sustainability

Article

Sustainability Management of Organic Food Organizations: A Case Study of Azerbaijan

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Abstract: Potentially, sustainable development can lead to the global alignment of goals and values, such as social justice and environmental balance. This study examines the supplier sustainability management programs that exist in the food industry and combine economic, environmental, and social priorities using sustainability theory. The study aims to identify sustainability priorities and develops recommendations for Azerbaijani agrifood policy in order to ensure the dynamic sustainable development of the national food industry and economy. The analytic hierarchy process (AHP) model and the priority theory enabled the identification of global priorities in relation to Ganja Agribusiness Association (GABA). These priorities include climatic conditions issues, certification standards and labels, possibility of acquiring land in private ownership, price of land, and qualification characteristics of the workforce.

Keywords: sustainability in agriculture; food safety; supplier sustainability; food industry; supplier sustainability management (SSCM); environmental and social priorities; innovation

1. Introduction

Agricultural development is considered relevant by international organizations as a driver of the food safety improvement [1]. Additionally, agricultural growth enhances the supply of raw materials to other sectors of national economy, including the food industry [2]. A number of scholars emphasize the importance of adopting a comprehensive solution to the organizational and economic problems in agriculture, boosting the competitiveness of crop production and improving the basic production and sale mechanisms. These steps can intensify the development of food industry in the near future [3,4].

In modern conditions of population growth, the problems of global sustainability management that exist in the food industry are complicating the food supply chain and, consequently, exhausting limited resources [5,6]. Supplier sustainability management (SSM) is an ability to adapt, constantly innovate, learn, improve, and use the advantage of emerging opportunities in order to cope with uncertainty and risks [7]. The rapid development of the market, increased competition, and requirements for improving the quality of service all pose new challenges for companies. One of the tools to enhance the competitive advantage of global companies is sustainable supply chain management (SSCM) [8,9]. In the global sense, the SSCM maintains a balance between profitability and high quality, environmental and social standards, and reliability and safety of food supply, which is not an easy task. Increasingly close relationships between suppliers and customers are a key to creating benefit through reliable high-value chains. At the same time, supply chains could potentially be at serious risk [10–13]. SSCM can be regarded as “the management of material, information and capital flows as well as cooperation among companies in the supply chain while taking into account goals from all three dimensions of sustainable development (environmental, social and economic)" [14]. Differences found between 22 definitions identified for green SCM and 12 definitions identified for SSCM demonstrate that SSCM is an extension of green SCM, with ecological and social dimensions, as well as economic sustainability [10]. Categorizing SSCM as management philosophy and a set of management processes [9], the SSCM practices may be considered as those consisting of internal and external economic, environmental, and social practices of a company [15–17]. Social, economic, and environmental priorities of sustainability are aimed at improving the quality of life for the population and ensuring sustainable food production. Top-level managers of organic food organizations decide on sustainability priorities on their own, seeking to promote the industry in certain climatic and macroeconomic circumstances, and meet national food demands [18].

Researchers concerned with food industry-related issues previously addressed sustainability theory to explore social, environmental, and economic factors. Sustainability in the agroindustrial sector is largely driven by environmental factors—the category that is difficult to quantify. Sustainable development requires organizations with green supply chains to take into account environmental and social factors in order to meet consumer demands. These factors may include climate change and supplier responsibility [19]. In a food industry, environmental sustainability is achieved via reduction of carbon footprint and agrochemical use in organic farming. Organic food producers may reach economic sustainability through price optimization and marketing, and by selling their products directly to the consumer without the use of intermediaries. Socioeconomic development is achieved via improvement of healthy nutrition of the population, by encouraging manufacturers to increase safety of their food products, and through the adoption of effective support policies for local producers. Organic food organizations may achieve progress towards socioenvironmental sustainability by making their farming activities chemical-free, using more ecofriendly packaging, and raising awareness of the public about the safety and origin of their food products [20].

Reaching sustainability under the agrifood policy in Azerbaijan may be challenging, as it relates to nonessential problems, including bifurcation (instability). Bifurcation theory was previously not applied to the agricultural food industry. This study sets out recommendations for sustainable rural development that are based on the priority theory and bifurcation-related survey results. These recommendations together with the state agrifood policy will help increase the impact of bifurcation and thereby balance sustainable development and improve security and competitiveness of organic food organizations.

The study aims to ensure supplier sustainability management by identifying environmental, economic, and social priorities of food industry development, as well as to draw more attention to food safety and profitability. The priorities under consideration relate to stakeholders and government agencies. A combination of socioeconomic, environmental, and socioenvironmental domains of sustainability determines the importance of the study subject.

The objectives of this study are:

1. use the analytic hierarchy process method to determine global priorities among the multitude of supplier sustainability criteria that are specific to the food sector in Azerbaijan;
2. survey the conjuncture of organic food producers and consumers (farms and processing enterprises) in Azerbaijan to subsequently offer recommendations for agricultural and food policy making;
3. verify the bifurcation model through a comparative study of the two certified and noncertified groups using a telephone survey approach.

The agreement of global priorities on sustainable organic food production contributes to the balance in the local agricultural development goals of stakeholders, as well as to socioenvironmental improvement and food safety. The high relevance of the study is due to the fact that the sustainable food industry plays a crucial role in international business [21] through the integration of social, environmental, and economic responsibilities [22]. In the socioeconomic perspective, the problem of achieving effective SSM in the regional food industry is connected with the theory of priorities, the theory of sustainability, and the theory of bifurcation; however, many literature sources under review have not addressed the priority theory whatsoever.

