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Sustainability Transition in the Polish Agri-Food Sector—Why Does Organic Food Production Develop So Slowly?

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Abstract

The purpose of this research was twofold. Firstly, it aimed to indicate factors hindering and accelerating the development of organic food as a niche innovation in Poland. Secondly, to depict a phase and a pathway of sustainability transition in the Polish agri-food sector. The analysis was performed taking advantage of the multi-level perspective on socio-technical transitions, which has not been used to analyze the sustainability transition in Poland so far. Data were collected through a systemic literature review. Organic food production is a slow-growing niche in Poland, and the sustainability transition from the current dual agri-food regime consisting of small family farms and intensive food production is at a take-off phase. Organic food production struggles to become a regime with short food supply chains and agroecology, and the number of barriers it faces outweighs the number of enablers for its development. A de-alignment and re-alignment transition pathway can be observed. Which niche innovation becomes dominant depends on changes in regulations and on the development of both local marketplaces and online sales channels. The major conclusion is that in order for the transition in the Polish agri-food sector to happen, it should be better governed. Specifically, we need new policy instruments and governance mechanisms, new financing schemes, alternative and hybrid organizational and ownership structures, and institutional and transformative change approaches.

Keywords: transformation; multi-level perspective; Polish economy; agri-food sector; transition pathways; organic food; innovation for sustainability

1. Introduction

Environmental problems, like climate change, loss of biodiversity, or depletion of resources, are accompanied nowadays by large societal problems caused by unsustainable consumption and production patterns in many socio-technical systems, like electricity, heat, and mobility, as well as in the agri-food sector [1]. These problems have proven to be unsolvable using any incremental changes or technological repairs. Only a radical shift to a new socio-technical system called the sustainability transition may help [2]. This phenomenon is often called socio-technical transition, as it involves not only technological modifications but also changes in structure (organizations, institutions), culture (norms, behaviour), and practices (routines, skills) [3].

Studies in the field of sustainable transition in the agri-food sector mostly aim to conceptualize and explain how radical changes can occur so that societal functions may be fulfilled. Interestingly, more emphasis has been placed on interactions between multiple technologies or niches rather than on single innovations lately [4,5], as well as on how to accelerate the speed of transformation [6,7]. Apart from answering the current societal

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problems, one of the strongest advantages of sustainability transition research is that it allows one to see the "big picture", as it is interdisciplinary and does not focus on single dimensions or one social group but rather aims to boost enthusiasm and creativity [1].

The agri-food sector includes all processes related to agricultural raw materials, food production, and utilization. Transitions in agri-food systems are not rare. Many were initiated by technical innovations like mechanization or robotization, as well as societal innovations like the emergence of cooperatives. They led to not only improving or optimizing the system but also to the emergence of a completely new one, whose technical and non-technical parts experience important changes [1]. Currently, the highest risks faced by the agri-food sector are connected with the intensive use of synthetic chemical fertilizers and pesticides, as well as poor dietary habits, which increase health concerns. In addition, climate changes cause food insecurity and natural resource degradation.

Organic food production is a niche innovation that is eminently a sustainable agri-food system [8]. Therefore, many scholars and practitioners want it to become a part of the present socio-technical system, and in some countries like Belgium, it has happened [9]. As this radical change decreases societal problems, it has become one of the major tools to make the European agri-food sector more sustainable. The European Commission [10] in the Green Deal's Farm to Fork Strategy set the target of having at least 25% of the agricultural land across the EU under organic farming in 2030. The share of the agricultural area under organic farming is interpreted as a statistical determinant of the state of development of agriculture [11]. According to the European Environmental Agency's latest report [12] in 2021, this share was only 9,9%, and assuming the present rate of growth, the aim will not be met. The only country in which it did not increase during 2012–2021 was Poland. While in the majority of Global North countries this category has gained importance, in Poland, it seems to be a disappearing niche.

The agri-food sector plays a significant socio-economic role, as the share of manufacturing of food products and beverages in all manufacturing in 2022 regarding persons employed amounted to 15.91% and regarding value added amounted to 17.17%. In 2022, the Polish share in EU food and beverage processing regarding the number of people employed amounted to 9.8%, giving Poland fifth place in the EU after Germany, France, Spain, and Italy. Regarding value added, the share was only 6%, which gives Poland sixth place, also after the Netherlands, and indicates productivity loss [13]. In 2023, the area of Poland was 31.39 mln ha, and the utilized agricultural area (UAA) covered 14.62 mln ha, which constitutes 46.6% of the Polish area and 9.1% of the EU27 UAA [14]. This puts Poland in the fourth place in the EU27 after France, Spain, and Germany.

