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The Role of Hidden Costs in Agri-Food Systems: Economic, Environmental, and Social Consequences

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Abstract:

This article examines the concept of hidden costs in agri-food systems and their impact on the sustainability of the economy, environment, and public health. Hidden costs, which are not reflected in traditional financial reports, include environmental, social, and medical expenses, such as greenhouse gas emissions, ecosystem degradation, social inequalities, and adverse health effects on the population. Using statistical data and a methodology for assessing hidden costs, the author analyzes their distribution and proposes incorporating them into policy development to address the food crisis and improve food security in developing countries. The purpose of this study is to emphasize the importance of integrating hidden costs into economic models and policy decisions to increase the efficiency of agri-food systems and reduce their negative impacts on society.

Keywords: hidden costs, agri-food systems, food crisis, sustainable development, environmental costs, social costs, economic policy.

Introduction

The concept of hidden costs plays a key role in analyzing economic systems, especially in the context of agri-food systems. Amid the food crisis affecting many developing countries, understanding and accounting for hidden costs has become critically important for informed decision-making and effective policy development.

Hidden costs[1] are expenses that are not directly reflected in financial statements or market prices but have a significant impact on the economic system and societal well-being. In agri-food systems, hidden costs may include environmental, social, and health-related expenses. For example, environmental pollution, population health deterioration, and social inequalities are examples of hidden costs that are not considered in traditional economic calculations.

Using various data sets, such as the FAOSTAT database, a preliminary quantitative assessment of hidden costs has been conducted across 154 countries. This assessment is performed by modeling the impact and cost evaluation of hidden costs.

Table 1 Structure of Hidden Costs.

Classification of Hidden Costs		
Environmental Costs	Social Costs	Health-Related Costs
- Soil and water quality degradation - Greenhouse gas emissions - Loss of biodiversity	- Rising unemployment - Social inequality. - Deterioration of working conditions	- Spread of diet-related diseases. - Increased healthcare costs.

Source: Compiled by the author based on the FAO 2023 report.

Results can be generalized and compared across various criteria and geographic scales. Notably, both costs and benefits are considered in this process. Hidden costs are defined as net hidden costs, subtracting hidden benefits. For instance, converting pastures to forested land can reduce greenhouse gas emissions, which is a hidden benefit.

The food crisis in developing countries is often exacerbated by hidden costs, which are overlooked in traditional economic models. Accounting for these hidden costs enables a more comprehensive assessment of the real consequences of the crisis and facilitates more effective measures for its resolution[2].

Accounting for hidden costs raises awareness among policymakers and the public about the real expenses and benefits of agri-food systems. This more complete information allows for better-informed decisions aimed at improving the sustainability of agri-food systems and mitigating the negative impacts of the food crisis. It also supports the development and implementation of policies aimed at reducing environmental, social, and health-related costs, which is especially crucial for developing countries. Thus, analyzing hidden costs enables a more accurate evaluation of food policy development to enhance food security, ultimately helping to minimize potential food crises.

Materials and methods

The value of agri-food systems to society extends beyond their contribution to GDP. However, transforming these systems to bring even greater benefits requires reducing hidden costs and increasing measurable gains. The first important step is accounting for the hidden impacts of these systems' operations. Social inequality and environmental pollution are often unrecognized as hidden costs in decision-making processes. Quantifying these factors enables more rational decision-making that influences agri-food systems.

Impact of Hidden Costs on Economic Indicators

Hidden costs, by nature, are not reflected in GDP measured via purchasing power parity *(PPP)* based on market transactions. However, they represent significant economic losses in the form of

[1] FAO. (2023). The State of Food and Agriculture – 2023. Uncovering the True Cost of Food to Transform Agri-Food Systems.
[2] Smith, P., & Gregory, P. J. (2013). Climate change and sustainable food production. Proceedings of the Nutrition Society, 72(1), 21-28.

reduced productivity or environmental damage. Incorporating hidden costs into economic indicators would allow for a more accurate assessment and comparison of the economic status of different countries and their environmental impacts. The agri-food system comprises three components *(see Fig.1).*

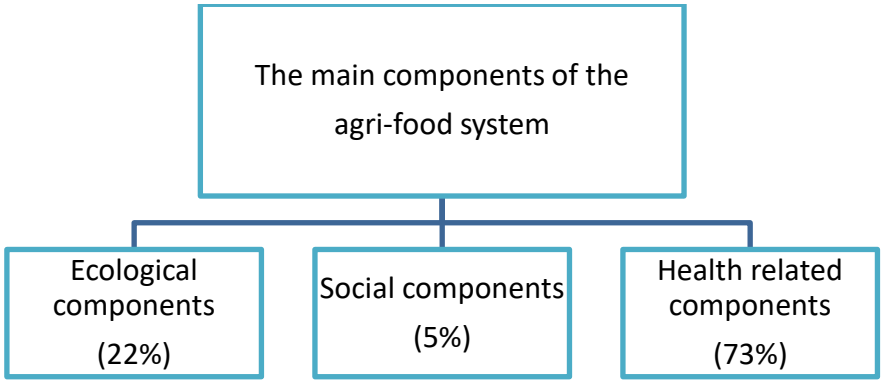


Fig.1. Quantified hidden costs in agrifood systems.

