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Ecological–Economical and Ethno-Cultural Determinants of the Development of Organic Farming in Kazakhstan

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Abstract: In the context of the transition to sustainable agriculture in Kazakhstan, the article considers one of its forms—organic farming. The adopted laws and by-laws not only have not contributed to but have also significantly hindered the development of organic farming due to the complexity of their implementation in the Kazakh legal field. The activities of Kazakhstani public organizations, deprived of any state support, are symbolic in nature. The absolute instability of organic production, the multidirectional long-term dynamics of the area of organic land and the cost yield of the products are demonstrated. The lack of demand for organic farming products among the population of Kazakhstan is due to socio-economic determinants, the dominance of livestock products in the nutrition structure of the indigenous population, only a small part of the inhabitants of megacities being the main consumers of any organic products, the exorbitant share of food costs and the high premium of organic products. The reasons for the ecological and economic instability of organic farming are the extensive development model, the lack of subsidiary obligations of the state and the zero-marginal cost of the export product. Conservative, utilitarian and innovative ways of developing organic farming are proposed.

Keywords: biologization of agriculture; green economy; ecologization of crop production; organic farming of Kazakhstan; ethno-cultural determinants

1. Introduction

1.1. A Socio-Economic Overview of Kazakhstan

Kazakhstan is the largest country in Central Asia by area (2724.9 thousand km^2), with a population exceeding 20 million people, whose ethnic structure has undergone major changes over the post-Soviet period (Table 1) [1].

Table 1. The ethnic structure of the population of Kazakhstan in 1989–2021 (%, compiled by the authors to [2]).

Ethnic Group	Years			
	1989	**1999**	**2009**	**2021**
Kazakhs	40.1	53.4	63.1	70.4
Russians	37.4	30.0	23.7	15.5
Ukrainians	5.4	3.7	2.1	2.0
Uzbeks	2.0	2.5	2.8	3.2
Tatars	2.0	1.7	1.3	1.1
Germans	5.8	2.4	1.1	1.2
Uighurs	1.1	1.4	1.4	1.5
Other ethnic groups	6.2	4.9	4.5	5.1
Total number, thousand people	16,199.2	14,953.2	16,004.8	19,169.6

The most intensive population movement occurred in the 90s of the last century due to the mass emigration of Russians, Germans and Ukrainians, as well as the return of ethnic Kazakhs under the repatriation program from China, Russia, Mongolia and Uzbekistan (more than 1 million people) [3–5]. The synergistic effect of this group's high natural growth in comparison with other ethnic groups has led to an increase in the share of the titular nation to 70% and a disparity in the distribution of the population, dominated by regions in the south, where 52% of these inhabitants are concentrated in 26% of the area [2].

Kazakhstan has the highest gross domestic product (GDP) in the region (USD 221 billion, 2023) and GDP per capita, which increased by 13.5% compared to the previous year—from USD 11,500 to USD 13,300 [6]. The gross product of the country is characterized by a high share of industry (42%), mainly mining, and an average share for the service sector (54%) [2,7], equal to its neighbors Russia and China but significantly lagging behind Western economies. The share of agriculture, traditionally considered an industry of specialization in Kazakhstan since the Soviet period, in GDP in the last decade has fluctuated within 5% and has tended to decrease slightly, with a continuously high proportion of people employed in the industry, 10% of the economically active population.

1.2. Prerequisites for the Development of Organic Farming in Kazakhstan

After the collapse of the Soviet Union, Kazakhstan's agriculture underwent a radical transformation, which was expressed, as a result, as a change not only in the socio-economic formation but also in the leader in the industry. Despite a 30% reduction in the area of low-productivity arable land (from 35 to 24 million hectares), crop production has prevailed since 1992 and to this day provides an average of 60% of the cost of agricultural production, with an ever-increasing share of participation in the structure of the agricultural sector and the economy [8]. Such metamorphoses are due not so much to the intensification of crop production as to a landslide decline in livestock numbers compared to those in the Soviet period. However, the country's rain-fed agriculture, the leader of gross and value production, despite certain successes in the intensification of production [9,10], is still characterized by exceptional dependence on favorable agro-climatic conditions and resulting fluctuation in crop yields and gross output [11–14]. Considering the increasing aridization of the climate and the deterioration of the soil and climatic conditions in the agricultural sphere, the most dynamic situation occurs for grain production, where its annual volatility corresponds to tens of percent: in 2021, the harvest amounted to 14.2 million tons (with an average yield of 9.8 c/ha), and in 2022, 38% growth was recorded—22.8 million tons (13 c/ha). In 2023, due to extremely unfavorable weather conditions (torrential rains for 25 days in September in the main grain-growing regions), the harvest amounted to 16.4 million hectares (9.7 c/ha), demonstrating a drop of 28% compared to the previous year [15]. In addition, the development of agriculture is hampered by a few negative factors, among which is the deterioration of arable land due to depletion and

pollution by contaminants due to the ill-advised chemicalization of agriculture. Currently, the routine (unified) application of fertilizers even below the agronomic standards leads to the deposition in soils and therefore in products of nitrates and heavy metals, which, along with technological backwardness and an imperfect legal framework, hinder the sustainable development of the country's agriculture [16]. Against this background, the ideas of organic farming are becoming increasingly popular in Kazakhstan, which is considered by both the authorities and agricultural producers to be a kind of silver bullet to solve both the agroecological and economic turbulence of the industry.

1.3. Organic Farming as a Factor of Sustainability of the Agricultural Sphere

Organic farming (OF) as an integrated symbiotic combination of ecology and healthy nutrition originated a hundred years ago in the ideas of the Austrian scientist R. Steiner and his concept of biodynamic agriculture, developed later by Lord Northbourne in the work *Look to the Land* (1940) [17]. However, it has become popular in Western countries since the second half of the last century as the response of a society with a dominant nature-centered worldview and eco-alarmist sentiments to the socio-ecological and economic consequences of the third ("green") agricultural revolution. The latter, along with the achievement of economic sustainability in agricultural production and the multiple growth of agricultural products, gave rise to the problem of the chemicalization of agriculture and the expansion of genetically modified products.