In 2023, 555 thousand hectares in Poland were under organic farming (including fully converted and under conversion) compared with 656 thousand hectares in 2012, representing a decline of 15.4% [15]. With organic accounting for 3.5% of total UAA, Poland is among the five EU countries with the lowest shares of organic area. The country's target for 2030 has been set at 7%. In 2020, the only country that had already exceeded the EU's goal for 2030 was Austria (25.7%). Other leading countries were Estonia (22.1%), Sweden (22.4%), Italy (15.7%), and Czechia (15.3%). Organic farming accounted for the smallest shares of agricultural area in Ireland (1.66%), Bulgaria (2.3%), Poland, Romania (3.6%), and the Netherlands (4%). When comparing changes in the share of organic farming in total UAA between 2015 and 2023, the highest increases were observed in Austria (by 5.4 percentage points), Denmark (5.1 p.p.), France (4.2 p.p.), and Italy (4.2 p.p.), whereas Poland and Bulgaria recorded decrease of less than 1 percentage point [16]. Interestingly, in 2020, the highest shares of organic farming in total EU agricultural area were in France (17.1%), Spain (16.6%), Italy (14.2%), and Germany (10.8%) [17].

Many researchers have investigated the reasons why organic farmers in Poland discontinue their activities [18–20]. They identify the following factors as the most important: the end of a five-year period of financial support, burdensome bureaucracy and inspections, high production costs, insufficient levels of support, low yields, and unprofitable production. Although numerous studies explore opportunities for further development of this innovation e.g., [21], there is a lack of broader research examining organic food as a niche innovation from the perspective of sustainability transitions. In the literature, many such studies exist for other countries, e.g., [8].

In this context, we formulated three research questions:

- What are the enablers and barriers for organic food production as a niche innovation in Poland?
- On which phase of development is the transition in the Polish agri-food sector?
- Which transition pathway can be observed in the Polish agri-food sector?

Consequently, the main objectives of this paper are as follows:

- To identify factors that accelerate or hinder the development of organic food as a niche innovation in Poland;
- To depict the sustainability transition phase and pathway in the Polish agri-food sector.

Our contribution to the literature is twofold. First, we introduce a multi-level perspective to analyze the Polish agri-food sector sustainability transition. In our view, this perspective helps to shed more light on the core of the transition process in the sector. Second, we conducted the first systemic literature review of the sustainability transition in the Polish agri-food sector. The remainder of the paper is structured as follows: Section 2 describes the methodological approach of this study; Section 3 presents the results; Section 4 discuss them; and Section 5 concludes.

2. Materials and Methods

There are different research perspectives on transitions. Gottschamer and Walters [22] categorized them into top-down and bottom-up analytical frameworks. The first includes large-scale historical studies, such as the multi-level perspective [23], strategic niche management [24], and transition management [25,26], as well as meta-analyses [27], transition pathway typologies [28], and innovation system studies [29]. The second relies on in-depth case studies at scales ranging from regional to supra-national [1]. In our analysis, we adopted the top-down approach, specifically the multi-level perspective (MLP) and transition pathways typologies. Importantly, transition pathways typologies focus on expected futures, unlike visions and pathways of transitions created by stakeholders, which concentrate on desired futures.

The MLP was chosen because it is the most widely used analytical framework for understanding dynamic processes in sustainability transitions [1,23,30,31]. These transitions unfold through interactions across three heuristic and analytical levels: niches, the socio-technical regime, and the socio-technical landscape. The regime consists of sets of rules and routines that define the dominant way of conducting business. It is characterized by path-dependent stability and is often locked in, which hinders radical change. Transition are changes from one socio-technological regime to another, and tensions between stability and change lie at the core for this framework. The landscape represents a broad exogenous environment beyond the direct influence of niche and regime actors. It includes factors affecting the incumbent regime through slow-changing trends (such as population growth, pollution, climate change, and urbanization), as well as exogenous shocks that are minimally influenced by the incumbent regime (such as wars, political and economic crises, and accidents) [32]. Landscape is shaped by macro-economic forces, deep cultural

patterns, and macro-political developments. Changes in the landscape typically unfold over decades.

Alternatives develop in niches, which are protected spaces that facilitate experimentation with novelties. Initially, innovations emerge as unstable socio-technical configurations with low performance, and niches provide incubation space that protects these novelties from mainstream market selection. Developments in the landscape exert pressure on the regime, potentially causing cracks, tensions, and windows of opportunity. Interactions between niches and the regime can be observed in markets, regulations, cultural meaning, and technologies. System transformation is driven by change agents and occurs as an outcome of mutually reinforcing processes of destabilization and the upscaling of innovations within niches. Actors navigate transitions by fighting, negotiating, searching, learning, and building coalitions [1].

In the next step, we identified the transition phase in which the Polish organic sector currently resides. According to multi-phase theory, the following transition phases can be distinguished: pre-development, take-off, acceleration (breakthrough), and stabilization [33]. In the pre-development phase, new innovations have only a limited influence on the system. During the take-off phase, the system becomes unstable due to rapid and conflicting changes, creating "windows of opportunity" for new developments to enter the system. In the acceleration phase, accumulations of physical, economic, socio-cultural, and institutional changes occur, while in the final phase, the system reaches a new dynamic equilibrium.

Typologies of transition pathways have been developed as elaborations of the MLP, e.g., [28,34,35]. Taking into account the different timing and nature of multi-level interactions, Geels and Schot [28] identified the following transition pathways: transformation, reconfiguration, technological substitution, and de-alignment and re-alignment. In the transformation pathway, when innovations in a niche are not sufficiently developed, moderate pressure from the landscape on the regime changes the direction of development paths and innovation activities. In the reconfiguration pathway, similar innovations address local problems within the regime, leading to its incremental adjustments. In the technological substitution pathway, significant landscape pressure enables the replacement of the existing regime by sufficiently developed niche innovation. In the de-alignment and re-alignment pathway, large landscape changes coincide with insufficiently developed niche innovations, causing regime erosion and competition among multiple niche innovations.

