenvalue=0.81). This third factor had a cross-loading. "Safer" had a factor loading of 0.51 for factor one "Accessibility, Availability, and Quality and security" as well as for factor three. The analysis results are presented in the form of the following average scores:

Table 5. Summarizes the three factor solutions for participant attitudes

No . crt	**Community - Variable**	**Safety and Trust**	**Fresh, Taste, and Look**	**Accessibility, Availability, and Quality**
1	Accessibility	0.16	0,32	**0.88**
2	Availability	0.19	0.17	**0.93**
3	Quality	0.13	0.29	0.24
4	More fresh	0.24	0.82	0.2
5	Better tasting	0.13	**0.94**	0.29
6	Better looking	0.08	**0.78**	0.56
7	Safer	0.56	0.48	0.19
9	More trustful	**0.93**	0.17	0.88
10	**Average**	**0.269**	**0.441**	**0.463**

Sources: Own calculation.

A low eigenvalue accompanied by cross-loading prompted a second factor analysis of Consumption with a 2-factor solution instead of the current 3-factor solution. This second analysis had a lower explanation of the total variance, and the 2-factor solution was conceptually and logically unclear in terms of factor labels. Keeping the 3-factor solution, it was decided that "Safer" refers more to confidence in knowing how food is produced, as suggested by factor three, than to how healthy, natural, or nutritious local food is, as suggested for factor one [13]. The third factor was labeled "Safety and Trust". As seen in the Table 5, the ranking of factors is led by "Better tasting" with 0.94, encompassing "Fresh, Taste, and Look", followed closely by 0.93 for "More trustful" and "Availability" in relation to "Safety and Trust." The highest average across all analyzed factors is represented by "Accessibility, Availability, and Quality."The solution for the Community of Factorial Analysis consisted of two factors that met the Kaiser-Guttman Rule for retaining factors with eigenvalues greater than 1 (KMO=0.86), explaining 75.2% of the total variance of the model. The first factor in this solution included four items and individually explained 61.1% of the model's variance (eigenvalue=4.28). This factor was labeled "Community - Social Well-being." The second factor included three items and individually explained 14.1% of the model's variance (eigenvalue=0.99) and was labeled "Community - Economic Well-being"[7].

The solution for the Environment/Sustainability of Factorial Analysis consisted of a single factor that met the Kaiser-Guttman Rule for retaining factors with eigenvalues greater than 1 (KMO=0.85), explaining 65.3% of the total variance of the model. This factor included six items and was labeled "Environment" (eigenvalue=3.92).

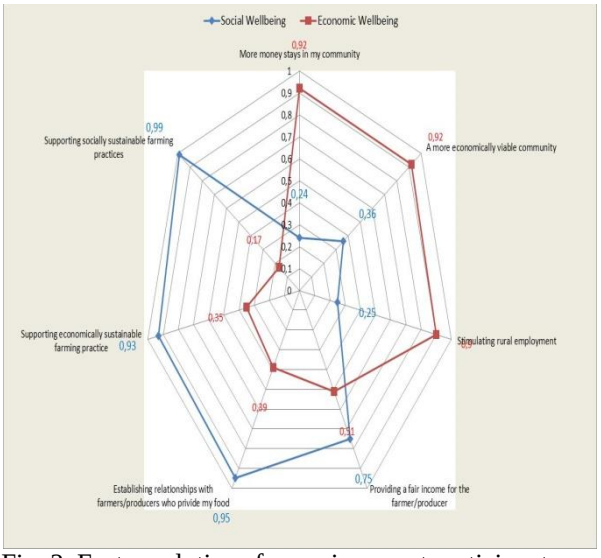

Fig. 2. Factor solutions for environment participant attitude.
Source: Own calculation.