2. Methods and Materials

2.1. Priority Theory in the Management of Food Industry Sustainability

In the context of globalization, choosing the right supplier is challenging due to many supply chain criteria, including speed and quality of delivery, price, and guarantees. Based on the general stakeholder perspective regarding the importance of criteria set out in SSM [18] and through the analysis of scientific literature [23,24], the hierarchical structure of sustainability criteria was incorporated [25]. Priority theory [25] as used here describes the analytic hierarchy process (AHP). This is a decision-making process for identifying priorities while taking the qualitative and quantitative aspects into account to substantiate the best-structured decision and break down the goals into subgoals. Afterwards, decision makers help compare the ideas and find the best alternative priorities. Using the AHP model, it was decided to estimate the relative weight of many criteria (or many alternatives) defined in previous research [25]. The sustainability criteria selected were analyzed with regard to all stages of the supply chain: resource supply, farming, processing, and distribution. The interviews with stakeholders involved in the supply chain were integrated with secondary data under a case study protocol [26]. Three experts attended every interview and these case studies. The selected priorities were then scaled using a Saaty's 1–9 scale (Table 1).

The Saaty's scale was the only tool used in qualitative characterization. The limitation of knowledge about the research subject, however, may result in the inconsistency of expert assessments. The consistency ratio should be no more than 20%.

Table 1. The Saaty's scale of relative importance.

Intensity of Importance	Definition
1	Equal importance
3	Moderate importance of one over another
5	Strong importance
7	Very strong importance
9	Extreme importance
2, 4, 6, 8	Intermediate values between two adjacent judgments

Source: [27].

2.2. Sustainability Theory in the Management of Food Industry Sustainability

Sustainability theory helps restore sustainability in the management of food industry suppliers. Poincare's research [28,29] on this theory is a new approach towards defining the behavior of a system of differential or difference equations. The variety of sustainability concepts that offer static, dynamic, and asymptotic solutions agree on the trajectory of the system, which tends to a stationary point after passing the differences, i.e., this refers to the management of compromise between the present and future resource consumptions [30,31]. This characteristic is considered such that it allows for a desired trajectory of the system components, dynamically or asymptotically sustainable. Using empirical and theoretical research methods, a set of socioeconomic priorities was proposed and a hypothesis about sustainability assessment was formed. The choice of priorities can serve as a starting point for adaptation in the food industry during the sustainability assessment at a specific place and time [32]. The environmental and social dimensions of SSCM drive companies in their joint effort to solve problems with a certain set of methods [33] and pose a challenge of high performance to governmental and nongovernmental organizations [34]. The SSCM practice involves choosing professional partners and building long-term business relationships [35] for competitiveness [36]. SSCM requires a collaborative relationship between more stakeholders to reach business development. Innovative development is also a preferable objective of SSM strategies [37]. Food consumers care about mass production processes and their impact on the environment no less than about the quality of food [38]. This statement will remain relevant even if SSCM practices reach dynamic development. In developing countries, enriching farming experience is an important part of supply chain management processes [39].

2.3. Bifurcation Theory in the Management of Food Industry Sustainability

Bifurcation in science is seen as the result of standardization [40] where agribusiness consists of a system performing a large-scale replacement of high-value crops intended for secondary markets. Small farms use more sustainable agronomic methods, which are targeted at direct markets. Categories describing the bifurcation of organic agriculture were analyzed by various scholars [41,42]. Bifurcation theory is a theory of asymptotic solutions (stationary solutions, time-periodic solutions, and quasiperiodic solutions) to nonlinear equations [43–45]. P. Kaltoft believes that the process of institutionalization of organics is carried out through the government adoption of certification standards [46]. In his opinion, organic production becomes institutionalized and integrated into the global food system and ceases to be a social process.

Research on certified and noncertified organic production in Canada showed that farms that switched to organic production are larger but inconsistent with the specialized monoculture models for secondary markets. The number of farms that specialize in field crops without a livestock component for manure is growing, while migrant labor is practically not used. There was no relationship found between farm size and the number of labor migrants. Organic farmers depend on family labor and other unpaid workers [18,47,48]. UK scholars believe that lowering farm prices limits the development of organic agriculture [49]. The price reduction is due to the wholesale purchase by large supermarkets, which is associated with the conventional food supply chains. Consequently, other supermarkets become more dependent, and manufacturers must apply more effective production strategies to develop competitiveness and maintain their position in agribusiness.

Bifurcation is the process by which agriculture splits into small and large farms/food processing facilities [50]. This method permitted the comparison of certified and noncertified organic food producers (farms and processing facilities) in Azerbaijan. This study applied a mixed approach and defined a promising direction in the food industry for organic agriculture. The sustainability management research involved surveying a focus group of 70 managers (40 certified and 30 noncertified organic food producers) between 3 September 2018 and 5 December 2018, with the aim of testing the bifurcation theory. The research method of choice was a telephone survey. The telephone numbers were preselected and all interview calls were recorded for the assessment of the interviewer's influence on the respondent and the relative bias. A questionnaire form was filled out with responses and contact details of the respondents by the interviewer using an Excel spreadsheet. The phone survey method allowed for a deeper analysis of organic food producers across the following set of characteristics: revenue; net income; market size; employees (age, race, education); working hours; and the ratio of certified to noncertified organic farmers.

2.4. Research Population and Data Analysis

Between winter 2018 and summer 2019, the research on organic food producers was carried out using focus groups and telephone survey methods to draw conclusions and adequately assess the market situation, as well as to predict changes in consumption and production of organic food in the next two years. Three focus groups of respondents consisted of 100 participants from Ganja Agribusiness Association (GABA) and AZEKOSERT organizations, both consumers and manufacturers, and 50 certified organic producers were attracted via phone in Azerbaijan. The feedback was used in conjunction with the survey results. The study was conducted in a four-stage process: (1) setting a goal (this corresponded with the research aim), (2) designing a questionnaire, (3) survey, (4) statistical processing.