Source: Compiled by the author based on the work of Lord, S. 2023. «*Hidden costs of agrifood systems and recent trends from 2016 to 2023 – Background paper for The State of Food and Agriculture 2023*»

Environmental Components of Hidden Costs

The operation of agri-food systems has significant negative impacts on the environment, resulting in hidden costs. The main environmental components of these costs include: **1**. ***Greenhouse Gas Emissions*:** Across all stages of food production and distribution, from crop cultivation to fertilizer production and energy use, greenhouse gases are emitted. This contributes to climate change, leading to agricultural losses. **2**. ***Nitrogen Compound Emissions*:** The cultivation of crops and wastewater releases nitrogen compounds, which pollute the environment**. 3. *Freshwater Use*:** Intensive freshwater use leads to water scarcity, reducing crop yields and labor productivity due to malnutrition. ***4. Land Use Changes*:** Changes in land use at the farm level cause degradation and destruction of ecosystems, resulting in the loss of their beneficial functions.

Social Components of Hidden Costs. Social issues arising in agri-food systems also lead to significant hidden costs: **1.** ***Malnutrition of the population*:** Disruptions in food distribution systems lead to malnutrition in some countries. According to FAO data for 2022, this phenomenon reduces labor productivity, which is confirmed by estimates from the World Health Organization. **2.** ***Poverty Among Agri-Food Sector Workers*:** Moderate poverty levels among agri-food sector workers are due to failures in distribution mechanisms within agri-food systems.

Health-Related Components. Health-related factors also contribute significantly to the hidden costs of agri-food systems: **1**. ***Unhealthy Diets*:** Eating a diet low in fruits, vegetables, nuts, whole grains, calcium, and healthy fats, but high in sodium, sugar-sweetened beverages, saturated fats, and processed meats, contributes to obesity and noncommunicable diseases. This reduces productivity and negatively impacts the economy. ***2*. *Economic and Physical Accessibility of Healthy Foods:*** As of 2019, healthy food was unaffordable for three billion people, and with declining real incomes, an additional billion people may be unable to afford it**.**[3]. **3**. ***Influence of Cultural and Social Factors:*** Food choices are determined by individual preferences, knowledge, motivation, social traditions, norms, food advertising, and its portrayal in the media. It should be noted that the

[3] **FAO, IFAD, UNICEF, WFP and WHO. 2021.** *The State of Food Security and Nutrition in the World 2021. Transforming food systems for food security, improved nutrition and affordable healthy diets for all. Rome, FAO*. https://www.fao.org/3/cb4474ru/cb4474ru.pdf

quantified hidden costs of agri-food systems cover a wide range of environmental, social, and health aspects *(see Table 2)*. To achieve sustainability in agri-food systems, these hidden costs must be comprehensively considered, and measures to reduce them should be developed and implemented. This will enhance environmental sustainability, social justice, and public health, ultimately leading to more sustainable development of society as a whole.

Results

According to the FAO 2023 report[4], the preliminary cost of global hidden costs of agri-food systems in 2020, which includes greenhouse gas emissions, nitrogen compounds, water use, land use change, unhealthy eating habits, undernutrition, and poverty, is estimated at 12.7 trillion USD at 2020 purchasing power parity *(PPP)*. This amount is nearly 10% of the global GDP at PPP in 2020. When calculated on a daily basis, these costs are equivalent to 35 billion USD at 2020 PPP.

Table 2.