Currently, the global market for organic products, exceeding USD 120 billion in 190 countries in 2022 [18], has shown an impressive rate of increase in its production of 10% per year, while agricultural production in 2011–2020 demonstrated the lowest amount of growth of the past 60 years of 1.93% per year (although, in the previous decade, this indicator was 2.72%) [19].

One of the leading players in the organic market is the European Union (EU), which accounts for 1/3 of its production value (EUR 45.1 billion, 2022) and 20% of the world's organic land. The EU has demonstrated an average growth of 6.7% over the past 20 years, which, however, is not enough to achieve the stated goal of increasing the share of organic land from the current 10% to 25% by 2030 [20–22]. Nevertheless, the EU has become the world's leading center for the development and implementation of innovative solutions in the field of organic agriculture and farming in particular [23–25].

Nowadays, OF has become an integral part of the biologization of the agricultural sphere not only in developed but also in developing countries [26,27], becoming one of the main consumers of technological innovations for the full-fledged vital activity of agricultural plants and soil microbiota, soil cultivation and the reproduction of organic matter and nutrients, as well as for biological means of combating diseases and pests in cultivated plants.

Regardless of the level of development, all countries consider OF in light of four key indicators of sustainability: productivity, environmental impact, economic efficiency and social well-being [28].

As already mentioned, OF in Kazakhstan is perceived as a driver of the sustainable socio-economic and environmental development of rural areas, the effective operation of the food industry and the promotion of products to the domestic market [29]. An important role in this can be played by public–private partnership, which makes it possible to increase the country's food security with respect to healthy nutrition [30].

In addition, OF can have a multiplier effect and become a catalyst for the development of related industries and the service sector of the economy—agrotourism and ecotourism [31–33].

The purpose of this study is a comprehensive analysis of the current state of OF in Kazakhstan. The research objectives are to analyze the state of the regulatory framework of Kazakhstan in regulating the production and certification of organic products; to identify the underlying causes that have led to the weak development of and domestic demand for organic farming products; to identify potential competitive organic products.

2. Materials and Methods

2.1. The Evolution of Agriculture in Kazakhstan

The significant (1700 km) latitudinal extent of the country and various climatic conditions within four natural zones (forest–steppe, steppe, desert–steppe and desert) have caused spatial differentiation of the soil and show climatic potential for agriculture [34]. The agriculture of the country is formed by the northern and southern belts, which are polarized in their difference from each other, both in terms of the nature of their natural agricultural potential and their set of cultivated crops.

2.1.1. The Northern Belt of Rain-Fed Arable Land

This farming area began to form in the territory of Northern and later Eastern Kazakhstan from the moment the Kazakh Khanate joined the Russian Empire (1731), when the first arable land began to appear around the fortresses of defensive lines built along the Kazakh–Russian border. The subsequent waves of peasant resettlement and the development of new territories were of an increasing nature, but they clearly show stages. Documents on the admission of the Kazakhs of the Younger Zhuz to Russian citizenship did not raise the land issue at all; it was only vaguely indicated that "... nomads own their traditional nomads and use them according to custom" [35] (pp. 323–328), so the plowing was of a piecemeal nature. Peasants from neighboring, southern districts of the Tobolsk province arbitrarily settled in a narrow border strip within the forest–steppe zone (up to 100 km) without moving deeper into the annexed territory, plowing and putting down small sections of proximate spaces after 2–3 years using a fallow farming system. However, the abolition of serfdom in the Russian Empire (1861) became the trigger for active agricultural development, and already in 1868, a separate act of the "Temporary Provision" (the legislative act of the Russian Empire, which defined the administrative–territorial structure of Northern and Western Kazakhstan) defined the lands occupied by the nomads: "...state-owned, provided for public use to Kyrgyz (Kazakhs)" [35] (p. 337). The "Steppe Provision" legislative act of 1891 determined the state ownership of Kazakh lands but at the same time defined their "... indefinite use by Kazakhs" [35] (p. 395). However, it was stipulated that the surplus lands would be seized by the Ministry of State Property. Landless peasants from Central Russia and Eastern Ukraine began to move actively and in large numbers to these lands, who adopted the principles of dry steppe agriculture.

Peasant colonization turned out to be much more widespread as part of the Stolypin agrarian reform of 1906–1911, when agriculture covered the entire Chernozem zone within Northern Kazakhstan. At the same time, a number of limiting factors—soil moisture, prolonged droughts and land erosion, as well as the complexity of the soils (with a proportion of salt from 5–10% in the southern forest–steppe to 70% in the dry steppe zone) [36]—led to the focal nature of agriculture by the early 50s of the last century. In the steppe zone, for the above-mentioned reasons, the share of arable land was only 12% of the area of agricultural land, with fluctuations in individual areas from 2 to 30% [37]. Khrushchev's 1954–1959 virgin land campaign secured Kazakhstan the status of an important grain region in the USSR (along with Russia and Ukraine), the plowing of 22.5 million hectares expanded the arable section to include a zone of chestnut soil and the latitude of Karaganda became its southern border, covering a stretch of 200 mm. However, it was Northern Kazakhstan that became the main area of virgin farming not only in Kazakhstan but also in the entire USSR, and the area of developed land amounted to 40% of that of the union [38].