To analyze the sustainability transition in the Polish agri-food sector, we selected–somewhat arbitrarily–one niche and conducted the analysis through its lens. This niche was organic food production, as organic certification is commonly regarded as a marker of sustainable production, and organic farming is one of the most widely recognized sustainable models of agricultural production [36].

The study is based on secondary data collected through a systematic review of scholarly articles following the PRISMA guidelines [37]. The search was conducted on 23–24 July 2024 using the Social Sciences Citation Index (SSCI) database of Clarivate Analytics Web of Science, and it focused on articles published in the period 2015–2024. Various keywords were used to cover all relevant search themes, as presented in Table 1 (column: search string). The wildcard character asterisk (*) was employed to capture multiple word endings and spelling variants within the search strategy.

A total of 316 records were identified through database searching. After removing 23 duplicates, 293 records remained. The abstracts of these articles were screened, with the inclusion criterion being the relevance of their conclusions to the study. When two or more articles addressed similar subjects, only the one with conclusions most pertinent to the MLP analysis of transition or to the identification of transition phase and pathway

was included. Using this approach, 190 articles were excluded. Ultimately, 103 studies were included in the qualitative synthesis. No full-text articles were excluded. In total, 213 articles were excluded.

The analysis and assessment of the gathered information were conducted through the lens of MLP, as adapted to the agri-food sector by El Bilali [38]. According to this framework, the Polish agri-food system was divided into three levels: socio-technical landscape, socio-technical regime, and niche. Subsequently, the transition phase and pathway were inferred. Additionally, the analysis was supplemented with the most recent quantitative data from various databases, institutional articles, and reports collected through Google search engine. The main challenge lies in integrating results from studies differing in time, space, and thematic scope and assessing their relevance to the MLP analysis of transition in the Polish agri-food sector, as well as to the identification of transition phase and pathway. To minimize the risk of bias affecting the cumulative evidence, the review was conducted by a single researcher with many years of experience observing transition processes in the European agri-food sector through the MLP.

As shown in Table 1, the majority of the articles included in the analysis focused on organic agriculture in Poland (22) and diet and lifestyle (20), highlighting the importance and awareness of issues in these areas. The least attention was given to the following themes: environment footprint in Poland (2), impact of climate change on Polish agriculture (2), and food policies in Poland (4). Only five included articles addressed the theme of sustainability transition in Poland, indicating that much remains to be explored in the field. Moreover, the highest number of records was identified for the search theme diet and lifestyle in Poland, which aligns with the broader trend of moving away from a narrow focus on the agri-food sector toward a comprehensive food system perspective.

To present a comprehensive picture of the sustainability transition, the research was dived into two parts. The first part addressed one research question, while the second part focused on the remaining two. First, within the MLP framework, the following elements are described based on a review of journal articles: landscape factors, regime elements, and the organic food niche. The analysis of the niche level includes the SWOT (strengths, weaknesses, opportunities, and threats) analysis of organic food production in Poland. Second, the maturity of organic food production is assessed, and the transition pathway is identified. The obtained results are then discussed and concluded.

Table 1. Summary of literature search carried out in Web of Science database.

No.	Search Theme	Search String	Number of Records Identified	Number of Selected Records	References to Selected Records
1	Agricultural policies in Poland	(Poland OR Polish) AND agricultur* AND polic*	19	9	Siemiński and Krukowski, 2018; Kiryluk-Dryjska and Baer-Nawrocka, 2021; Stępien et al., 2023; Ściubel, 2021; Smędzik-Ambroży et al., 2019; Bilewicz et al., 2022; Czyżewski et al., 2020; Wiśniewski et al., 2021; Zieliński et al., 2021 [39–47]
2	Food policies in Poland	(Poland OR Polish) AND food AND polic*	5	4	Romaniuk, et al. 2022; Chmieliński and Wieliczko, 2022; Zielińska-Chmielewska et al., 2023; Jurkowska-Gomutka, 2018 [48–51]
3	Agri-food system in Poland	(Poland OR Polish) AND (agri-food OR agro-food OR agrifood OR agrofood)	11	6	Hagemajer et al., 2021; Ambroziak et al., 2023; Bułkowska and Bazhenova, 2023; Pawlak and Smutka, 2022; Wiśniewska-Paluszak and Paluszak, 2021; Stokłosa et al., 2019 [52–57]

