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4 authors, including:

Ola Aljaafreh
Hungarian University of Agriculture and Life Sciences (MATE) Kaposvár Campus

Imre Nagy
University of Agriculture and Life Sciences Budapest/Godollo/Hungary University …

Tariq Ismail
Hungarian Univeristy of Agriculture and Life Sciences Mate University Hungary

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Sustainable Agriculture, Food Production, Export and Animal Food Products: A Case of Hungary

Ola Al Jaafreh[1], Imre Nagy[2], Tariq Ismail[3] , Abel Rahman Al-Tawaha[4]

[1]Hungarian University of Agriculture and Life sciences, P.O.BOX 100, Hungary
[2]University of Novi Sad, P.O.BOX 21000 Novi Sad, Serbia
[3]University of Balochistan, P.O.BOX 87300Quetta, Pakistan
[4]Al-Hussein bin Talal University, P.O.BOX 20 Maan,Jordan

Correspondence Authors: Ola Al Jaafreh, Hungarian University of Agriculture and Life sciences, P.O.BOX 100, Hungary
E-mail: ola.aljaafreh2016@gmail.com

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Abstract
The sustainability of agriculture is a crucial concern for many social elements today, starting with the farming equipment or methods that all farmers use in the global agricultural production process. However, in many instances, the study of sustainable agriculture focuses only on the effects of the branches of animal and crop production that are sustainable until the products reach consumers, ignoring the relationship between the fundamental elements of the sustainability process that starts with farmers and moves through the producer and exporter to reach the consumer. Understanding the elements that make sustainable agriculture a crucial engine for the production and export processes, as well as how one phase influences the other, are pertinent topics to be addressed. Additionally, it covers the key elements necessary for sustainable agriculture to serve as a strong foundation for food production and export. Examining the presence of sustainable agriculture as well as its impact on food export and production in Hungary is the aim of the study. This study is quantitative, which means that it is built on data collecting and information that aids in the proper description and analysis of the problem. The study thus adopted the survey method to collect the primary data. Findings suggested that sustainable agriculture largely (with the exception of tools) influences food production and export.

Keywords: Hungary, sustainable agriculture, food production, food export

INTRODUCTION

Agriculture has been the main means of subsistence for human populations for thousands of years, and it still is for half the world's population. According to figures from the Food and Agriculture Organization published in 2007, as the population is expanding at an unprecedented rate, the amount of food produced per person has declined since 1984. Around 0.5 hectares of farmland per person was available in 1960, when there were only 3 billion people on the planet, and was thought to be the bare minimum required for the progress of a varied, stable, and nutrient-rich plant and animal diet [41]. [36] [10]. As a result of the ever-increasing population levels associated with the reduction in per-capita availability of natural resources, the associated negative environmental effects, and the ensuing unplanned construction activities, the natural resources and socio-economic structures have improved to a point of disaster resilience.

The desire for more production has exacerbated the problems that render agricultural production systems unsustainable globally, particularly in emerging countries, which call for a pattern shift toward integrated, sustainable agriculture growth and modernization management for a holistic agroecosystem [11] [37]. According to [37], science and technology have historically contributed significantly to increasing output, nutrition, and total income. However, advances have been patchy, and successes have had an impact on the environment and society. The expenses of extensive fertilizer use, eutrophication from pesticide contamination, and the disappearance of locally farmed landraces have typically accompanied gains in productivity rather than increasing the availability of food for the world's poor. The review revealed that to partially divide gains and lessen environmental consequences, institutional adjustments in science and research administration, production, and distribution are required. With the right training, decreased reliance on chemical inputs, and improved management, farmers may achieve high profitability through integrated pest management (IPM), according to research from the FAO's Plant Protection Service. With the right training, farmers may grow crops that are very profitable.

The Food and Agriculture Organization’s objective is to focus on the poorly paid farmers who, given their frequently high production and profit potential, are typically food insecure. Farmers Field Schools are training models that were originally found in the Indonesian National IPM System starting in 1989 and covered the rest of Asia and other crops during the 1990s. The FAO Specific Food Security Program has found a correlation between IPPM (Integrated Production and Pest Management) and livelihood advice. Sustainable agriculture and production intensification work as parallel processes that aim to approach ecosystems for greater production efficiency, the use of resources, and the prevention of food insecurity by using genetics, agricultural technology, and mechanization [18][32] [33] [34][46] [48] [49] [52] [53] [54] [56] [57] [58] [59] [60].