After the completion of the virgin land campaign, the share of cereals in the total structure of arable land in Northern Kazakhstan remained almost unchanged, having increased by only 2% compared to 1953—from 82% to 84%. This structure persisted until the collapse of the USSR, when due to the withdrawal of unproductive arable land from circulation and the search for new crops, the area of technical (oilseed) crops began to increase, because of which the share of cereals decreased to 60–65%, giving way to rapeseed and curly flax, now cultivated on 3 million hectares [2]. During the post-virgin period, the arable lands of Northern Kazakhstan lost up to 40% of their humus and macrobiogenic

elements due to extensive agriculture [39,40]; in addition, 9 million hectares were exposed to wind erosion, which destroyed the arable lands of the right bank of the Irtysh with light sandy loam soils. Currently, the northern belt of agriculture is localized within North Kazakhstan, as well as the northern and central parts of the Kostanay and Akmola regions, limited by an isohyet 280 mm from the south, having lost 4 million hectares [41].

2.1.2. The Southern Belt of Irrigated Agriculture

The first centers of irrigated agriculture appeared in the territory of modern Kazakhstan in the Early Iron Age (4th century BC) in the lower reaches of the Syr Darya, having evolved from primitive rain-fed and estuarine agriculture [42,43]. Paleobotanical samples from the Tuzusai settlement showed the presence of wheat (dominated), barley, millet, grapes, nutshells, remnants of rice and rice husks [44]. The presence of millet, barley, oats and rice was noted in cytolytic samples of the Talgar settlement [45]. The earliest written evidence of irrigated agriculture in Kazakhstan dates to 630, and it belonged to the Otrar oasis [46].

Even the Mongol invasion, although it significantly undermined it, did not stop irrigated agriculture—separate tracts of land remained in the Mongol period, as well as during the existence of the Kazakh Khanate around the cities of Turkestan, Sauran, Sygnak, Sairam, etc., as well as in the valley of the Irtysh river and on the Zaisan lake [47]. After the accession of the Kazakh Khanate to the Russian Empire, expeditions of scientists and researchers recorded elements of ancient irrigation systems not only in Southern Kazakhstan but also in the East, in the area of the Semipalatinsk fortress [48], and in Western and Central Kazakhstan—numerous dried-up channels of irrigation ditches derived from the Ata-Uil and Kata-Turgai rivers [49] were observed. The main cultivated crops were wheat, millet and barley. In the 19th century, the network of irrigation canals became more complicated, especially in the Syrdarya river valley due to the increased demand for cotton and its export to the central provinces to weaving factories. At the end of the 19th century, horticulture appeared (apples, cherries, apricots and plums were grown), as did viticulture [50]. The Soviet period marked the heyday of irrigation agriculture—an array of irrigated lands were located in the valleys of the Syrdarya, Ile, Talas, Karatal and Shu rivers, and their area reached 2194 thousand hectares by 1991. At the same time, their long-term operation led to excessive salinization, which, along with the degradation of the irrigation and drainage systems, caused a narrowing of their area—by 2023, it had decreased by more than 1 million hectares to 1112 thousand hectares, while the share of irrigated arable land in Southern Kazakhstan decreased from 86 to 78% [2]. At the same time, 30% of the current irrigated lands are in poor condition [51,52].

During the post-Soviet period, there was a significant transformation of both the line of cultivated crops and the structure of the crops (Table 2).

Table 2. Structure of irrigated agriculture crops in Southern Kazakhstan (by administrative region, 2023, compiled by the authors to [2]).

Regions	Cultures, ha				
	Grain	Technical	Vegetables and Fruits	Feed	Total
Almaty	80,405	3164	1401	29,364	114,334
Zhambyl	17,709	10,790	43,625	34,946	107,070
Zhetysu	80,405	71,847	6346	34,689	193,287
Kyzylorda	99,421	4416	836	67,034	171,707
Turkestan	53,752	119,173	50,137	112,721	325,783

Analyzing the modern structure of the acreage, it can be noted that in comparison with the Soviet period, it has undergone a significant transformation: the areas of moisture-intensive cotton and rice have been reduced, and corn has become the main crop. In addition, there is a pronounced regional specialization of irrigated agriculture: a total of 100% of cotton and tobacco cultivation takes place in the Turkestan region, 99% of sugar

beet cultivation in Zhambyl and Zhetisu, 89% of rice cultivation in Kyzylorda, 80% of vegetable cultivation in Zhambyl and Turkestan (including 82% of onion cultivation in Zhambyl) and 76% of corn cultivation in the regions of Zhetisu and Turkestan [2].

Despite these problems, active steps have recently been taken to restart agriculture on abandoned and saline lands, including through organic methods for their restoration [53].

2.2. Data and Research Methods

From a methodological point of view, the study, along with a set of general geographical methods (historical, comparative geographical, geoinformation), is based on a systematic approach, as well as geographical monitoring, forecasting and mathematical and statistical research methods.

The regulatory legal acts designed to regulate the production and certification of organic products in Kazakhstan are used as the initial data [54–61], as well as statistical and analytical data from the Bureau of National Statistics, the International Federation of Ecological Agriculture Movements (IFOAM), the Research Institute of Organic Agriculture (FiBL), the World Bank and the European Union [18,62–64].

The socio-economic indicators characterizing the gross and value output of organic farming products were taken from the IFOAM website.

The graph of the dynamics of the area of organic land was created using the Microsoft Office software package (Excel 2019). Correlation and regression analysis of the dependence of the cost yield of organic products on the area of arable land was carried out using the statistical package SPSS 29.

3. Results and Discussion

3.1. Regulatory and Legal Framework for the Regulation of Organic Production

In his first Address to the People of Kazakhstan as Head of State, President Kassym-Jomart Tokayev named the production of organic and environmentally friendly products one of the priorities of agriculture since the chemical industry has become a serious threat not only to the health of the nation but also to the environment as a whole [65]. In addition, the Strategy "Kazakhstan-2050" sets an ambitious task for the republic—to become a global player in the field of environmentally friendly agricultural products [66].