Table 1. *Cont.*

No.	Search Theme	Search String	Number of Records Identified	Number of Selected Records	References to Selected Records
4	Diet and lifestyle in Poland	(Poland OR Polish) AND (diet OR nutrition)	160	20	Jeżewska-Zychowicz and Plichta, 2022; Myszkowska-Ryciak and Harton, 2018; Rejman et al., 2020; Janowska-Miąsik et al., 2021; Korzycka et al., 2020; Znyk et al., 2024; Domosławska-Żylinska, 2024; Szczebyło et al. 2022; Laskowski et al., 2018; Grajek et al., 2022; Żarnowski et al., 2022a; Żarnowski et al., 2022b; Pańczyk et al., 2023; Merkiel et al., 2016; Gołębiewska et al., 2023; Myszkowska-Ryciak and Horton, 2018; Jończyk et al., 2016; Wądołowska et al., 2021a; Wądołowska et al., 2021b; Jończyk et al., 2021 [58–77]
5	Environment footprint in Poland	(Poland OR Polish) AND footprint	10	2	Stępniewska, 2015; Wróbel-Jędrzejewska et al., 2024 [78,79]
6	Food security in Poland	(Poland OR Polish) AND food security	8	5	Buko et al., 2021; Kuczuk and Widera, 2021; Łaba and Olech, 2023; Skawińska and Zalewski, 2021 [80–83]
7	Food waste in Poland	(Poland OR Polish) AND (food waste OR food wastage)	18	7	Ankiel and Samotyja, 2021; Bilska et al., 2018; Bilska et al., 2020; Jungowska et al., 2021; Nicewicz and Bilska, 2022; Tomaszewska et al., 2020; Zębek i Žilinskienė, 2021 [84–90]
8	Impact of climate change on Polish agriculture	(Poland OR Polish) AND climate change AND agricultur*	4	2	Michalak, 2020; Pawłowski et al., 2021 [91,92]
9	Organic agriculture in Poland	Poland AND (organic farming OR organic agriculture)	41	22	Antczak, 2021; Baer-Nawrocka and Błocisz, 2018; Berbeć et al., 2018; Chmieliński et al., 2019; Gołaś, 2016; Jezierska-Thole et al., 2017; Kobylińska, 2021; Łuczka et al., 2021; Łuczka and Kalinowski, 2020; Kołoszko-Chomentowska, 2015; Kociszewski et al., 2020; Kociszewski, 2022; Mazurek-Kusiak et al., 2021; Miśniakiewicz et al., 2021; Podawca and Dąbkowski, 2020; Sadowski et al., 2021; Smoluk-Sikorska and Malinowski, 2021; Sobocińska et al., 2021; Szczech et al., 2018; Śpiewak, 2016; Zieliński et al., 2024; Żakowska-Biemans and Takien, 2017 [19,36,93–112]
10	Organic food in Poland	Poland AND organic food	19	14	Bryła, 2016; Bryła, 2017; Bryła, 2018; Dudziak and Kocira, 2022; Dziuba, 2023; Dziuba and Szczyrba, 2023; Hermaniuk, 2016; Kazimierczak, et al. 2024; Kowalska et al., 2021; Kowalska et al., 2023; Mazur-Wlodarczyk et al., 2024; Radzyminska and Jakubowska, 2019; Smoluk-Sikorska et al., 2024; Wojciechowska-Solis and Soroka, 2017 [113–126]

Table 1. *Cont.*

No.	Search Theme	Search String	Number of Records Identified	Number of Selected Records	References to Selected Records
11	Power, governance, and politics in Polish agri-food sector	(Poland OR Polish) AND (agricultur* OR food OR agri-food OR agro-food) AND (institution* OR govern* OR politic* OR power)	10	7	Beckmann et al., 2016; Fałkowski et al., 2017; Fałkowski, 2018; Havrysh et al., 2021; Mroczkowska, 2019; Prové et al., 2016; Walkowiak, 2021 [127–133]
12	Sustainability transition in Poland	Poland AND sustainability transition	11	5	Cholewa et al., 2022; Rybak and Włodarczyk, 2023; Skrzypczyński et al., 2021; Wrzaszcz, 2018; Żuk and Pacześniak, 2020 [134–138]

3. Results

3.1. Multi-Level Perspective on the Agri-Food Sector Transition

3.1.1. Landscape Factors

On one hand, socio-economic and environmental landscape factors put pressure on the regime, creating opportunities for niche innovations to develop and spread within the existing regime. On the other hand, the landscape also protects niche innovations, providing them with space for development [32]. Current landscape developments in Poland are substantial and divergent. So far, they have primarily concerned health and climate issues, but in recent years, rising energy and raw material prices have become increasingly significant. These developments are consequences of the Russian invasion of Ukraine in 2022. The blockade and disruption of Ukraine's exports via the Black Sea altered routes and logistics. A sharp increase in Ukrainian agri-food imports into the EU affected supply and price levels. Reduced cultivation areas in Ukraine, lower harvests, and damaged infrastructure have caused market volatility across the region. Specifically, in 2022, imports of agri-food products from Ukraine to Poland nearly tripled in value compared to 2021, increasing competitive pressure on Polish producers [54].

Moreover, following the outbreak of the war, natural gas prices in Europe reached all-time highs. In 2022, European wholesale gas prices rose by 163%, driving up the costs of electricity, heating, and industrial production. Wholesale electricity prices increased by 125% in the same year [139]. Higher gas prices also raised the costs of fertilizers, fuel, energy-intensive food processing, and agricultural production, contributing to higher food prices. In Poland, fertilizer prices doubled in 2022 [140]. Consequently, Poland recorder one of the fastest food price increases in the EU, with year-on-year inflation of food and beverages reaching 24% in February 2023 [141].