The survey questionnaire had open-ended questions, representativeness or community coverage, and accurate data on organic operators [51], which highlight the main problems of certification and the consumption of certified organic foods. A cover letter informing about the research goal (i.e., expanding of organic food marketing capabilities in Azerbaijan) was emailed to survey candidates. In case of a positive response to such an invitation, respondents were given a link to an online application form. To ensure survey effectiveness, a reminder message was sent 10 days after the first reminder. Out of 80 questionnaires, six were not completed and four were filled out incorrectly. The remaining 70 cases involved 40 certified producers and 30 noncertified producers (medium-sized firms, large firms, and small firms). Data processing was carried out using Excel software. The final expert assessment included the analysis of the estimates received from each expert, accurate group ranking, and the group accuracy analysis.

To determine if the organic agriculture problem in Azerbaijan coincides with the previous research on bifurcation, several hypotheses were considered—the existing ones and those developed within the framework of this study. The problem of organic food certification is not completely disclosed in the literature and this is when certification resembles the major issue in the bifurcation model research. Comparative data on two groups (certified/noncertified producers) were analyzed and validated under a Likert scale (strongly agree, somewhat agree, neutral, somewhat disagree, strongly disagree) [52]. The questionnaire form is presented in Appendix A.

3. Results and Discussion

3.1. Priority Theory

For priority ranking, 20 criteria for assessing sustainability management of GABA and AZEKOSERT were selected based on the procedures for collecting and processing data specified in Section 2.3. These criteria were exposed to Saaty's AHP analysis (Table 2). The analysis framework determined the choice of priority criteria.

Table 2. Important sustainability criteria in food industry and agribusiness of Azerbaijan.

Sustainability Dimension	Criteria
Economic sustainability	1. The possibility of acquiring land in private ownership and the price of land
	2. The presence or absence of foreign investors in the market
	3. Bank interest rate
	4. The national tax system characteristics
	5. The presence of inflationary processes and the rate of inflation
	6. Government participation in pricing
	7. Government support for sustainable food production
Social sustainability	1. The number and structure of food consumers
	2. The rate of trade union activity
	3. The real and potential amount of labor
	4. Qualification characteristics of the workforce and trends
Environmental sustainability	1. Strength of the legislative framework
	2. Geographical location of industrial and agricultural centers
	3. The state of the environment, significantly affecting the quality of food
	4. Climatic conditions issues
Food safety and Innovation in agricultural field	1. Certification standards and labels for ensuring that various social, environmental, and quality practices are followed and conveying this information to the consumer via labeling and marketing campaigns
	2. Bacterial growth inhibition, microelement pollutant detection, food stabilization, and general contaminant prevention
	3. Direct seeding into field stubble, which prevents erosion, as there is no tilling
	4. Dairies and other animal facilities are experimenting with biodigesters to convert animal and plant wastes into useful fuels on the farm
	5. Other technologies aiming to improve product quality, traceability, and resource use

The major aim of socioeconomic and socioenvironmental priorities is economic growth, new jobs, increased rural incomes, innovative development, and food safety. Let us construct pairwise comparison matrices for sustainability criteria (Tables 3–7).

Table 3. The pairwise comparison matrix for economic sustainability criteria.

	Crit.1	Crit.2	Crit.3	Crit.4	Crit.5	Crit.6	Crit.7	Priority	Normalized Priority
Crit.1	1	2	3	5	4	2	3	2.512	0.306
Crit.2	1/2	1	4	7	3	1	1/2	1.53	0.187
Crit.3	1/3	1/4	1	1/4	1	3	1	0.678	0.08
Crit.4	1/5	1/7	4	1	1/2	1	1/2	0.606	0.07
Crit.5	1/4	1/3	1	2	1	3	1/4	0.870	0.106
Crit.6	1/2	1	1/3	1/3	1/3	1	1/4	0.469	0.057
Crit.7	1/3	2	1	2	4	4	1	1.532	0.186
Sum	3.11	6.72	14.33	17.58	13.83	15.00	6.5	8.193	

Table 4. Random index values for matrices of different orders.

Matrix Order	1	2	3	4	5	6	7	8	9
Random Consistency Index (RI)	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45

Source: [53].

Table 5. The pairwise comparison matrix for social sustainability criteria.

	Crit.1	Crit.2	Crit.3	Crit.4	Priority	Normalized Priority
Crit.1	1	1/5	1/7	1/8	0.244	0.039
Crit.2	5	1	1/6	1/5	0.639	0.102
Crit.3	7	6	1	1/4	1.80	0.288
Crit.4	8	5	4	1	3.556	0.57
Sum					6.239	

Table 6. The pairwise comparison matrix for environmental sustainability criteria.

	Crit.1	Crit.2	Crit.3	Crit.4	Priority	Normalized Priority
Crit.1	1	1/5	1/7	1/8	0.244	0.039
Crit.2	5	1	1/6	1/5	0.639	0.102
Crit.3	7	6	1	1/4	1.80	0.288
Crit.4	8	5	4	1	3.556	0.57
Sum					6.239	

Table 7. The pairwise comparison matrix for criteria of food safety and innovation in agricultural field criteria.

	Crit.1	Crit.2	Crit.3	Crit.4	Crit.5	Priority	Normalized Priority
Crit.1	1	2	3	5	4	2.605	0.425
Crit.2	1/2	1	4	2	2	1.516	0.247
Crit.3	1/3	1/4	1	5	3	1.044	0.170
Crit.4	1/5	1/2	1/5	1	3	0.569	0.093
Crit.5	1/4	1/2	1/3	1/3	1	0.398	0.065
Sum	2.28	4.25	8.53	13.33	13	6.132	

Let us find the overall priorities across the economic sustainability criteria:

Criterion 1 = $(1 \times 2 \times 3 \times 5 \times 4 \times 2 \times 3)^{1/7} = (720)^{1/7} = 2.512$
Criterion 2 = $(1/2 \times 1 \times 4 \times 7 \times 3 \times 1 \times 1/2)^{1/7} = (21)^{1/7} = 1.53$
Criterion 3 = $(1/3 \times 1/4 \times 1 \times 1/4 \times 1 \times 3 \times 1)^{1/7} = (0.33 \times 0.25 \times 1 \times 0.25 \times 1 \times 3 \times 1)^{1/7} = (0.062)^{1/7} = 0.678$