Subjective Norms

The Influence EFA solution consisted of three factors that partially met the Kaiser- Guttman Rule to retain factors with eigenvalues over 1 (KMO=0.73), accounting for 67.0% of the total model variance explained. The first factor of this solution consisted of four items and individually accounted for 35.8% of the

variance in the model (eigenvalue=2.51). This factor was labeled "Others." The second factor consisted of two items and individually accounted for 18.9% of the variance in the model (eigenvalue=1.32). This factor was labeled "Parent(s) and Kid(s)." The third factor solution consisted of one item and accounted for 12.3% of the variance in the model (eigenvalue=0.86).

Concern with an eigenvalue under 1 prompted a second factor analysis of influence with a 2-factor solution rather than the current 3-factor solution.

The 2-factor solution of influence had lower total model variance explained (54.7%), as well as a cross-loading on the item "My children."

A 3-factor solution was retained for this analysis. This factor was labeled "Partner or Spouse."

The cultural and traditional significance of local products in Romania is profound and plays a vital role in promoting the country's cultural identity and diversity. Both consumers and producers value these aspects and consider them essential in preserving and promoting Romania's cultural heritage [7]. Overall, the data suggests a diet that is heavy in grains, vegetables, and dairy, with less emphasis on legumes, nuts, seafood, and sugar.

The standard deviations and percentiles indicate varying consumption patterns among individuals, which could be due to personal preference, availability, or cultural dietary habits [2].

If we explore the similarities and differences between the three terms: food sustainability, food security, and food safety, we observe than food sustainability is focusing on the environmental impact of food production, promoting sustainable agriculture, reducing waste, and conserving natural resources.

It encompasses practices that are environmentally responsible, socially equitable, and economically viable.

On the other hand, the food security is looking to ensure that all individuals have access to sufficient, safe, and nutritious food to meet their dietary needs and lead a healthy life.

It addresses issues of hunger, malnutrition, and poverty and involves efforts to improve food availability, access, utilization, and stability. Finally, food safety is dealing with preventing contamination and foodborne illnesses throughout the food supply chain.

It involves maintaining strict standards, proper handling, and storage practices, and regular inspections to protect consumers from harmful substances and ensure safe food consumption. Also, consumer behaviour has changed being more oriented to a healthier food [19].

Consumers' option for short food supply chains becomes an alternative once they become more interested in healthier products and thus are oriented towards local products [16].

Table 6. Food consumption

Name of agroalimentar products	Number of consumers	Mean consumption in grams/day	Standard Deviation of consumption in grams/day	5th percentile of consumption in grams/day	10th percentile of consumption in grams/ day	Median consumption in grams/ day
Foodex L1	Nr Consumers	Mean	STD	P5	P10	Median
Grains and grain-based products	274	194.92	102.59	63.92	84.39	180.78
Vegetables and vegetable products	274	420.45	213.27	161.44	198.40	378.93
Starchy roots and tubers	267	126.41	79.26	11.80	30.70	117.68
Legumes, nuts and oilseeds	172	19.94	25.18	0.00	0.00	12.60
Fruit and fruit products	262	169.06	159.04	1.10	18.97	130.19
Meat and meat products	27	211.82	102.99	73.36	93.44	201.24
Fish and other seafood (including amphibians)	113	19.45	36.11	0.00	0.00	0.00
Milk and dairy products	274	163.74	108.03	25.19	40.54	146.58
Eggs and egg products	264	39.00	28.93	2.36	8.34	33.15
Sugar and confectionary	243	18.43	18.94	0.00	0.00	12.90
Animal and vegetable fats and oils	274	56.08	25.13	21.53	26.77	52.80
Fruit and vegetable juices	155	9.41	35.80	0.00	0.00	2.36
Non-alcoholic beverages (excepting milk based beverage	270	238.67	221.49	29.13	55.10	183.14

Source: Own calculations based on the questionnaire.

Analyzing the table, here are some insights on food consumption:

- Grains and grain-based products are consumed at a mean of 194.92 grams/day, indicating they are a staple in the diet.