On the other hand, purchase prices of basic agricultural produces in December 2023 were approximately 19.6% lower year-on-year [142]. One year later, they were 9.6% higher year-on-year, demonstrating cyclical fluctuations. However, in the second quarter of 2024, Poland recorded the largest drop in agricultural products prices, at 12% [143]. It should also be noted that although gas, electricity, and fuel prices in Poland decreased in 2023–2024, they remained above pre-war averages [144]. In summary, due to major changes in prices, competition, and trade structures, dividing the analysis into pre-war and post-war periods appears to be the most accurate and analytically sound approach. After the invasion, the cost structure in the agri-food sector changed dramatically, and the prices of energy, fertilizers, fuel, agricultural products, and consumer prices of food became more volatile.

These changes negatively impacted the economic situation of farmers as well as a portion of society.

Before the war, climate change, water scarcity, and health problems were undoubtedly the most important factors shaping the Polish agri-food system. An increasing number of people live in cities, which contributes to higher dietary carbon footprints. Poland is the fourth-largest emitter of greenhouse gases (GHGs) in the European Union [145], primarily from the energy sector, transportation, and industrial activities. In 2023, agriculture represented about 9.8% of national emissions.

Water resources are very limited, as 97% of them come from rainfall and a large share is lost as a result of leakages and waste. Moreover, because Poland is located within the drainage basins of two major rivers (the Oder and the Vistula), flooding has become a significant natural risk. Approximately 22% of surface water bodies are affected by pollution, mainly due to nutrient runoff from agriculture and inadequate treatment of municipal and industrial waste [146]. Through the instruments of the Common Agriculture Policy (CAP), Polish farmers are encouraged to take appropriate actions and avoid harmful practices when managing the impact of climate change on water resources [91].

The prevalence of non-communicable diseases (NCDs), such as heart disease, cancer, chronic respiratory disease, and diabetes, is steadily increasing. The weakest aspects of Poland's healthy food policies are the food labelling system and training for individuals involved in school nutrition [48]. Both children and adults suffer from malnutrition, e.g., [71,73]. Education can positively influence the quality of nutrition, as can improved legal nutritional regulations [59].

The intensity of mineral fertilizer use has increased, which reduces the amount of organic matter in the soil. For the agricultural year 2022/2023, preliminary data indicate that the average amount of mineral fertilizers (nitrogen, phosphorus, potassium) applied per hectare of agricultural land was 121.9 kg [147]. In 2018, among 28 EU countries, the highest consumption of mineral fertilizers per hectare was recorded in Belgium, Luxembourg, the Netherlands, and Poland [148]. In Poland, it amounted to 177.6 kg/ha, indicating a decrease in recent years. Moreover, in 2023, Poland's share of total EU mineral fertilizer use was approximately 12.3%, while the country accounted for about 9% of EU arable land [140]. In 2023, the countries with the highest use of phosphorus-based fertilizers in agriculture were France, Poland, Germany, Spain, Italy, and Romania, collectively accounting for nearly three-quarters of the EU's total use. The use of nitrogen-based fertilizers in agriculture was highest in France, Poland, and Germany [149].

Another landscape factor is related to high agricultural residuals and food waste, although the situation in recycling and waste management has improved. Electricity and thermal energy are produced from the biomass of catch crops [92], while the utilization of food waste supports cleaner production and a circular economy [57]. Nevertheless, in Poland, 9.2 million tons of food is lost annually, 53% of which is generated by consumers [86]. The main factors contributing to food waste include over-purchasing, often driven by susceptibility to promotions, the tendency to stockpile, and a lack of prior planning [87].

Following EU accession in 2004, rural living conditions improved, along with the level of mechanization, agricultural output, and revenues. The most significant weakness is the low level of R&D expenditure in bioeconomy sectors, whereas the greatest strength is the large number of newly active entities implementing innovations, supporting the bioeconomy, and fostering cooperation between science and practice [49].

With the Russian aggression, the nature of landscape pressure appears to have changed. The economic situation of farmers has worsened, as prices of agricultural products continue to fall while input prices continue to increase. Although food inflation in Poland during

the period 2015–2023 amounted to 42.6% (producer prices in the manufacturing of food products, beverages, and tobacco products) [150], the situation among food producers was heterogeneous, as this group also faced rising costs, primarily for energy and animal feed. Due to high inflation (with the price index increasing by 42.8% between 2015 and 2023), consumer purchasing power declined despite rising average wages. In response, the Polish government expanded social transfers and introduced various support programmes aimed at stabilizing demand. However, these measures contributed to additional inflationary pressures. As a result, Green Deal solutions were abandoned or postponed, holding back their positive impact on Europeans' health and climate change mitigation.