The concept of a transition to a "green economy" adopted in 2013 (hereinafter referred to as the Concept) [54] de jure became the first milestone of organic legislation, proclaiming the transition of the country's economy and agriculture, including to resource-saving technologies: USD 119 billion (1% of GDP) is expected to be allocated for these purposes by 2050 per year. The maximum volume of investments is planned for the current stage (2020–2024), at 1.8% of the GDP (USD ~3.5 billion/year). However, de facto, most of the funds (80%) are provided for the implementation of industrial energy efficiency measures (USD 37 billion), the development of renewable energy sources and the conversion of thermal power plants into gas plants (USD 52 billion), and only USD 4 billion (108 million/year) is planned for the introduction of advanced tillage methods.

According to this Concept, by 2030, the productivity of agricultural lands in Kazakhstan due to the introduction of "green" technologies should increase by 1.5 times and labor productivity in the industry by 3 times, including an average wheat yield of up to 14 c/ha in 2020 and up to 20 c/ha by 2030. However, an a posteriori analysis of the 30-year situation in the grain sector, including the 10 years since the adoption of this Concept, suggests that even in 2030, the average yield of 14 c/ha will still be an unattainable boundary for Kazakhstani farmers. In general, the Concept focuses on reducing the water consumption of irrigated agriculture—from 450 m^3 in 2020 to 330 m^3 in 2030 per 1 ton of products—although this indicator is not likely to be achieved.

The economic losses of crop production resulting from the low productivity of arable land are estimated by this Concept at 1.5–4 billion dollars/year, which is 15–41% of the total value of agricultural production in the country (KZT 4361 billion in 2023) [54]. In this case, a decrease in arable land productivity (according to the Concept) is taken as an integrative

value of elementary soil depletion due to dehumification, a negative balance of humus and biogenic elements (direct and by-harvest removal + erosion products), as well as the growth of pathogenic microflora and pathogens through a decrease in the suppressiveness of arable soils.

One of the most important conditions for the development of OF is the formation of an institutional framework. Kazakhstan is among the 84 countries where, since 2015, the National Law "On the Production of Organic Products" (hereinafter referred to as the Law) has been in force [55], which in fact is a set of 18 declarative articles that fixes well-known provisions for and definitions of organic farming, devoid of any specifics. Its main disadvantage is the lack of guarantees to producers on measures of financial support for organic production and export support for product promotion. To implement the above-mentioned Law, a few regulatory legal acts were later adopted [54–61] (Table 3), blindly extracted from the relevant regulatory documents of the EU.

Table 3. Legal regulation of organic production in Kazakhstan (compiled by the authors).

Name	Year of Admission	Rank
The concept of the transition of the Republic of Kazakhstan to the "green economy"	2013	The Decree of the President of the Republic of Kazakhstan
About the production of organic products	2015	Law
On approval of the rules for maintaining the register of producers of organic products	2015	By-law
On approval of the rules for the production and circulation of organic products	2016	By-law
On approval of the list of permitted products used in the production of organic products	2016	By-law
Technical requirements and procedure for labeling organic products	2017	National standard
Conformity assessment: requirements for bodies to confirm the conformity of the production of organic products	2017	National standard
The products are organic: requirements for the production process	2017	National standard

Currently, only 38 farms in Kazakhstan are certified for the production of organic farming products, and over the past 3 years, their number has increased by only 3 [67,68].

In addition, the "Roadmap for the development of organic agriculture for 2024–2026" is currently being formed, which will simplify the process of the certification of organic production and, most importantly, develop a mechanism for subsidizing organic farms [69,70]. Currently, a few public organizations in the field of organic agriculture operate in Kazakhstan: the Kazakh Federation of Organic Agriculture Movements (KAZFOAM), organized in 2010 as an integrated association of business and society, as well as the Union of Organic Producers (2018), have been represented in IFOAM since 2019. However, the most representative, both in terms of the number of participants and the scale of events, is the one created in 2013: the coalition for the "green economy" and the development of G-Global. This alliance of legal entities is the largest public and expert association engaged, in addition to promoting "green" ideas, in the popularization and promotion of organic agriculture, as well as acting as an aggregator of institutional support for the "green economy" and organic farming in particular [71]. At the same time, the steps taken are, in fact, a palliative—there

are still no statistics on organic production and domestic consumption in Kazakhstan or registers of producers or certification agencies. There are only reference data on the exports of products presented since 2019, at the level of unofficial information. It was only in 2020 that the Bureau of National Statistics began to publish official data on the gross harvest of organic farming products [2].

3.2. Analysis of Organic Production in Kazakhstan

Nowadays, a paradoxical situation has developed in the country: an extremely narrow market for imported organic products has been formed, four times more expensive than local traditional products and consumed only by expats and foreign tourists. At the same time, all domestic organic products are exported to the EU, which amounted to 25,718 tons in 2023 and EUR 21.74 million, having decreased by 29% and 35%, respectively, compared to 2022 (Table 4):

Table 4. Comparison of the structure of exports of organic farming products in Kazakhstan in 2022 and 2023 (in physical and cost terms, compiled by the authors to [18]).

Products	2022		2023	
	Tons	Thousand Euros	Tons	Thousand Euros
Wheat	9507	4876	646	384
Seeds of Curly Flax	9501	10,065	10,194	7400
Soybeans	9221	11,002	2500	2966
Soybean Meal	6200	7019	11,800	10,557
Peas	611	340	360	204
Lentils	337	415	218	228
Total	35,337	33,717	25,718	21,739

All exports fell into unprocessed crop products with zero-added value supplied to Germany and Sweden, while imported products were high-margin items requiring deep processing and long-term storage.

The reasons for the drop in exports lie in the difficult weather conditions in the autumn of 2023, when incessant precipitation sharply reduced yields, both on ordinary lands and on certified organic ones. In addition, the price situation on the European market had a negative impact—the prices of the main export items of organic farming in Kazakhstan, curly flax seeds and soybean meal, decreased by 31.5% and 21%, respectively.