Criterion 4 = $(1/5 \times 1/7 \times 4 \times 1 \times 1/2 \times 1 \times 1/2)^{1/7} = (0.2 \times 0.14 \times 4 \times 1 \times 1 \times 0.5 \times 1 \times 0.5)^{1/7} = 0.606$
Criterion 5 = $(1/4 \times 1/3 \times 1 \times 6 \times 1 \times 3 \times 1/4)^{1/7} = (0.25 \times 0.33 \times 1 \times 6 \times 1 \times 3 \times 0.25)^{1/7} = 0.870$
Criterion 6 = $(1/2 \times 1 \times 1/3 \times 1/3 \times 1/3 \times 1 \times 1/4)^{1/7} = (0.5 \times 0.33 \times 0.33 \times 0.33 \times 0.25)^{1/7} = 0.469$
Criterion 7 = $(1/3 \times 2 \times 1 \times 2 \times 4 \times 4 \times 1)^{1/7} = 1.532$

After finding the sum of values in the column, the overall priorities were normalized:

Criterion 1 = 2.512/8.193 = 0.306
Criterion 2 = 1.53/8.193 = 0.187
Criterion 3 = 0.678/8.193 = 0.08
Criterion 4 = 0.606/8.193 = 0.07
Criterion 5 = 0.870/8.193 = 0.106
Criterion 6 = 0.469/8.193 = 0.057
Criterion 7 = 1.532/8.193 = 0.186

The economic sustainability criterion 1 (i.e., the possibility of acquiring land in private ownership and the price of land, which are the most significant aspects of agricultural and food industry sustainability of Azerbaijan) ranked highest with a normalized priority of 0.306. Let us examine the inconsistency in expert judgments. Measures of random index are depicted in Table 4.

Let us find the consistency index (CI), given as:

$$CI = \frac{\lambda max - n}{n - 1} \quad (1)$$

where λmax is the largest eigenvalue of the matrix order and n is the matrix order (the size of the matrix).

λmax = $(3.11 \times 0.306) + (6.72 \times 0.187) + (14.33 \times 0.08) + (17.58 \times 0.07) + (13.83 \times 0.106) + (15.0 \times 0.057) + (6.5 \times 0.186) = 0.95 + 1.25 + 1.14 + 1.23 + 1.47 + 0.855 + 1.209 = 8.104$

Hence, the consistency index equals $\frac{8.104-7}{7-1} = 0.184$. The consistency ratio (CR) is computed by the following formula:

$$CR = \frac{CI}{RI} \quad (2)$$

where the random consistency index (RI) for criterion 7 equals 1.32 (Table 5). CR = 0.184/1.32 = 0.14 or 14% (if CR is smaller or equal to 20%, the inconsistency is acceptable).

Let us find the overall priorities across the social sustainability criteria:

Criterion 1 = $(1 \times 1/5 \times 1/7 \times 1/8)^{1/4} = 0.244$
Criterion 2 = $(5 \times 1 \times 1/6 \times 1/5)^{1/4} = 0.639$
Criterion 3 = $(7 \times 6 \times 1 \times 1/4)^{1/4} = 1.8$
Criterion 4 = $(8 \times 5 \times 4 \times 1)^{1/4} = 3.556$

The normalized priorities were found in the same way as those for economic sustainability criteria. CR was 6.93%, assuming adequate consistency. The social sustainability criterion 4 (i.e., qualification characteristics of the workforce and trends) ranked highest with a normalized priority of 0.57. This criterion emphasizes the importance of the socioeconomic aspect of labor relations with regard to sustainability (Table 6).

Let us find the overall priorities across the environmental sustainability criteria:

Criterion 1 = $(1 \times 1/5 \times 1/7 \times 1/8)^{1/4} = 0.244$
Criterion 2 = $(5 \times 1 \times 1/6 \times 1/5)^{1/4} = 0.639$
Criterion 3 = $(7 \times 6 \times 1 \times 1/4)^{1/4} = 1.8$
Criterion 4 = $(8 \times 5 \times 4 \times 1)^{1/4} = 3.556$

The normalization procedure remained same. CR was 6.93%, assuming adequate consistency. The social sustainability criterion 4 (i.e., climatic conditions issues) ranked highest with a normalized priority of 0.57 (Table 7), which is in line with global trends [54,55].

Let us find the overall priorities for criteria of food safety and innovation in agricultural field:

Criterion 1 = $(1 \times 2 \times 3 \times 5 \times 4)^{1/5} = 2.605$
Criterion 2 = $(1/2 \times 1 \times 4 \times 2 \times 2)^{1/5} = 1.516$
Criterion 3 = $(1/3 \times 1/4 \times 1 \times 5 \times 3)^{1/5} = 1.044$
Criterion 4 = $(1/5 \times 1/2 \times 1/5 \times 1 \times 3)^{1/5} = 0.569$
Criterion 5 = $(1/4 \times 1/2 \times 1/3 \times 1/3 \times 1)^{1/5} = 0.398$

After finding the sum of values in the column, the overall priorities were normalized:

Criterion 1 = 2.605/6.132 = 0.425
Criterion 2 = 1.516/6.132 = 0.247
Criterion 3 = 1.044/6.132 = 0.170
Criterion 4 = 0.569/6.132 = 0.093
Criterion 5 = 0.398/6.132 = 0.065

λmax = (2.28 × 0.425) + (4.25 × 0.247) + (8.53 × 0.170) + (13.33 × 0.093) + (13.00 × 0.065) = 0.969 + 1.049 + 1.45 + 1.24 + 0.845 = 5.553

The consistency index equals $\frac{5.553-5}{5-1} = 0.138$. RI for criterion 5 is 1.12 (Table 4). CR = 0.138/1.12 = 0.123 (12.3%), assuming adequate consistency. Criterion 1 (i.e., certification standards and labels for ensuring that various social, environmental, and quality practices are followed and conveying this information to the consumer via labeling and marketing campaigns) ranked highest with a normalized priority of 0.425. In general, this can be regarded as a consequence of globalization in the spread of common standards and norms within the global economy.