- Vegetables and vegetable products have the highest mean consumption at 420.45 grams/day, showing a strong preference or availability in the diet.
- Starchy roots and tubers show a lower mean consumption of 126.41 grams/day with a wide range of consumption (standard deviation of 79.26 grams/day), suggesting varied intake among consumers.
- Legumes, nuts, and oilseeds; Fish and other seafood; and Sugar and confectionary have the lowest mean consumption rates, which could indicate these are less common or less preferred foods.
- The median consumption figures generally follow the mean trends but are slightly lower for most food categories, which may imply that a smaller portion of the population consumes these foods in larger quantities, skewing the mean upwards.
- The 5th and 10th percentiles for several food categories, such as legumes, nuts, oilseeds, fish, and sugar, are at 0 grams/day, indicating that a significant portion of the population does not consume these foods regularly. Percentiles are descriptive statistics that divide a data set into 100 equal parts. Each percentile indicates the value below which a certain percentage of the data falls. For example, the 5th percentile (P5) shows that 5% of the data are less than or equal to that value, and the 95th percentile (P95) shows that 95% of the data are less than or equal to that value. These are useful for identifying the distribution and trends in food consumption, such as observing that a small percentage of people consume very small amounts or none at all of certain food categories.

CONCLUSIONS

Having the intention of analyzing the agricultural sustainability of Romania, in comparison with European countries in economic, environmental, social, and political terms, by analyzing the central agricultural food policies related to food sustainability worldwide, the authors started from the assumption that food security policies are indeed an integral part of agriculture-food policies. We observed that the inclusion of food security measures within broader agricultural and food policies is crucial to ensure the production, processing, distribution, and consumption of safe and wholesome food. These policies aim to protect public health, prevent foodborne illnesses, and maintain consumer confidence in the food system.

Given Romania's fluctuating position in the Global Food Security Index and the identified indicators related to food security improvements, it is advisable to implement comprehensive educational campaigns and awareness initiatives targeting consumers, producers, and stakeholders. These efforts should emphasize the importance of safe food handling, adherence to food security standards, and informed dietary choices to mitigate risks associated with excessive calorie consumption and promote healthier eating habits.

The disaggregated scores by indicators provide a more detailed insight into the weaknesses of food security: agricultural production volatility and political commitments regarding access (including the absence of an officially endorsed food security strategy and a coordinating agency for this field), as well as the insufficient coordination and consistency of policies addressing climate-related impacts on natural resources. Vegetable agricultural production focuses on cereal production, primarily wheat and maize, while animal agricultural production centers around the production of milk, eggs, and meat. These findings are applicable at the level of the entire macro-region, including Iasi County.

In general, average household incomes are over 10% higher than average household expenditures, with expenditures on food and beverages accounting for over 20% of total expenditures in the entire macro-region. There is a noticeable trend of decreasing expenditures on food and beverages.

The solution for factorial analysis consisted of three separate factors that partially met the Kaiser-Guttman Rule for retaining factors with eigenvalues greater than 1 (KMO=0.86), explaining 75.6% of the total variance of the model. The first factor in this solution

included three items and individually explained 52.9% of the model's variance (eigenvalue=4.23). This factor was labeled "Accessibility, Availability, and Quality, and Security". The second factor included three items and individually explained 12.6% of the model's variance (eigenvalue=1.00) and was labeled "Freshness, Taste, Appearance". The third factor included two items and individually explained 10.1% of the model's variance (eigenvalue=0.81). This third factor had a cross-loading. "Safer" had a factor loading of 0.51 for the first factor "Accessibility, Availability, and Quality, and Security", as well as for the third factor.

ACKNOWLEDGEMENTS

This research received no external funding.