Due to the lack of a transparent policy on the tax regulation of the organic market, Kazakhstan is included in the EU's "grey list"—an important importer of Kazakh organic products. This, in turn, led to an increase in additional costs up to USD 70 per ton of exported organic products to confirm certification, which requires additional checks when importing organic products to Europe. In addition, local organic exporters incur significant costs due to imperfect logistics and transport routes.

Unlike Kazakhstan, in neighboring Russia, the demand for organic products comes from well-off segments of the population, and the number of farms and the share of crops engaged in organic production are steadily growing: the market volume in 2023 amounted to RUB 12.8 billion [72], and organic products are sold at 300% profit, at an extremely low share of domestic products of 20% [73]. The latter fact is extremely important for Kazakhstan given the common market of the Eurasian Economic Union and the absence of customs barriers to the promotion of potential products from organic farming to the Russian organic market.

As already noted, modern rain-fed agriculture in Kazakhstan is characterized by its exceptional dependence on agro-climatic conditions and a similar correlation between crop yields and the chemical industry. The main problem for agriculture in Kazakhstan is the extremely low volume of mineral fertilizers: their annual application in 2023 amounted to

116,270 tons (in terms of 100% nutrients, 24% of the scientific needs), with a pronounced leader, the North Kazakhstan region, at 35,761 tons [2].

The degree of interest of the authorities in the greening (biologization) of agriculture in Kazakhstan is most eloquently evidenced by the fact that in the light of the complete absence of any financial instruments to stimulate organic producers, 26.8 billion tons of mineral fertilizers were subsidized in their purchase, alongside 31.7 billion tons of pesticides (herbicides in the country are subsidized by 60–70%); that is, subsidies are received only by those who actively use chemical protection products and synthetic fertilizers to increase and preserve crops. The area of organic land in Kazakhstan is extremely unstable and characterized by multidirectional dynamics. So, if in 2019, an increase in arable land was demonstrated by 102,156 hectares, increasing to 309 thousand hectares, then in the eco-friendly year of 2020, it collapsed to 115 thousand hectares. In 2023, the area remained at the level of the previous year—200 thousand hectares (Figure 1).

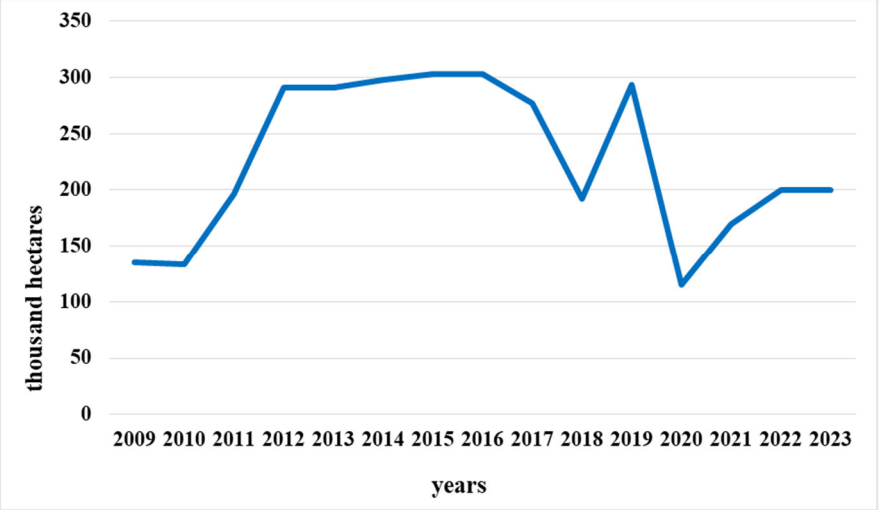

Figure 1. Dynamics of organic land area in Kazakhstan (2009–2023) (compiled by the authors according to [18]).

Correlation and regression analysis for the specified period of time showed an inverse dependence of the cost of organic production on the area of arable land: the correlation coefficient was −0.38.

A characteristic feature of the organic agricultural sphere of Kazakhstan is the production of crop production exclusively and only in the north of the country—within the Kostanay and North Kazakhstan regions (70% and 30%, respectively) in the zone of the most fertile Chernozem soils (ordinary and southern Chernozem). At the same time, in countries such as the USA and Germany, organic farming, on the contrary, has gained an advantage in areas with less favorable soil and climatic conditions, thus becoming a tool for the bioamelioration of agricultural landscapes [74,75]. There is a completely different trend in the world: out of almost 80 million hectares of organic land, only a quarter is arable land. The example of Australia is particularly indicative, the leader in terms of the size of farmland allocated as "organic"—53 million hectares, 97% of which are pasture lands [18].

As is known, organic (biodynamic) agriculture is based on the imperative use of biological resources for fertility (manure, bird droppings, compost, by-products of crops: straw, chaff, crop residues, etc.). The need for organic fertilizers in Kazakhstan is about 100–110 million tons with a scientifically based application rate of 5 tons per hectare. Kazakhstan is one of the few CIS countries that has included in its register of official agricultural statistics the section "Indicators of the green economy", which reflects data (for a calendar year) on the volume of production of organic fertilizers, their application per 1 hectare of arable land and the area and proportion of land treated with organic fertilizers. The category of "organic fertilizers" refers to manure, the application of which, compared

with the late Soviet period, fell by 20–25 times: in 2023, only 260 thousand tons were introduced into arable land in the country, 54% of which fell on the North Kazakhstan region [2]. The unbalanced distribution of organic fertilizers at the regional level leads to a loss of economic and social benefits [76].

The largest areas with organic fertilizers fall on cereals in the northern region, which is explained by the powerful raw material base of cattle (Figure 2).