A summary of priority criteria is depicted in Table 8.

Table 8. The key sustainability priorities across domains.

Sustainability Dimension	Criteria
Economic Sustainability	The possibility of acquiring land in private ownership and the price of land
Social Sustainability	Qualification characteristics of the workforce and trends
Environmental Sustainability	Climatic conditions issues
Food safety and Innovation in agricultural field	Certification standards and labels for ensuring that various social, environmental and quality practices are followed and conveying this information to the consumer via labeling and marketing campaigns

Azerbaijan is a post-Soviet country with a transition economy. In the process of transition from a planned economy, the processes of hyperinflation, oligopoly, and the mismatch of prices with supply and demand were observed in the market. All this has reflected in the extremely specific regulation of the land market of Azerbaijan. Today, there is no transparent system of pricing and land ownership, the reason for this is that the state seeks to protect itself against the background of conflicts over the territory (de facto land) that have occurred in western Azerbaijan. People who cultivate the land do so by investing their resources, labor, money (including borrowed money), and time, and they want to reduce the risks that the cultivated land will be "taken away" from them since they are not its owners. There is also no hereditary transfer of land in the event of death of a person who was in contact with state bodies and who had received permission to cultivate land.

Amid the crises of the 1990s and 2000s, a significant number of highly skilled workers left Azerbaijan. Against this background, there is a gap in labor resources. On the one hand, there are old workers with Soviet education and outdated knowledge. On the other hand, there are young workers, who are still getting an education, or have just gotten it and do not have enough experience for effective management and work. Therefore, it can be said that social stability in the market is largely dependent on this factor.

The importance of climate change issues and introduction of standards for Azerbaijan is due to Azerbaijan's active inclusion in the world community at the level of trade, economic, political, and cultural relations. The latter is largely due to the fact that Azerbaijan is on the border of the civilizational paradigms of Western and Eastern societies; in addition, it has the historical memory of the Soviet Union and the Ottoman Empire. Today, Azerbaijan is a modern country included in global processes, which is confirmed by the 25th place in the Doing Business ranking (2019). In addition, Azerbaijan is a member of organizations such as the UN, Non-Aligned Movement, The Commonwealth of Independent States (CIS), The Organization for Security and Co-operation in Europe (OSCE), The North Atlantic Treaty Organization (NATO) Partnership for Peace, European Association for Palliative Care (EAPC), World Health Organization, Asian Development Bank, Asian Infrastructure Investment Bank, European Bank for Reconstruction and Development, Council of Europe, Conventional Armed Forces in Europe (CFE) Treaty, International Monetary Fund (IMF), and World Bank. This once again emphasizes Azerbaijan's interest in the speedy implementation of standardization processes and participation in addressing global challenges such as climate change.

Let us find the most important criteria so far via the pairwise comparison (Table 9).

Table 9. The pairwise comparison matrix for sustainability priorities in the food industry and agribusiness of Azerbaijan.

	Economic Sustainability	Society Sustainability	Environmental Sustainability	Food Safety and Innovation in Agricultural Field	Priority	Normalized Priority
Crit.1	1	1/3	1/5	1/4	0.358	0.07
Crit.2	3	1	1/3	1/2	0.840	0.166
Crit.3	5	3	1	3	2.59	0.511
Crit.4	4	2	1/3	1	1.275	0.251
Sum	13	6.33	1.86	4.75	5.063	

Criterion 1 = $(1 \times 1/3 \times 1/5 \times 1/4)^{1/4}$ = 0.358
Criterion 2 = $(3 \times 1 \times 1/3 \times 1/2)^{1/4}$ = 0.840
Criterion 3 = $(5 \times 3 \times 1 \times 3)^{1/4}$ = 2.459
Criterion 4 = $(4 \times 2 \times 1/3 \times 1)^{1/4}$ = 1.275

After finding the sum of values in the column, the overall priorities were normalized:

Criterion 1 = 0.358/5.063 = 0.07
Criterion 2 = 0.840/5.063 = 0.166
Criterion 3 = 2.59/5.063 = 0.511
Criterion 4 = 1.275/5.063 = 0.251

λmax = (13 × 0.07) + (6.33 × 0.166) + (1.86 × 0.511) + (4.75 × 0.251) = 0.91 + 1.05 + 0.95 + 1.19 = 4.1

The consistency index equals $\frac{4.1-4}{4-1}$ = 0.03. RI for criterion is 0.9 (Table 4). CR = 0.03/0.9 = 0.037 (3.7% < 10%), assuming adequate consistency. Let us conduct the pairwise comparison of the alternatives, GABA and AZEKOSERT, according to the four criteria shown above (Tables 10–13).

First, let us find the economic sustainability scores:

GABA = $(1 \times 1/6)^{1/2}$ = 0.412
AZEKOSERT = $(6 \times 1)^{1/2}$ = 2.45

After finding the sum of values in the column, the overall priorities were normalized:

GABA = 0.412/2.862 = 0.144
AZEKOSERT = 2.45/2.862 = 0.856

Second, let us find the social sustainability scores:

GABA = $(1 \times 1/7)^{1/2}$ = 0.378
AZEKOSERT = $(7 \times 1)^{1/2}$ = 2.646

After finding the sum of values in the column, the overall priorities were normalized:

GABA = 0.378/3.024 = 0.125
AZEKOSERT = 2.646/3.024 = 0.875

Third, let us find the environmental sustainability scores:

GABA = $(1 \times 3)^{1/2}$ = 1.732
AZEKOSERT = $(1/3 \times 1)^{1/2}$ = 0.574

After finding the sum of values in the column, the overall priorities were normalized:

GABA = 1.732/2.306 = 0.751
AZEKOSERT = 0.574/2.306 = 0.249

Finally, let us find food safety and innovation scores:

GABA = $(1 \times 2)^{1/2}$ = 1.414
AZEKOSERT = $(1/2 \times 1)^{1/2}$ = 0.707

After finding the sum of values in the column, the overall priorities were normalized:

GABA = 1.414/2.121 = 0.667
AZEKOSERT = 0.707/2.121 = 0.334

Table 10. Comparison matrix for the possibility of acquiring land in private ownership and the price of land.