Sustainable Agriculture, Management, Practices, and Model

Sustainability is studied and managed on a range of time and spatial scales across a number of environmental, social, and economic variables. Sustainability evaluation is frequently a difficult task. Only a few metrics, such as biodiversity, productivity, yield patterns, soil health, outflow quality, nutrient health, pore water quality, pollutant concentration in the productive system, production of soil and nutrients, and the finite resource coefficient, among others, are provided in the literature for evaluating the sustainability of farm systems [2] [3][5] [6] [9] [12] [14] [17] [25] [55] . A sustainable agricultural system may be attained through various productive management techniques that encourage a balanced production system with little negative influence on the environment. Field trials to evaluate management impacts on multiple temporal and geographical scales may not be practical since the impact of diverse managerial actions on agriculture and the environment varies in time and space due to differences in soil, climate, and cultivation practices[1][4][7] [8] [13][15] [19] [26] [27] [28] [29] [30] [31]. Consequently, it can be a quick and affordable tool to study how different agricultural management techniques affect sustainable production systems. Process models replicate management techniques[23][55].

In many agricultural systems, it is damaging to current commercial and subsistence practices when output exceeds input. Without proper replacement, the loss of soil nutrients would eventually cause crop yields to significantly fall, necessitating outside intervention or replenishment and beginning a vicious cycle. Farmers are increasingly cultivating more marginal areas on many lands that go under intensive farming and husbandry practices to sustain output levels. In terms of raising and breeding animals, municipal pasture grounds have shrunk, and cattle have grown more reliant on drilling in agricultural fields, particularly in regions where there have historically been more dry weeds. The exchange of nutrients across rangelands, croplands, ruminant animals, and soil is necessary to maintain agricultural output. However, farmers are ignorant of how nutrients are distributed. An improved comprehension of nutrient cycles and the creation of fresh, creative management approaches are necessary to maintain the sustainability of an environment that is becoming more and more vulnerable. It is generally recognized that biomass cycling from crop components to animal excrement fertilizes the soil in integrated systems, linking animal production with soil productivity. In integrated farming systems, the connection between crop and animal husbandry may be leveraged to the advantage of sustainability. The nutrient availability, nutrient exchange, and water-holding capacity of the soil are all conserved. If animal excretions are not collected, digested, and distributed on farms, nutrient losses in stall feeding to animals may increase. While several agricultural methods make claims about their sustainability, organic farming is the only one with a well-defined farm management system that includes both recommended and prohibited environmental and food production activities. The primary difficulty in protecting lands, however, is to preserve biodiversity while also laying the groundwork for the social and economic advancement of the community [42]. If a worldwide food system promotes competition, devalues interpersonal connections, inhibits interactions with nature and food producers, and imposes high costs on the environment, society, and health, it cannot be sustained [24] [40] [39] [44] [50] [51].

The cost of food production and delivery to the environment must not be included in the price of food for the user. Future generations would make up for the hidden costs of our current "effective" farming methods. Strategies must make sure that the poor in our society are more susceptible to such pressure in order to prevent escalating the existing unfairness. Farmers join local food systems for a variety of reasons, not the least of which is to counter the effects of the main international food system and to create a workable alternative food system in the city. Progressing agricultural diversity, producing fresh, nutritious foods that are primarily organic, and lowering "food miles" are some of the contributing reasons. Customers are urged to support regional food processing systems by buying fresh, natural, and seasonally appropriate items, assisting farmers, building trusting connections with them, and taking part in social activities [35]. To create sustainable local/regimes, farmers must organize and incorporate the "nexus of food, non-food, and natural resources" (including ecosystem services) in an integrated landscape strategy. By using an ecologically friendly embedding technique and a recommended, standard, or contractual practice in industrial supply chain management, alternative food systems can be developed [47]. Circular economies can help to some extent with the challenge of producing local or regional bioenergy [38]. Stakeholders can create regional or local agro-ecological transitions to manage this connection with the aid of conceptual and methodological frameworks. The need to take into account interdependencies between farming practices, the management of natural resources, and supply chains, as well as priorities, constraints, and other considerations, is emphasized [53-61].