Regarding future scenarios, even without considering the consequences of the war beyond Poland's eastern border, climate projections are not optimistic. By the end of the century, sea levels are expected to rise, which will threaten deltas, reduce harvests and food supplies, and increase food prices. Many NGOs are pressuring governments to take coherent, global-scale action without shifting responsibilities or consequences onto other countries. In particular, numerous international environmental and health organizations are pressuring the European agri-food sector regime to enhance its sustainability. Moreover, to remain competitive in the face of Ukrainian products entering the EU market and the growing awareness of the impact of nutrition on health, Polish agri-food sector stakeholders seek to ensure that Ukrainian products comply with safety standards while enhancing the quality of Polish products.

3.1.2. Regime Elements

The socio-technical regime refers to the current situation with respect to industry, markets and user preferences, policy, technology, culture, and science [28]. Following Kamel and El Bilali [8], we analyzed the socio-technical regime from production, institutional, and social perspectives. Regarding production, the most important issue is the declining number of mixed crop-livestock farms, while the majority of Polish farmers operate small family farms, which is often indicated as the main barrier to agricultural transformation in Poland. The reasons for their limited development include difficult access to large retailers, which prefer cooperation with bigger enterprises, underinvestment, poorly developed marketing channels, and weak extension services.

The regime is characterized by intensive milk and poultry production and high wheat exports. In 2023, the agri-food sector contributed approximately 12% of GDP [150] and 14.7% of exports [151]. Around 7.6% of the workforce in 2023 was employed in agriculture, highlighting the sector's substantial role in the economy [152]. Poland has one of the largest food processing industries in the EU, with key sectors including meat, dairy, beverages, confectionery, baking, and processed fruit and vegetables. Polish export products are gaining importance, and their quality is steadily improving.

The institutional dimension comprises physical and institutional infrastructure. Regarding physical infrastructure, the number of facilities and equipment, such as laboratories, mechanization, and recycling facilities, has increased thanks to EU funding. In contrast, institutional infrastructure is characterized by overly complex laws, bureaucracy, detailed and restrictive surveillance of production process, low coordination among different system actors and institutions, a lack of extension services, and limited implementation of sustainability transitions.

The social dimension can be characterized by poor dietary habits and a high intake of calorie-dense foods, driven mainly by large discount retailers and the increasing pace of life, rather than by a lack of knowledge. Clearly, to increase the purchase of organic products, greater encouragement and education of the youngest generation are necessary.

Knowledge and practices should be primarily improved in the following areas: storage of food products, improper thawing, and heating of dishes [82,83].

Table 2 presents the elements and main actors at the landscape, regime, and niche levels in the Polish agri-food sector. At the regime level, international actors operate and influence the environmental and socio-economic landscape factors affecting the Polish agri-food sector. These factors, in turn, exert pressure on national regime actors to implement change. Numerous niche innovations can be observed in Poland, including organic food production, organic agriculture, agroecology, short food supply chains, urban agriculture, permaculture, community-supported agriculture, and regenerative agriculture. Many Polish private organizations that promote and popularize these innovations act as national niche actors, responsible for facilitating regime penetration. The regime, in turn, often resists the expansion of these innovations. The emerging agri-food system is expressed through new visions and expectations, evolving norms and beliefs, and ongoing learning and experiments.

Table 2. Summary of elements and main actors constituting landscape, regime, and niche in the Polish agri-food sector.

Three Levels of the MLP	Main Factors and Actors	
Landscape	Environmental and socio-economic factors: Climate change Water scarcity Food waste Agricultural land degradation Health problems, pollution, and urbanization War, costs increase, and social instability Inflation and economic instability.	Large and divergent landscape developments. Health and climate issues gaining importance. Increasing prices of raw materials connected with the Russian aggression in Ukraine have a negative impact on financial situation of farmers.
Regime	Conventional agri-food sector: Production side: small family farms domination; the intensive production of milk and poultry and the high export of wheat. Institutional side: physical infrastructure improved with EU funds; too complicated laws and bureaucracy. Social side: poor dietary habits and high intake of high caloric food.	Regime international actors: International pesticide companies International retailers Multi-national food companies operating in Poland Multi-national financial groups. Regime national actors: Ministry of Agriculture and Rural Development Faculties of Agriculture and Food Conventional private-sector farms/companies Conventional inputs producers (e.g., pesticides, fertilizers) National financial institutions.
Niche	Many niche innovations: organic food production, organic agriculture, agroecology, short food supply chains, urban agriculture, permaculture, community supported agriculture, regenerative agriculture. Emerging sustainable food system: new innovations learning and experiments new visions and expectations new norms and beliefs.	Niche international actors: FAO EU institutions IFOAM International organic importers. Niche national actors: Ministry of Agriculture and Rural Development Agricultural and Food Quality Inspection Agricultural Advisory Centre in Brwinów Agency for Restructuring and Modernization of Agriculture R&D: agricultural universities, 13 national research institutes, Polish Academy of Sciences Non-governmental organic organizations and associations Private-sector farms/companies.

As can be observed, governmental institutions simultaneously protect the current regime and act as intermediaries of new niche innovations. Although many initiatives undertaken by the Polish Ministry of Agriculture and Rural Development (and its subordinate institutions) aim to promote sustainability innovations, non-governmental organizations appear to lead the way. Examples include Food Rentgen, Dobrze Cooperative, the Polish Chamber of Organic Food, the Living Earth Coalition, the Organic Agriculture Forum, the Polish Agroforestry Association, Demeter, the AgriNatura Foundation, CoopTechHub, the MOST Cooperative Urban Farm, the social movement Science for Nature.