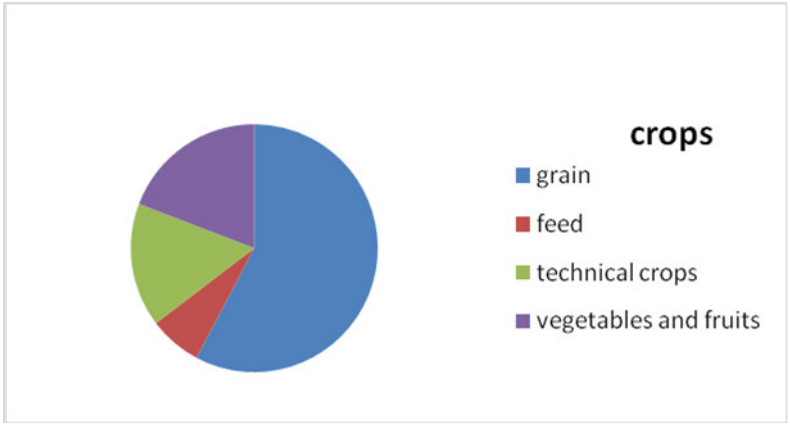

Figure 2. Structure of acreage by applied organic fertilizer (in the context of crops, compiled by the authors according to [2]).

In the context of administrative regions, the situation is extremely variable, both in terms of the share of organic matter in the total amount of fertilizers applied and its application per 1 hectare of arable land (Figure 3).

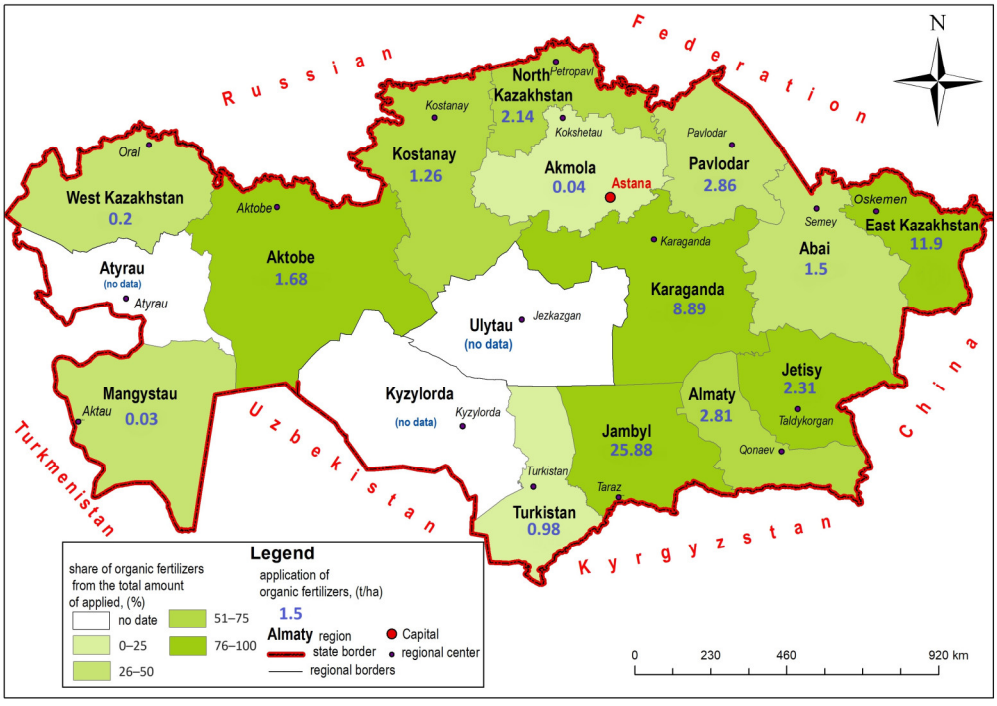

Figure 3. Zoning of the territory of Kazakhstan according to the use of organic fertilizers in agriculture (by administrative region, 2023, compiled by the authors according to [2]).

Despite such a motley picture, Kazakhstan has a significant regional potential to produce organic fertilizers [77], only in the North Kazakhstan region exceeding 8 times their level of application throughout the country, which is explained by the maximum density of cattle. In addition, there are more and more innovative developments by local

scientists on the processing of local biological and organomineral resources into organic fertilizers [78–80]. At the same time, the complete absence of its own biological products (bio-antistressants) is one of the most vulnerable areas of organic farming in Kazakhstan, which causes complete dependence on imported supplies and significantly increases the cost of production.

3.3. Socio-Economic Prerequisites of the Organic Farming Underdog

In addition to the reasons discussed above, the problem of low production and consumption, due to the unpopularity of organic farming products in Kazakhstan, is mainly socio-economic in nature and is due to a few prerequisites:

1. The historically established dominance of livestock products in the daily Kazakh cuisine—meat (from horse meat, mutton, less often beef) and dairy (ayran, kumis, shubat, kurt, zhent) dishes. Both horses and sheep are still grazed only on natural pastures (extensive cattle breeding), which are predominant in the structure of agricultural land in Kazakhstan (188 million hectares, 70% of the country's area), which, according to Kazakhs, a priori serves as an unconditional guarantee of the ecological purity of the meat of these animals [69]. The horse is considered a sacred animal of the Kazakhs (kieli—*kaz*.), but, unlike Hindus, whose religion prohibits the consumption of beef, horse meat among the Kazakhs has been appreciated since time immemorial because of its warming effect in harsh steppe and desert climates, as well as its easy digestibility. All of the above is of decisive importance given that the Kazakh ethnic group is predominant in the structure of the country's population (72.5%, 2024), with 0.5% annual growth [2].
2. Traditionally, the main consumers of organic products in the world are citizens who not only have a higher average per capita income but also take care of their health due to an unfavorable environment. Kazakhstan is a medium-urbanized country: a total of 38.5% of its citizens live in rural areas [2]. In such densely populated regions as Turkestan, Almaty and Kyzylorda, the share of the population living below the subsistence minimum (KZT 43,407/month) ranges from 7 to 10%, and the average in Kazakhstan exceeds 5%. Among the urban population, 60% are residents of small- and medium-sized cities with salaries much lower than the median (KZT 259,463 thousand on 1 January 2024). The potential group of consumers of organic products in Kazakhstan is only residents of million-plus cities (Almaty, Astana and Shymkent), totaling 4.8 million people; however, considering the national composition of each of them (the share of Kazakhs is 70%, 81% and 69%, respectively) [2], this circle is even more limited.
3. The high cost of traditional food products in the country: throughout its post-Soviet history, there has been a rapid increase in food inflation: only from 2015 to 2023, the share of consumer spending on food increased from 43.8 to 55.7% [81]. This indicator puts the republic on a par with such world anti-leaders as Nigeria (59%), Myanmar (56.6%) and Kenya (56.1%), despite the fact that in Kazakhstan the average salary is 2.2–3.8 and its GDP per capita is 5.32–10.01 times higher in comparison with the listed countries [63]. The amendment to the premium of organic products makes the possibility of their promotion to the Kazakh market even more difficult.