MATERIALS AND METHODS

For gathering primary data, this study adopted a survey methodology. Hungary's farmers received questionnaires in the mail. Five components make up the questionnaire: information about the respondent and the company, instruments and elements of sustainable agriculture (economic, environmental, political and social), agriculture export portion , and agricultural production portion. A thorough assessment of the literature served as the foundation for the measures [45] [16] [20] [43]. On a five-point Like scale, all measures were made. The sample was chosen at random from a list of all farm owners, food producers, and exporters in Hungary. A poll that was conducted online between February and April 2020 produced 106 useful results. Table 1 displays the responder profile details.

Table 1: Data on respondents' profiles

Characterization	Categories	Frequency	Percentage（%）
Gender	Male	85	80%
	Female	21	20%
Age	20-30	16	15%
	31-40	31	29%
	41-50	45	42%
	More than 51	14	13%
Education level	Postgraduate	34	32%
	Graduate	57	54%
	Other qualifications	16	15%
Type of firm	Self-owned	78	74%
	Rented	28	26%
Size (Employees)	Less than 100	12	11%
	100-300	23	22%
	301-500	26	25%
	501-1000	25	24%
	More than 1000	20	19%
Motivation for cultivation	For income	98	92%
	for hobby	0	00%
	Inheritance	8	8%

RESULTS

Descriptive statistics

Table 2 displays illustrative data, including (mean, standard deviation, and correlation). The findings show that the range of the average score for all of the constructs is (2.684-3.957) and standard deviation (0.496-1.357). The findings also demonstrate a positive and substantial correlation between each of the constructs.

Table2- Descriptive statistics

	Mean	S.D.	SAT	ED	END	SD	PD	E	P
SAT	3.696	0.727	1						
ED	3.823	0.496	.609**	1					
END	3.957	0.869	.475**	.443**	1				
SD	3.689	0.930	.534**	.316**	.362**	1			
PD	3.510	1.294	.354**	0.147**	0.236**	0.154**	1		
E	2.684	1.357	0.144**	0.146**	0.244**	0.125**	0.340**	1	
P	3.746	0.703	.369**	0.213**	.400**	0.257**	.306**	.345**	1

**. Correlation is significant at the 0.01 level (2-tailed).
SAT= Sustainable Agriculture Tools, ED= Economic Dimension ,END= Environmental dimension, SD= Social dimension ,PD= Political dimension E= Agricultural Export , P= Agricultural Production.

Reliability and Validity

The AMOS 24 and confirmatory factor analysis (CFA) were used to evaluate the validity as well as reliability of measurement ranges. The reliability of the scales was assessed by the Cronbach's alpha coefficient, as can be seen in Table 3. All constructions have a range between 0.930 and 0.756, which is more than the cutoff value of 0.50 and shows that all the items are internally consistent [21]. Hair et al. (2006) indicate that items with loadings between 0.50 and 0.70 can be kept. The approximate validity was assessed in three crucial indicators, which are element loadings (standardized estimates), average variance extracted (AVE), and composite reliability (CR). The item loadings are all over the threshold value and statistically significant (p 0.05), as shown in Table 3. All of the constructs' composite reliability (CR) values are above 0.50 and vary between 0.891 and 0.792, which indicates that they all exhibit high levels of CR in accordance with [22's advice]. The range of the average variance extracted (AVE) value for all the constructs is between 0.701 and 0.771, which is higher than the indicated threshold value of.50 by [21]. Using the (Fornell & Larcker, 1981) technique, discriminant validity was evaluated. They proposed that discriminant validity is established if the square root of the AVE for a latent construct is larger than the correlation values among all the latent variables. According to Table (4), the square root of the AVE values for each construct is bigger than the correlations between the constructs, supporting discriminant validity. The fitness of a measuring model was evaluated using goodness-of-fit metrics. The outcomes (CMIN/df= 2.214, GFI=0.8821, TLI= 0.860, CFI=0.881, RMSEA = 0.031) support an appropriate model fit. A good concept's validity and reliability are therefore shown by the measurement methodology.