REFERENCES

[1]Bazga, B., 2012, Prospects for food security in Romania. Procedia Economics and Finance 3, 2012, Food Security Management at the European level. The 2nd WSEAS International Conference, 1262 –1267.
[3]Blackman, A., Naranjo, M.A., 2010, Does Eco-Certification Have Environmental Benefits? Organic Coffee in Costa Rica; Discussion Paper; Resources for the Future: Washington, DC, USA, 2010; pp. 10–58. https://core.ac.uk/download/pdf/9304506.pdf, Accessed on 19 March 2023.
[2]Birdwell et al. 2021, "Fixing Food 2021: An opportunity for G20 countries to lead the way", The Intelligence Unit and Barilla Foundation. 2021, foodsustainability.eiu.com. 2021. 8, 163–173.
[4]Bobeică, M., Arghiroiu, G., A., Beciu, S., 2023, Assessing Romania's food security status in 2022: a comparative analysis with regional peers. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol. 23(4), 95-102.
[5]Bourget, B., 2021, The Common Agricultural Policy 2023-2027. Change and Continuity, Foundation Robert Schuman Policy Paper, The Letter, Issue 948.
[6]Burcea, D., Dona, I., 2015, Study regarding the evolution of food consumption of Romania during 2007- 2013, from the perspective of food security insurance and export availability growth, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development. Vol. 15(2), 45-52.
[7]Burja, C., Burja, V., 2016. The economic farm size and sustainable value. Disparities between Romania and the EU States Annals of the „Constantin Brâncuşi" University of Târgu Jiu, Economy Series, Issue 1/2016.
[8]Diaconescu, M., 2005, Agri-Food Marketing. University Publishing House.
[9]Eurostat data base, https://ec.europa.eu/eurostat/data/database, Accessed on 15 April 2024.
[10]Fleseriu, C., Cosma, S.A., Bocănеț, V/, 2020, Values and Planned Behaviour of the Romanian Organic Food Consumer. Sustainability 2020, 12, 1722
[11]Ghiuleanu, I.V., Buzatu, C.S., Tudor, V.C., Panait, R., (Carbarău) Smedescu Cosmina Andreea, 2023, Risks analyses and challenges in crop management In Romania. Economic Engineering in Agriculture and Rural Development Scientific Papers Series Management, Vol. 23(4), 353-354.
[12]Gkountani, V., Tsoulfas, G., Mouzakitis, Y., 2022, Mαpping sustainability assessment methods in agri-food supply chains: a circular economy perspective. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development. Vol. 22(2), 361-367.
[13]Graves, B.S., Hall, M.E., Dias-Karch, C., Haischer, M.H., Apter, C., 2021, Gender differences in perceived stress and coping among college students. PLoS One. 2021 Aug 12;16(8):e0255634. doi: 10.1371/journal.pone.0255634. eCollection 202Raj Patel; Jim Goodman. The Journal of Peasant Studies. 2020-04-15, Journal article, DOI: 10.1080/03066150.2020.1741551. 2021.
[14]Grigoras, M.A., 2016, Trends in Romania's agricultural production, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 16, Issue 1, 2016, pp.183-191.
[15]National Institute of Statistics in Romania, https://insse.ro/cms/en/content/european-statistics-day-2023, Accessed on March 19, 2024.
[16]National Institute of Statistics, 2024, Press release, No. 7 /24 January 10, Domain: Income and living conditions. Romanian National Institute of Statistics. wwww.insse.ro 2023.
[17]Paraschivu, M., Cotuna, O., Matei, G., Sărățeanu, V., 2022, Are food waste and food loss a real threat for food security? Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 22(1), 479-484.
[87]Popescu, G., 2022, Sustainability of Food Safety and Security in Romania. Challenges for the Future National Strategic Plan. In: Conference: Competitiveness of Agro-Food and Environmental Economy. DOI: 10.24818/CAFEE/2019/8/01. October 2022
[19]Puiu, F., Turek-Rahoveanu, A., 2024. Short food supply chains: key concepts, benefits, risks, European Union Support, Models from Romania, Strategies Of Development Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol. 24(1), 819-827.
[20]Robu (Sluser), B.M., Ioan, C.C., Robu, E., Macoveanu, M., 2009, European frame for sustainable agriculture in Romania: Policies and strategies. Environmental Engineering and Management Journal. Vol.8(5), 1171-1179.