3.4. Prospects for the Development of Organic Farming in Kazakhstan

3.4.1. Organic Rain-Fed Agriculture

One of the basic scenarios for the development of organic farming, seriously considered by the authorities, is the involvement in production of 10 million hectares of the fallow non-productive (including complex) and arid lands of Northern, Western and Central Kazakhstan, withdrawn from circulation in the late and post-Soviet periods during agrarian reform [82]. The main motivation for this is the immutable fact that these lands do not need preliminary bioconversion (on average, it takes 3 years after traditional land use with intensive chemicalization). However, it is also important to understand that although they

will cause a short-term cost increase in OF production, their use will exactly repeat the extensive path of virgin farming based solely on natural agricultural potential.

To intensify production, the first and most important step is the production of products with a higher added value—organic flour and flaxseed oil, i.e., the processing of currently exported raw materials. And if the latter type is not in demand among the local population, then organic flour can become a driver of the development of organic farming, while being supplied both to the foreign market and to domestic consumers. The fact is that dough products are widely represented in the cuisine of the ethnic groups inhabiting Kazakhstan (Table 5):

Table 5. National dishes made from dough of the predominant ethnic groups of Kazakhstan (compiled by the authors).

Ethnic Group	Dishes
Kazakhs	beshbarmak, baursaks, shelpeks
Russians	pancakes, fritters, pies, kulich, dumplings
Ukrainians	pampushki, dumplings, kulich, verguns
Uzbeks	lagman, naryn, samsa, manty, chuchvara, gumma

The processing of organic wheat, in addition to flour, will yield additional products that will expand the range of organic farming exports (cereals and food bran) and create value-added products.

In addition, we should not forget about the current supplies to the foreign market (Italy and Turkey) to produce durum wheat paste, exported from the North Kazakhstan and Kostanay regions. In organic production, these products can become an important export item, subsequently transforming into the export of flour.

Organic agriculture in Kazakhstan, especially in arid areas, could be inspired by that practiced in Australia [83,84] or Spain [85,86].

3.4.2. Organic Irrigated Agriculture

The production of organic products on the irrigated lands of Southern Kazakhstan is currently extremely difficult for a few reasons. Here are the least fertile soils in the country—brown and gray soils with a humus content of 1–2%—which have been used for a long time to produce soil-depleting crops such as cotton, which is possible only with a sufficiently high application of mineral fertilizers by republican standards (71 kg/ha in 2023) [2]. At the same time, these lands receive a minimum level of organic fertilizers in the country—the region accounts for only 9% of the national volume of their application, which is explained by the weak raw material base. The primary measures for the development of organic farming here may be the production of organic corn due to its minimum transpiration coefficient (300) among all cultivated cereals and the insignificant response of the crop to soil fertility. Production experiments in the Almaty region showed an almost 50% increase in the corn harvest when using organic fertilizers [87]. In addition, to saturate the domestic market, it is advisable to produce organic vegetables on irrigated lands, potatoes, sweet peppers, onions and garlic, especially the last two crops actively used in the manufacture of Kazakh national dishes, beshparmak and horse sausages (kazy and shuzhuk), respectively. The Zhetysu and Zhambyl regions are the leaders in their share of organic fertilizers used of the total volume (88% and 97%, respectively). When certifying land, this creates excellent prerequisites for the organization of organic farming in the valleys of the Ile, Shu and Talas rivers, where two crops are harvested per year, which significantly increases the profitability of production. Finally, another additional advantage is the proximity of the markets of Almaty and Shymkent, considering the optimal logistic leverage of product supplies.

3.4.3. The Creation of a Branded Product with OF

At the same time, it is important to realize that in conditions of fierce competition, for successful entry into the world market of organic products, the priority step is to create your own authentic product, considering the experience of neighboring countries [88]. In Kazakhstan, apples of the Aport variety are a similar product. Seedlings of this variety were imported in 1865 into Semirechye (the Vernensky district) from Central Russia. Unfortunately, there is no consensus in pomology about the origin and distribution of the variety: some scientists consider it Turkish, some Polish and others Ukrainian or Russian. In Ukraine, information about the Aport is dated to the 12th century. The time of the appearance of the Aport in Poland is precisely indicated by the famous historian and Catholic hierarchy Jan Dlugosz in *The History of Poland* (1175) [89]. However, it was in Kazakhstan that the mild foothill climate and the evening breeze led to the formation of a local terroir for gardening, ensuring the formation of a product with organoleptic uniqueness, becoming the standard of this apple variety. However, during the post-Soviet period, the country's horticulture and, above all, the production of Aport apples declined, and the mountain gardens on the outskirts of the southern capital, due to the expansion of the boundaries of the union, were cut down. Now, due to the termination of breeding work, there is no accurate information about the remaining number of gardens and their productivity, although it is known that even the most productive gardens at maximum intensity yield 7–8 t/ha in Kazakhstan, against 40 t/ha in countries with developed horticulture (China, USA, Poland, etc.). This not only makes it difficult to organize organic farming on their basis and assess potential exports but in general has led to a catastrophic situation—imports of these products amount to 140 thousand t/year (30%) at USD 1 billion [90], which elevates this to the rank of surreal given the fact that it is the territory of the foothills of the Trans-Ili Alatau of Kazakhstan that is the birthplace of the domesticated apple tree.