Test of hypotheses

The stated hypotheses were examined using structural equation modeling (SEM), and Table 5 and Fig. 1 show the hypothesis test results . The results show that employing sustainable agricultural uses has no discernible effect on agricultural production (B=0.066, p=0.213). Therefore, H1 is not supported. H6 is ignored since the correlation between sustainable agriculture tools and agricultural productivity was insignificant (B=-0.052, p=0.071). The findings also indicate that the social, environmental, and economic components have a significant and positive impact on agricultural output (B=0.322, p.0.000), which is substantially consistent with H2, H3, and H4 (B=0.791, p.0.000). H5 and H10 are supported even if the Political component has a considerable negative effect on agricultural export (B=-0.287, p.0.000) and output (B=-0.378, p.0.000). Finally, the findings show that the environmental (B=0.571, p.0.000) ,economic (B=0.501, p.0.000), and social (B=0.606, p.0.000) dimensions all have a substantial and beneficial influence on agricultural export, supporting H7, H8, and H9. There is support for H5 and H10.

Table 3- CFA results: reliability and validity

Constructs	Measurement Items	Factor Loading	a	CR	AVE	P.Value
Sustainable Agriculture Tools	SAT1	0.786	0.788	0.821	0.720	0.000
	SAT2	0.968				0.000
	SAT3	0.871				0.000
	SAT4	0.628				0.000
	SAT5	0.688				0.000
	SAT6	0.804				0.000
	SAT7	0.967				0.000
Economic Dimension	ED1	0.971	0.794	0.792	0.701	0.000
	ED2	0.88				0.000
	ED3	0.657				0.000
	ED4	0.878				0.000
	ED5	0.864				0.000
	ED6	0.843				0.000
Environmental dimension	END1	0.796	0.867	0.810	0.710	0.000
	END2	0.92				0.000
	END3	0.921				0.000
	END4	0.939				0.000
	END5	0.961				0.000
Social dimension	SD1	0.977	0.756	0.841	0.730	0.000
	SD2	0.954				0.000
	SD3	0.937				0.000
	SD4	0.923				0.000
	SD5	0.773				0.000
Political dimension	PD1	0.968	0.930	0.891	0.751	0.000
	PD2	0.909				0.000
	PD3	0.938				0.000
	PD4	0.928				0.000
Export	E1	0.841	0.917	0.886	0.771	0.000
	E2	0.851				0.000
	E3	0.927				0.000
	E4	0.926				0.000
	E5	0.931				0.000
	E6	0.942				0.000
	E7	0.92				0.000
Production	P1	0.947	0.811	0.832	0.733	0.000
	P2	0.911				0.000
	P3	0.865				0.000
	P4	0.847				0.000
	P5	0.746				0.000
	P6	0.947				0.000
	P7	0.929				0.000

a= Cronbach's alpha ,CR =Composite Reliability and Average, AVE=Variance Extracted

Table 4-Discriminant validity

	SAT	ED	END	SD	PD	E	P
SAT	0.849						
ED	0.431	0.837					
END	0.231	0.421	0.843				
SD	0.512	0.201	0.331	0.854			
PD	0.501	0.531	0.610	0.309	0.867		
E	0.391	0.561	0.509	0.612	0.583	0.878	
P	0.520	0.613	0.712	0.301	0.591	0.322	0.856
Notes: Bold values in diagonal represent the squared root estimate of AVE.							

Table 5- Result of hypothesis Test

NO.	Hypotheses	Beta Coefficient	PValue	Result
H1	Sustainable Agriculture Tools → Agricultural Production	0.066	0.213	Not Supported
H2	Economic Dimension→ Agricultural Production	0.791	0.000	Supported
H3	Environmental Dimension→ Agricultural Production	0.379	0.000	Supported
H4	Social dimension→ Agricultural Production	0.322	0.000	Supported
H5	Political dimension→ Agricultural Production	-0.378	0.000	Supported
H6	Sustainable Agriculture Tools → Agricultural Export	-0.052	0.071	Not Supported
H7	Economic Dimension→ Agricultural Export	0.501	0.000	Supported
H8	Environmental Dimension→ Agricultural Export	0.571	0.000	Supported
H9	Social dimension→ Agricultural Export	0.606	0.000	Supported
H10	Political Dimension→ Agricultural Export	-0.287	0.000	Supported