3.1.3. Organic Food Niche

Between 2012 and 2022, the share of the total organic area in the EU's total UAA increased from 5.9% to an estimated 10.5%. During the same period, the total organic area in Poland decreased by 15.4%, while increases of 305.5% and 278.4% were recorded in Croatia and Portugal, respectively. It appears that organic food production in Poland may be considered a declining rather than a significant niche. In 2023, there were nearly 24 thousand organic producers in Poland, including farmers, processors, feed producers, and importers [153]. In 2020, 84% of these producers held organic certificates, and 80% focused solely on crop production, while 20% produced livestock. The highest-value products included cereals, milk, milk processing and cheese making, fruits, and vegetables [11].

Organic food production in Poland is subject to EU legislation and relevant national regulations, with 13 control authorities operating in the sector. Certification and inspection procedures are conducted in accordance with EU regulations. These procedures and certification bodies are supervised by the Agricultural and Food Quality Inspection. The main organic niche actors facilitating regime penetration and development are national and non-governmental organic associations. The role of organic food in addressing landscape challenges is recognized by government institutions such as the Ministry of Agriculture and Rural Development and the Agricultural Advisory Centre in Brwinów. Numerous private-sector actors, both national and international, are also involved. Studies on organic agriculture and food production have begun to emerge at public universities, such as the Warsaw University of Life Sciences and the University of Warmia and Mazury in Olsztyn. The number of researchers specializing in more specific areas of organic farming, such as biocontrol or fertilization, is increasing.

To evaluate the potential of the organic food niche to become the part of the regime in Poland, a SWOT analysis was conducted. The results are presented in Table 3. It can be observed that the combined number of weaknesses (9) and threads (12) outweighs the combined number of strengths (6) and opportunities (10). This imbalance helps explain the low level of organic niche dynamics within the system. The predominance of structural barriers (market, regulatory, and economic) over enabling factors hinders the development of the niche and limits its penetration into the regime. The current regime appears stable and largely resistant to contemporary trends.

Many articles have addressed the problem of weak development in organic agricultural production and its future prospects. Numerous recommendations have been made, but relatively little has been implemented, particularly regarding regulations and the demand side. In summary, the main barriers to the development of the organic niche are related to market conditions as well as institutional and regulatory factors. Undoubtedly, more supportive policies would create greater opportunities to leverage the potential of Polish organic food production. The study reveals that it is difficult for the organic niche to become part of the regime in Poland, primarily due to a less supportive legal framework compared with other European countries. Coordination of laws and control rules for organic production remains a significant problem. Greater cooperation with farmers during

the law-making process, rather than merely enforcing regulations, is needed, alongside efforts to enhance collaboration among farmers themselves. In fact, it is the limited purchasing power of consumers and the weak bargaining power of organic food producers, rather than a lack of awareness, that constitute the main challenges.

Table 3. SWOT analysis of organic food niche in Poland.

Strengths	Weaknesses	Opportunities	Threats
• organic farmers act as local change leaders and are often the first to understand the economic (niche) and environmental reasons to go organic • high level of knowledge and engagement among producers • established method for attracting consumers for new entrants • opportunities to improve financial conditions and enhance brand image • higher retail margins compared to conventional food • extensive analyses on perspectives for organic farming, with many experts and NGOs interested in the field	• lack of capital for conversion among farmers and processors, as well as management difficulties in SMEs • many producers and processors consider their products healthy enough without certification • misinterpretation of regulations by lower-level officials and inspectors • organic certificates perceived as unreliable, and organic products considered too expensive by consumers • lack of effective networks influencing the nature and level of public support • weak development of organic processing and difficulties in sourcing organic ingredients • no nationwide database of organic producers • weak cooperation among organic food producers in sales and marketing • insufficient levels of support	• opportunities for foreign market expansion • growing interest among consumers, processors, and retailers, including private labels • improved management of the organic transition and better cooperation between public institutions and NGOs • increased availability of EU funds • expanding cooperation among producers, encouraging more food processors to adopt organic practices • further development of local markets • greater cooperation with universities and research institutes • more demonstration farms to showcase organic practices • morel local markets • development of public procurement for organic products	• bureaucracy and poorly designed institutional and legal frameworks • instability of laws applicable to organic farming • weak cooperation between regulatory and control institutions • insufficient promotional support from the Ministry (e.g., limited guidance for local authorities, insufficient highlighting of good practices, inadequate promotion domestically and abroad, lack of organic food options in public catering facilities) • limited advisory support regarding law, economy, contracts, and marketing • insufficient support from local authorities • lack of research on the sustainability transition • increasing costs and risks related to political instability and climate change • change driven more by economic necessity (competition, CAP requirements) than by environmental values • discontinuation of organic farming after the end of subsidies • low social trust and prevalence of greenwashing • lack of a shared vision among producers and other stakeholders

It should also be noted that substantial research is needed in the field of organic plant protection. This area remains underdeveloped and requires scientific and technological innovations to combat emerging pests and plant diseases. Such knowledge is often accessible to experts in organic plant protection and large organic producers, but conventional experts and small- and medium-sized producers typically lack it. Members of the first group frequently maintain their own laboratories and conduct in-house research and development, increasingly utilizing Agriculture 4.0 tools, which combine AI, robotics, sensors, drones, precision machinery, smart inputs, and digital platforms to create more efficient and sustainable food systems [154].