	GABA	AZEKOSERT	Priority	Normalized Priority
GABA	1	1/6	0.412	0.144
AZEKOSERT	6	1	2.45	0.856
Sum			2.862	

Table 11. Comparison matrix for qualification characteristics of the workforce and trends.

	GABA	AZEKOSERT	Priority	Normalized Priority
GABA	1	1/7	0.378	0.125
AZEKOSERT	7	1	2.646	0.875
Total			3.024	

Table 12. Comparison matrix for the climatic conditions issue.

	GABA	AZEKOSERT	Priority	Normalized Priority
GABA	1	3	1.732	0.751
AZEKOSERT	1/3	1	0.574	0.249
Sum			2.306	

Table 13. Comparison matrix for certification standards and labels.

	GABA	AZEKOSERT	Priority	Normalized Priority
GABA	1	2	1.414	0.667
AZEKOSERT	1/2	1	0.707	0.334
Sum			2.121	

The global priority of sustainability in the food industry of Azerbaijan is determined by summarizing data from Tables 9–13. This measure is depicted in Table 14.

Table 14. The global priority of sustainability in the food industry of Azerbaijan.

Alternative	Economic Sustainability	Society Sustainability	Environmental Sustainability	Food Safety and Innovation in Agricultural Field	Global Priority
	Priority				
Normalized priority	0.07	0.166	0.511	0.251	
GABA	0.412	0.378	1.732	1.414	1.332
AZEKOSERT	2.45	2.646	0.574	0.707	0.926

For GABA, the global priority of sustainability equals 0.07 × 0.412 + 0.166 × 0.378 + 0.511 × 1.732 + 0.251 × 1.414 = 0.029 + 0.063 + 0.885 + 0.355 = 1.332. For AZEKOSERT, the global priority score equals 0.07 × 0.245 + 0.166 × 2.646 + 0.511 × 0.574 + 0.251 × 0.707 = 0.017 + 0.439 + 0.293 + 0.177 = 0.926. The final ranks for sustainability criteria by domains of sustainability are 0.751 (climatic conditions issues), 0.667 (certification standards and labels), 0.144 (the possibility of acquiring land in private ownership and the price of land), and 0.125 (qualification characteristics of the workforce and trends). Such a distribution, in the authors' opinion, is directly related to the geographical position of Azerbaijan. Climate change directly affects the stability of the situation in the mountainous region of Transcaucasia (earthquakes, rockfalls) and the region of the Sea of Azov (storms, flooding). The latter may adversely affect consumers of food products and the ability to conduct agricultural activities. In addition, the state is an active exporter of goods to the world market. Therefore, the widespread adoption of international standards at the level of the entire state is important for the stability of the entire national system. This determines the great importance of these criteria in contrast to the more sectoral aspects of labor and land resources.

The priority theory in the management of food industry sustainability is used in many settings, with different climatic conditions and within various territorial locations [56]. This model also applies to vendor assessment and selection systems in combination with other models. For large food enterprises, supply chains will change the mechanism of long-term business management to achieve overall sustainability, including certain criteria. In the US, many indicators of social sustainability are determined using the SSCM approach [57] and the selected priorities are similar to those identified here: safety, product responsibility, society. In the UK, many indicators of social sustainability are determined using the theoretical basis, empirical data, research design, performance index, and structure integration. The main priorities are certification, food safety, staff training, farmer training, ethical trainings, and exclusive suppliers [58]. Intermediary institutions are responsible for the overall advancement and for the development of financial instruments, market information, standards, markets, technologies, food security, innovation, and property rights [59]. On the other hand, support services are also needed for transporting, storing, processing, packing, importing, exporting, dealer services, communications, etc.

3.2. Sustainability Theory

As evidenced by the previous subsection, sustainable food supply constitutes a potential path for the improvement of a relationship between socioeconomic development and environment quality (Table 15).

Table 15. Sustainability priorities in the food industry.

Socioeconomic, Environmental, and Socioenvironmental Domains of Sustainability Priorities	Related Conditions
Employment	Hiring local people, rural development, capacity building, food security
Household income	Food security, employment, health, energy security, social acceptance
Work days lost due to injury	Employment conditions, risk of catastrophe, social conditions, education, training
Food security	Household income, employment, energy security
Energy security premium	Crop failures, oil or bioenergy price shocks, macroeconomic losses, shifts in policy, geopolitics or cartel behavior, exposure to import costs, new discoveries, technologies affecting stock/demand ratio
Terms of trade	Energy security, profitability
Trade volume	Energy security, profitability
Return on investment (ROI)	Soil properties and management practices; sustainability certification requirements; global market prices, terms of trade $ROI = \frac{Current\ Value\ of\ Investment - Cost\ of\ Investment}{Cost\ of\ Investment}$ where Current Value of Investment refers to the proceeds obtained from the sale of the investment of interest. To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment. The result is expressed as a percentage or a ratio.
Net present value (NPV)	$NPV = \sum_{t=1}^{n} \frac{Rt}{(1+i)^t}$, where R_t = net cash inflow–outflows during a single period t, i = discount rate or return that could be earned in alternative investment, t = number of time periods.
Depletion of nonrenewable energy resources	Total stocks maintained; other critical resources depleted and monitored depending on context (e.g., water, forest, ecosystem services)
Public opinion	Aspects of social well-being, environment, energy security, equity, trust, work days lost, stakeholder participation and communication, familiarity with technology, catastrophic risk
Transparency	Identification of a complete suite of appropriate environmental and socioeconomic indicators
Effective stakeholder participation	Public concerns and perceptions, responsiveness of decision makers or project authorities to stakeholders, full suite of environmental and socioeconomic indicators
Risk of catastrophe	Health, including days lost to injury, environmental conditions
Socioenvironmental sustainability of farming	biomass sustainability index (BSI) BSI = (BSI-A + BSI-B + BSI-C)/3 where BSI-A: 1. Soil (erosion vs. conservation practices) 2. Nutrients (losses vs. rational management) 3. Fossil fuels (“hidden” links vs. decoupling) 4. Water (wasting/degrading vs. efficient use) BSI-B: 5. Mobilization of elements (pollution vs. control) 6. Impact on climate (GHG vs. green accounting) 7. Land use (“fuel or food” vs. biorefineries) 8. Biodiversity (monoculture vs. agroecosystem) BSI-C: 9. Social acceptance (concerns vs. consensus) 10. Human health (ecology vs. economy) 11. Employment (human vs. development and technology) 12. Regional development