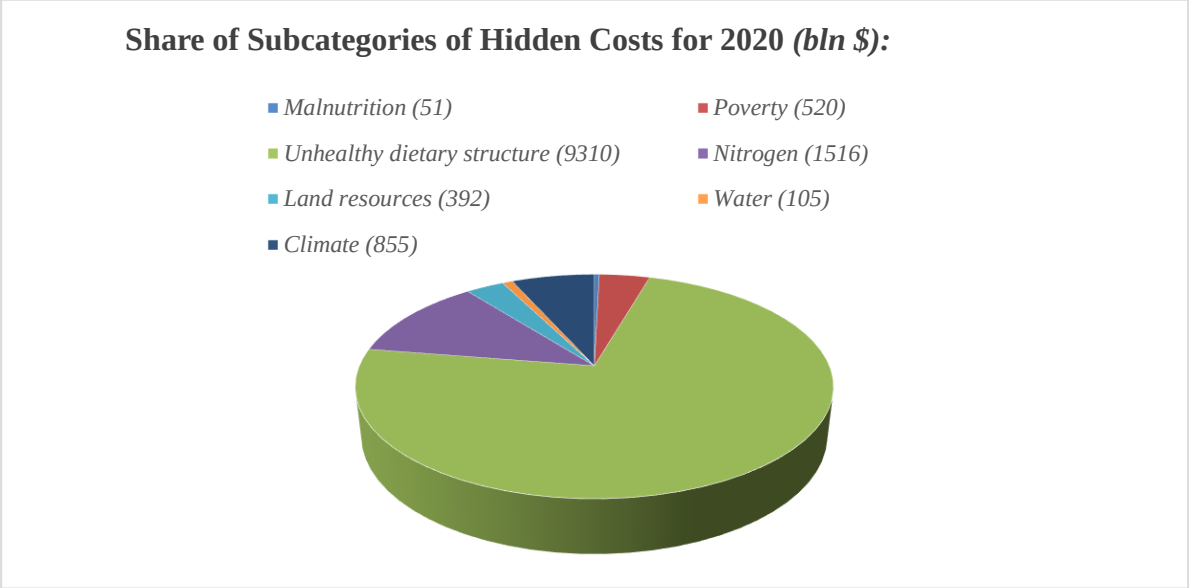
Quantified Hidden Costs by Categories *(in billion dollars for 2020)*

Categories of hidden costs	
1. Health	9310
2. Ecology	2868
3. Social sphere	571
Total	**12749**

The source was compiled by the author based on "FAO Agricultural Development Economics Technical Study, No. 31."

Range of Estimates and Probability Analysis: Given the uncertainty of data in some regions, these estimates must be presented as a range. With 95% confidence, global hidden costs are estimated at a minimum of US$10.8 trillion *(in 2020 PPP)*, and with 5% confidence, the costs could be as high as US$16 trillion *(in 2020 PPP)*. These figures clearly highlight the urgent need to transform the entire agri-food system.

Fig. 2. Subcategories of hidden costs.



***Source**: compiled by the author based on "FAO Agricultural Development Economics Technical Study, No. 31. Rome, FAO."*

[4] FAO. 2023. Programme Evaluation Report 2023. Rome

Of the total volume of $12.7 trillion USD, calculated in 2020 purchasing power parity *(PPP)*, 73% *(over $9 trillion USD)* is attributed to health issues that lead to productivity losses *(see Table 2)*. Approximately 20% *($2.9 trillion USD)* is related to environmental costs. More than half of these are connected to nitrogen emissions *(mainly from water runoff and ammonia emissions)*, which are partly due to high uncertainty.

Other significant factors include climate change from greenhouse gas emissions *(30%)*, land use change *(14%)*, and water usage *(4%)*. Social hidden costs related to extreme poverty and undernutrition make up only 4% of the total, mostly due to moderate poverty in the agricultural sector *(see Figure 2)*.

The analysis revealed that an unhealthy dietary structure contributing to obesity and non-communicable diseases is the primary factor driving global hidden costs, surpassing the environmental impacts of agriculture. However, the importance of environmental issues should not be diminished. A shift in agricultural policy direction is needed to support the production of nutritious and diverse foods that promote healthy eating. Consumers should have the ability to choose such products, which requires additional policy measures regarding agri-food systems. Government actions should focus on promoting healthy eating, which will benefit not only public health but also the environment.

According to statistical data, transitioning to a healthier and more environmentally sustainable diet could reduce climate change-related costs by 76%. This underscores the need to integrate environmental and health measures into agri-food system policies to achieve sustainable development and reduce hidden costs.

The total hidden costs for the Central Asia region amounted to $115,935 million *(see Table 3)*, which represents about 2% of the total for the Asia region. A breakdown by category reveals the following: Climate-related costs: $9,456 million, Blue water use: $4,818 million, Land resources: $2,766 million, Nitrogen: $4,985 million. Social costs, including poverty among agri-food sector workers, amount to $937 million, while the disease burden due to undernutrition stands at $86 million. The largest health-related costs are associated with the disease burden from dietary structure, amounting to $92,888 million. These figures highlight significant economic losses due to environmental, social, and health factors in the Central Asia region.