Greenwashing is becoming a significant risk factor for the emerging domestic market of OF products. Today, there are two types of this problem: network, when consumers who lack awareness of the specifics of the labeling and identification of organic products purchase local non-certified industrial products in supermarkets, sold at low (compared to traditional organic) prices under the non-binding brands "eco", "bio", "organic", "natural", "green", etc. Under such conditions, the unjustified labeling of any product with such terms harms the development of the nascent market of those products that really meet the organic requirements [91]. The second type is market greenwashing, when sellers unlawfully (intentionally or mistaken in good faith) treat vegetable products (potatoes, cabbage, beets, carrots) produced in farms/private subsidiary farms using biological resources as organically fertilized (cattle manure, bird droppings, compost). However, insecticides actively used in parallel with this have become commonplace (to combat the Colorado potato beetle and the white butterfly), posing a serious threat to the sanitary safety of these products, which are uncontrollably sold in the markets of large cities and/or handed over to visiting dealers.

The most preferred tool for the analysis of organic farming and its biologization is SWOT analysis, a universal method of strategic planning used to assess the phenomena and factors influencing the course of a process. All the phenomena and factors, to some extent related to the development of the industry, are conditionally divided by us into four categories: Strengths, Weaknesses, Opportunities, Threats (Table 6).

Reducing the amount of applied mineral fertilizers contributes to the accumulation of organic matter in organic farming systems, and accordingly, carbon deposition in agricultural soils is determined by a complex of mineralogical, structural, physicochemical and biological factors [92,93]. An increase in the content of organic matter in the soil causes the accumulation of basic plant nutrients. (N, P, K, S, Ca, Mg) and microelements that are necessary for plants [94,95].

The analysis shows that Kazakhstan has all the necessary agro-climatic and bioecological conditions for the development of sustainable OF, both on rain-fed and irrigated arable land.

Table 6. SWOT analysis of ecological and economic development of organic farming in Kazakhstan.

Strengths (S)	Weaknesses (W)
- An extensive local base of biological resources, both of plant and animal origin, for the production of organic fertilizers in the north of the country; - Relatively low level of chemicalization of agriculture; - Diversified structure of crop production; - Advantageous economical and geographical position in relation to the main sales markets.	- Acute shortage of organic waste on irrigated lands; - The determinant value of climatic factors on the yield of rain-fed arable crops; - Low level of "healthy food culture"; - Localization of domestic demand in megacities with high solvency of the population; - Lack of effective targeting of organic products; - Lack of certified enterprises; - Acute shortage of qualified managers; - High cost of organic products with lower yields; - Institutional barriers and lack of government support for "organic" farms.
Opportunities (O)	**Threats (T)**
- Maximum marginality of organic products; - Fast-growing global market amid the popularity of organic products; - High exportability of products; - Vast areas of fallow lands suitable for the cultivation of organic products without prior preparation.	- The unaffordable cost of the current product for the domestic consumer; - The market for current products is limited to European countries with high sanitary and certification requirements; - A decrease in fertility (a negative balance of humus and biogenic elements) due to the eventual transition to "green" technologies.

4. Conclusions

Currently, there are no objective prerequisites for the large-scale development of OF in Kazakhstan. Limited production of legumes and oilseeds is concentrated in the north of the country within the black earth zone, but even this, depending heavily on agro-climatic conditions, varies significantly by year. With the most optimistic forecast, in addition to the current lands of Northern Kazakhstan, the localization of production will be limited to the suburban lands of megacities and (in the very long term) large regional centers, gravitating towards the centers of production of biological resources for measures increasing soil fertility—nearby large livestock (dairy) farms and poultry farms. The institutional framework in the form of laws and by-laws, as well as an industry association that would coordinate local producers and form a local sales network, is not effective and needs to be transformed towards adaptation to the local conditions, primarily providing for a system of subsidies to producers of organic products. This will help to form a transitional model for the development of organic farming in Kazakhstan to gradually implement high European standards.

In conclusion, the following conclusions can be drawn:

1. Currently, OF in Kazakhstan is a trivial recursive entrepreneurial ecosystem, limited to the production of low-margin (unprocessed) products, fully oriented toward the external (European) market. Unfortunately, a sustainable organic product capable of creating high-value exports has not yet been achieved.
2. Due to the above-mentioned features of the national mentality and food culture, as well as the ethnic structure of the population, organic products of not only plant but also animal origin are not popular; therefore, they are not in demand, at least among three-quarters of the country's population. At the same time, the gastronomic preferences of the largest ethnic groups of the country revealed in this work make it possible not only to increase the production of existing types of organic farming products but also to expand the range of cultivated crops.

3. The most important measure of the codification of organic legislation should be the rejection of the mandatory certification of organic products. According to world practice, the object of certification is organic production processes but not the final product. This step will reduce the cost of production and avoid additional financial burden on farmers, especially small farms.
4. An eventual option for the long-term development of Kazakhstan is for it to enter the world market with its own authentic product. Of course, the most important opportunity for organic farming in Kazakhstan is to intensify efforts to develop organic exports to the EU. However, it will require communication activities to bring the benefits of these products closer to EU consumers, taking into account their quality requirements. At the same time, the formation of the domestic market requires large-scale sociological research to determine gastronomic needs and preferences, primarily those of the indigenous population, as well as targeting and promotion of organic products to generate sustainable demand among the high-income population.

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