Table 15. *Cont.*

Socioeconomic, Environmental, and Socioenvironmental Domains of Sustainability Priorities	Related Conditions
Socioenvironmental sustainability of food supply	- Sustainable process - Product recovery - Waste management - Sustainable transportation - Reverse logistics - Sustainable network design } Consumers
Ecoproduction practices	Consumption of resources–energy
Environmental certification	IICA-PROCISUR* requirements shall be met
Food packaging and labeling	Whole supply chain requires producers to package and label their products

Sources: adapted by the authors on the basis of [60,61]. * Note: IICA-PROCISUR – Inter-American Institute for Cooperation on Agriculture-Programa Cooperativo para el Desarrollo Tecnológico Agropecuario del Cono Sur.

The inclusion of these priorities in the model of food supply management within the entire state will allow Azerbaijan to achieve the sustainability of the national food supply system. That is, the national system will be able, while maintaining system-forming parameters, to ensure the filling of the food market in accordance with the demand for food products [6]. The national system will also be able to prevent and overcome the results of negative impact of changes in factors of the external and internal environment. In addition, on this basis, the progressive dynamics of the technical, technological, socioeconomic, legal and organizational, functional and industrial subsystems will be possible. Agriculture is the main activity throughout the history of Azerbaijan, which ensures employment and food security. As of 2018, agriculture accounts for more than 47% of rural areas and 36% of the total employment. Environmental issues such as salinization have emerged due to poor management in the past. The main problems with product delivery to the market, apparently, are associated with weak ties between the entities and, as a result, with the lack of producer–buyer relations [62]. This information gap is characteristic of the entire value chain, from production (e.g., the volume and cost of production/purchase price) to the market (i.e., requirements for quality and packaging, product tracking, and the maximum content of residual substances). In addition, despite the presence of significant resource potential, the fullness of the national food market is largely determined by imported food resources, and sustainable functioning is of particular importance in the agrifood sector of the national economy [63].

In the sustainability theory, particular attention is paid to environmental and socioeconomic aspects of the food industry. Some socioeconomic goals can be achieved with full consideration of trades-offs: product design, production process design, processing, etc. [64,65].

Socioeconomic priorities will enable manufacturers to set goals and create incentives for the continuous improvement of sustainable processes. In addition, these priorities permit the comparable performance measurements in different contexts where they will be applied. A detailed look at different specific areas of ecological sustainability helps improve environmental priorities of both certificated and noncertificated producers [66–68]. These actions require communication between stakeholders. The value chain demands the participation of intermediaries who must implement strategic plans and enforce business laws. Naturally, the development of agriculture at all levels must be carried out from systemic (integrated) positions, abandoning purely market and other narrowly oriented connotations. Moreover, the economic issue plays one of the key roles among the aspects of improving the agricultural sector. However, for all its importance, the economic component should be aligned with social transformation, socialization of the rural population, rural institutionalization, and the formation of new effective infrastructure links in the information economy.

Socioenvironmental sustainability is measured by the biomass sustainability index (BSI) used to assess the environmental state, the production of raw materials, and hence the biomass supply chain [61]. Product certification requirements are aimed at improving socioenvironmental relations, public procurement, motivation, and management practices in the field of farming. The socioenvironmental sustainability of the supply chain is associated with green logistics and planning, with environmental production and inventory management, with waste management, and with ecofood production [69].

3.3. Bifurcation Theory

The bifurcation model was applied here in view of the fact that noncertified organic producers are more likely to sell in direct markets with little return, while certified producers tend to sell in indirect markets. As in other studies, sales in both direct and indirect markets are the norm to the respondents in the present study. Scores on the Likert scale suggest that the national certification standards benefit both the domestic and export sectors and thus allow developing agribusiness legally. The use of the bifurcation model demonstrated that costs incurred for certification adversely affect small noncertified producers. These results are consistent with previous research [42] that considered abandoning certification due to the tax growth (the implication was that noncertified producers turned to local and regional markets). Additional studies of soil chemistry showed that noncertified producers have a high sorption capacity with respect to metallic and anionic pollutants [70].

The telephone survey was conducted according to the procedures described in Section 2.3. Survey results show that organic food sales of 75% of uncertified producers account for 23% or less of their net income, while 20% of certified producers make 76% or more in this way. These comparative findings corroborate the bifurcation model. Survey results show that older and more educated women run their businesses without certification due to their lifestyle. Although gender-based differences were not found in the previous literature, various sources [71–73] pinpointed significant differences concerning age ("less than 65" and "more than 65") and education. As expected, noncertified producers are often older and more educated.

Certified organic farmers account for a higher percentage of the market volume as compared to noncertified ones (40% vs. 10.8%, respectively). The survey shows that certified organic producers are more likely to work full time, which also corroborates the bifurcation model (52% vs. 47.5%, respectively).