Discussion

Central Asia includes Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. The total hidden costs for the region are $115,935 million. The highest costs are incurred by Kazakhstan, where the total hidden costs reach $42,384 million, while the lowest costs are observed in Kyrgyzstan ($5,351 million).

Table 3 Values of Hidden Costs for Central Asian Countries

Ecological, Social, And Health-Related Costs *(Million Usd)* In 2020								
Country	**Total Hidden Costs**	**Ecology**				**Social Sector**		**Health**
		Climate	"Blue" Water Use	Land Resources	Nitrogen	Poverty among workers in the agri-food sector	Burden of disease *(malnutrition)*	Burden of disease *(dietary patterns)*
ASIA	5 857 373	355 716	84 389	59 423	815 020	222 209	26 913	4 293 704
Central Asia	115 93	9 456	4 818	2 766	4 98	937	86	92 888

	5				5			
Kazakhstan	42 384	3 387	243	-1	1 795	6	-	36 953
Kyrgyzstan	5 551	495	513	31	388	137	17	3 970
Tajikistan	7 640	528	590	18	778	399	47	5 281
Turkmenistan	14 961	1 230	524	144	405	56	22	12 579
Uzbekistan	45 399	3 816	2 948	2 575	1 617	338	-	34 104

***Source**: Compiled by the author based on the FAO 2023 report "The State of Agriculture and Food"*

Central Asia includes Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. The total hidden costs for the region are $115 935 million. The highest costs are incurred by Kazakhstan, where the total hidden costs reach $42 384 million, while the lowest costs are observed in Kyrgyzstan *($5 351 million).*

In the environmental sector, the highest costs are related to water resources, land, and nitrogen. Kazakhstan leads in "blue" water use with $4 818 million, followed by Uzbekistan *($3 816 million)* and Turkmenistan *($1 186 million)*. Kyrgyzstan and Tajikistan have relatively low costs in this category. Regarding land resources, Kazakhstan again takes the lead with $2 766 million, while the other countries have significantly lower figures. Nitrogen-related costs are most significant in Kazakhstan *($1 795 million)*, while the other Central Asian countries have minimal costs in this area.

In the social sector, the highest costs are associated with poverty among workers in the agri-food and water sectors. Kazakhstan again leads with $937 thousand, followed by Uzbekistan *($353 million)* and Turkmenistan *($159 million)*. Kyrgyzstan and Tajikistan have minimal costs in this category. The disease burden related to undernutrition is highest in Kazakhstan *($86 million)*, with the other countries having lower figures.

In terms of health, the disease burden related to dietary structure is most significant in Kazakhstan *($362 953 million)*, followed by Uzbekistan with $179 516 million. Kyrgyzstan, Tajikistan, and Turkmenistan have significantly lower costs in this category.

Overall, the analysis shows that Kazakhstan bears the highest hidden costs across all categories, particularly in the areas of ecology and health. Uzbekistan ranks second in most indicators, while Kyrgyzstan, Tajikistan, and Turkmenistan have lower costs, showing reduced expenditures in various categories.

Kazakhstan and Uzbekistan demonstrate the absence of hidden costs related to undernutrition, which is a significant achievement in the context of Central Asia. In contrast, other countries in the region, such as Kyrgyzstan, Tajikistan, and Turkmenistan, have these costs, indicating challenges in ensuring adequate and nutritious food for the population.

This fact highlights the success of food security and healthcare policies in Uzbekistan and Kazakhstan. Achieving this level may result from effective government programs aimed at improving the availability and quality of food, as well as measures to reduce poverty among the population. The absence of costs related to undernutrition indicates that these countries have managed to create favorable conditions for maintaining the health and well-being of their citizens.

The data analysis shows that health-related issues account for the largest share of hidden costs in most Central Asian countries, except for Kazakhstan, where significant attention is given to ecological matters. The social sector requires particular attention in Kyrgyzstan and Tajikistan, while ecological issues are a priority in Kazakhstan and Uzbekistan.

Based on the above, it can be concluded that the preliminary assessment of global hidden costs in agri-food systems demonstrates substantial economic losses related to health, environmental, and social aspects. To achieve sustainable development, it is necessary to reconsider and reform agri-food systems by taking these hidden costs into account. This will help enhance environmental sustainability, improve public health, and reduce social inequality.

In conclusion, accounting for and analyzing hidden costs is an essential step toward improving the sustainability of agri-food systems and minimizing the risks of a food crisis. Including hidden environmental, social, and health costs in economic models will allow for more informed and effective measures aimed at reducing negative consequences for the environment and public health. Transitioning to sustainable agri-food production requires a comprehensive approach that considers hidden costs at all levels, from production to consumption. This will contribute to the creation of a sustainable food system that meets the needs of society, improving health and reducing social inequality.

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