DISCUSSION

Understanding the significance of sustainable agriculture and how it affects the production and exporting of food was the study's main objective. In this case, sustainable agriculture is operationalized to include its components and practices (economic, environmental, social, and political). According to the study, these components combined have an effect on the production and exporting of food. The study's findings demonstrated that employing sustainable farming methods had no impact on crop productivity. It has also been demonstrated that sustainable agriculture has no noticeable impact on agricultural production. The results propose that, in its current form, sustainable agriculture does not significantly increase agricultural production or food exports. The benefits of food export and production are unrelated to sustainable agriculture methods. Despite being employed, the tools may not be efficient in their applications. The farmers' incomplete use of the tools may also be a contributing factor. The economic, environmental, and social characteristics of sustainable agriculture have a major and positive influence on the country's agricultural output and food exports. They are noteworthy, maybe because they stand for elements that are crucial when a nation thinks about sustainable agriculture. It is reasonable to believe that financial, cost-benefit analysis, and all other economic reasons heavily influence the choice to improve sustainable agriculture. It is therefore not shocking to learn that the environment actively affects farm productivity in a beneficial way. The setting serves as a metaphor for the playing field where agricultural operations are carried out. In this situation, it is important to make sure that the ecosystem is properly maintained in order to increase its lifespan and benefit future generations. Reganold, Papendick, and Parr (1990) recognize that agricultural production and export have an adverse impact on the environment and that soil erosion must be prevented; this could have a lasting impact on the production of agriculture.Understanding the significance of sustainable agriculture and how it affects the production and exporting of food was the study's main objective. In this case, sustainable agriculture is operationalized to include its components and practices (economic, environmental, social, and political). According to the study, these components combined have an effect on the production and exporting of food. The study's findings demonstrated that employing sustainable farming methods had no impact on crop productivity. It has also been demonstrated that sustainable agriculture has no noticeable impact on agricultural production. The results propose that, in its current form, sustainable agriculture does not significantly increase agricultural production or food exports. The benefits of food export and production are unrelated to sustainable agriculture methods. Despite being employed, the tools may not be efficient in their applications. The farmers' incomplete use of the tools may also be a contributing factor. The economic, environmental, and social characteristics of sustainable agriculture have a major and positive influence on the country's agricultural output and food exports. They are noteworthy, maybe because they stand for elements that are crucial when a nation thinks about sustainable agriculture. It is reasonable to believe that financial, cost-benefit analysis, and all other economic reasons heavily influence the choice to improve sustainable agriculture. It is therefore not shocking to learn that the environment actively affects farm productivity in a beneficial way. The setting serves as a metaphor for the playing field where agricultural operations are carried out. In this situation, it is important to make sure that the ecosystem is properly maintained in order to increase its lifespan and benefit future generations.

Reganold, Papendick, and Parr (1990) recognize that agricultural production and export have an adverse impact on the environment and that soil erosion must be prevented; this could have a lasting impact on the production of agriculture. Additionally, it has been demonstrated that the social element has a positive impact on the production and exporting of food, which shows that farmers' social initiatives are crucial catalysts for sustainable agriculture. The results show that farmers see themselves as modern people who ought to use sustainable agricultural methods and ensure that farm employees are working in a safe environment. Since utilizing sustainable agricultural techniques boosts farmers' credibility in society, it also suggests that farmers are ready to agree to the adoption of a more convincing sustainable agricultural practice. This is supported by the view expressed by Pharm & Road (1987) that economic viability, environmental soundness, and social acceptance of agricultural production all have the hallmark of ensuring food production. Nevertheless, the political aspect has a detrimental impact on food export and production, which means that the agency does not adequately teach farmers how to use sustainable agricultural methods or encourage them to do so. Subsidies or loans, if they are absent, might be used as motivation. Based on the findings, it is reasonable to believe that the ongoing use of any agency to assist in informing farmers about sustainable agriculture or to urge them to practice it has a negative impact. Therefore, it is crucial to revamp the operations of anyone in charge of this.

CONCLUSION

The purpose of the study was to unearth the importance of sustainable agriculture for food production and export. Findings indicate that sustainable agriculture has a largely positive influence on food production and export. However, the political dimension, as a sustainable agriculture element, has been found to negatively influence food production and export. Again, sustainable agriculture tools were also found not to influence food production and export. This could perhaps mean that the tools used in sustainable agriculture are not properly applied or are not applied in the right context. Again, the researcher could argue that there is no holistic approach to the use of sustainable agriculture tools.

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Author Biography sample

Ola Madallah AlJaafreh,
Researcher in sustainable ecological, food security with sustainability in the world, member, Jordan Agriculture Engineers Association, July, 2008 till now, reviewer, Environment, Development and Sustainability, October, 2011 till now, member in Reviewing committee master thesis (Impact of sustainable tourism on Morocco's economy) at the Hungarian University of Agriculture and life science(2022) .