3.4. Requirements for Supplier Sustainability Management Imposed to Stakeholders and Government Bodies Involved in the Food Industry

A survey on focus groups (certified/noncertified organic food producers and consumers in Azerbaijan) was conducted and expert opinions of respondents from GABA and AZEKOSERT organizations were compared through the implementation of the procedures specified in Section 2.3. Out of 70 completed questionnaires, 40 were from certified and 30 from noncertified producers (medium-sized firms, large firms, and small firms). Responses were divided into groups according to the rating category set by respondents (strongly agree, somewhat agree, neutral, somewhat disagree, strongly disagree). On the basis of the most popular answers for each of the statements, the following conceptual results were formed (that is, reflecting not direct content, but ideas of the statements proposed to the respondents) (Table 16).

It should be remembered that the agricultural sector problems are constantly changing under the influence of various internal and external factors [74,75]. Thus, the existing data or the state of affairs enshrined in the legislative framework may change over time. Azerbaijan, with its history of agricultural production and rich genetic diversity, has great potential to integrate the organic management system into the structure of local/regional values [76].

Agriculture, which is the only provider of food products, should raise and process agricultural inputs with the well-known technologies. Thus, it is necessary to master the modern knowledge of agriculture. In spite of having relative advantages in agriculture, developing countries are suffering from the shortage of food products [6,77–79].

Table 16. Focus group results.

The Most Common Respondents' Answers	Number of Respondents, %
Preference for domestic products	85
Main motive to buy organic food is its positive effect on the human health	78
Standards and labeling correspond to high-quality food items	72
Organic products are more environmentally friendly	70.5
High-quality advertising contributes to consumer awareness of the benefits of organic food	66
Preference for purchases from certified organic producers	61
Preference for foods of plant origin	53
Main barrier for buyers is the lack of information about organic producers	45
Preference for animal products	38
Respondent fully understands the concept of organic food safety	32
Food safety as an important factor to consider when purchasing organic food	24
Knowledge about the content of organic food, specifically if there are macro- and micronutrients in the product, is important	20

4. Conclusions

The use of three methods (priority theory, sustainability theory, and bifurcation theory) for supplier sustainability management in the food industry contributes to rural development and helps create normal living conditions in rural areas. In this way, the natural potential of the country is preserved and increased. This study examined the need for socioenvironmental sustainability in the supply chain. Food corporations will be able to use the present findings for the assessment and selection of partners. The use of measures proposed here, such as socioeconomic and socioenvironmental sustainability, will enable stable and dynamic development of agriculture in Azerbaijan. Consequently, the food sector productivity and profitability will grow and the new jobs will be created in rural areas. This study through the AHP model showed that the following factors are of particular importance for the food industry in Azerbaijan: (1) the possibility of acquiring land in private ownership and the price of land, (2) qualification characteristics of the workforce and trends, (3) climatic conditions issues, and (4) certification standards and labels for ensuring that various social, environmental, and quality practices are followed and conveying this information to the consumer via labeling and marketing campaigns. The high importance of these factors is primarily associated with the historical features of Azerbaijani market development, the transitional state of the economy, the geographical position of the country, and the reorientation of exports to non-oil products. Identification of these zones of influence on the industry will become the basis for subsequent applied research and development of tools for the practical transition of the food sector of Azerbaijan to sustainable development. The bifurcation model used in this study will limit the use of new environmental technologies in large (certified) organic farming enterprises due to lack of investment opportunities but will increase the interest of small local (noncertified) enterprises. An additional advantage of organic farming is the creation of new jobs. In response to the survey, 70% of respondents noted that organic products are safer for the environment and 85% acknowledged their preferences for domestic producers of organic food. As it turned out, 68% of respondents do not understand the concept of the organic food safety and 55% consider this to be a barrier to the purchase of organic food products. Further research shall be aimed at a more detailed study of food safety and campaigns for raising public awareness about the ecofriendly nature of organic food. If performed on a broader scale, organic production will reduce production costs and provide advantage in the export markets. Nevertheless, government programs and subsidies are needed that can stimulate the transition to organic farming and lead to the expansion of domestic markets and export.

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Appendix A. Survey Questionnaire

Please complete the following survey for collecting and analyzing data and information on the population involved in food industry production. Thank you for your time.

Date:

(Farmer's) Name:

Contact information:

Gender: - Male - Female

Location:

Total land size:

Certificated land size:

Land ownership: - Private ownership - Rent

If rent, from whom: - Private owner - Municipality – Other

Table A1. Survey questionnaire

Statement	Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree
Insufficient information about the availability of organic food items is an obstacle to purchase.					
The major barrier for buyers is the lack of information about organic producers					
The major motive behind the organic food purchase is its positive effect on the human health					
The public fully understands the concept of organic food safety					
Family income affects the organic food purchase behavior					
Organic certification or other approval is crucial to organic food purchase					
A well-done advertising promotes consumer awareness of the organic food advantages					
Standards and labeling mean high quality of the food product					
Informing customers about certain producers at the time of purchase affects their choice of product					
Brand popularity is linked to certification					
Certified organic food producers are more popular compared to non-certified ones					
The price tag for organic food varies depending on whether it is certified and non-certified					
Certified organic food producers are more preferred by the public					
Non-certified organic food producers are more preferred by the public					
The consumer base and reputation of organic producers affect the organic food purchase behavior of people					
The distribution system is decisive in organic food purchase					
Convenient and bright packaging is important in food purchasing decisions					
Domestic organic food producers are more preferable					
Organic products are more eco-friendly					
The knowledge of macro- and micronutrients contained in organic food is important					
Customers prefer to purchase organic food of plant origin					
Customers prefer to purchase organic food of animal origin					

Thank you very much for taking the time to complete this survey.
Your feedback is valued and very much appreciated!

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