Moreover, new technologies may become a game changer for this niche. However, it is yet unclear how developments such as online sales influence the organic food market. Recently, there has been an abundance of online stores offering healthy food, partly organic.

Farmers engaged in direct selling and small food producers are increasingly interested in showcasing their products at national and local fairs, which are becoming more popular in Poland. Through direct contact, they gain consumers and continue selling online. A disadvantage for organic food producers is that such direct contact can serve as a substitute for an organic certificate. Similarly, trust in online shops selling healthy food may lead consumers to stop paying attention to organic certification.

Another phenomenon is the long-standing practice of purchasing food from close or distant acquaintances or individuals with recommendations, which functions similarly to organic labels. Kowalska et al. [122] noted that food acquired directly from farmers, as well as domestic and local food, represents a major barrier to purchasing certified organic products. The preference for personal recommendations over public labels may be a legacy of communist times or a sign of weak institutional legitimacy. Mroczkowska [131] argued that, due to legislative and political obstacles, farmers retreat into private spheres, engage in bartering, and practice informal food systems, rejecting certain values of modernity.

Maybe the place of organic food in Poland is not as in more developed countries and will never become the mainstream. Its development pattern could simply be different, with no breakthrough expected. Furthermore, the rather negative attitudes of agri-food sector stakeholders, including scientists, consumers, controllers, and conventional and even some organic farmers, regarding the future of this niche suggest that organic production in Poland may remain a niche. Polish consumers are often unwilling to pay extra for higher quality when they can purchase food of satisfactory quality without certification.

3.2. Transition Pathway in the Polish Agri-Food Sector

3.2.1. Development Phase of Organic Food Production in Poland

Organic food production in Poland is growing slowly, but quantitative accumulation has not led to qualitative change. Increases in production volume, cultivated area, and exports of organic food suggest that fertilization and pest control technologies have reached a stage of relative maturity. The existence of political institutions dedicated to organic food (such as the Department of Organic Agriculture and Food Quality within the Ministry of Agriculture and Rural Development) indicates formal political recognition. Another positive development is the emergence of numerous associations providing training for small farmers, as well as conventional companies producing bio-fertilizers and organic plant-protection products. These activities are supported by multiple projects aimed at bioeconomy development in Poland.

The organic innovation niche has moved beyond the pre-development and experimental phase, which was characterized by coalition-building among NGOs, private-sector actors, and public authorities. The pioneering activity can be traced back to the agricultural course led by Dr. Rudof Steiner in 1924 near Wrocław [155]. Currently, further coalition-building is taking place, accompanied by increases in organic land area and in the number of organic farms and processors. However, the development of organic normative institutions, necessary for niche acceleration, has not yet fully occurred. There is also a limited understanding of the ecologies of intermediation and insufficient support for activities and institutions that could act as intermediaries bridging Polish agri-food sector stakeholder and their processes [156].

The organic food production niche is currently in the take-off phase, which is a critical one, as the innovation may remain confined to the niche level, thereby hindering broader sustainability transitions. Without support from incumbent actors and intermediaries, the niche risks stagnation or decline. In the acceleration phase, a novel solution should build up [157] and begin to compete with markets within the incumbent regime [158], while structural changes should become more visible [159], leading to a faster pace of

transition [160]. To date, none of these developments have occurred. The most optimistic scenario would involve stabilization following a successful acceleration phase.

3.2.2. De-Alignment and Re-Alignment Transition Pathway

The transition currently unfolding in the Polish agri-food sector follows a de-alignment and re-alignment pathway. Recent landscape developments may be characterized by low frequency, high amplitude, high speed, and high scope. As a result, actors within the conventional agri-food regime have begun to lose confidence in the stability of the existing system, leading to gradual regime erosion and partial openness to niche innovations. However, the organic niche is not yet sufficiently developed to fully replace the incumbent regime. Consequently, regime substitution remains unlikely in the short term. At the same time, other niche innovations have emerged and are increasingly competing for resources, attention, and legitimacy. The most prominent among them are short food supply chains (SFSCs) and agroecology. Thus, it can be argued that three niche innovations (organic food production, agroecology, and short food supply chains) are simultaneously competing within the Polish agri-food sector. These niches differ from the dominant regime in terms of guiding principles, technologies, user relations, policy and regulatory frameworks, knowledge bases, and cultural meanings, resulting in parallel and competing pathways of potential system reconfiguration.

In this type of transition pathway, the regime is subject to high landscape pressure, which may even pull it apart, as it causes major internal problems and collapses. Incumbents slowly lose confidence in the regime's ability to respond to problems. Consequently, they refrain from defending it and do not significantly increase investments in research and development. Existing rules become destabilised, yet no new and coherent guiding principles, user preferences, selection criteria, or regulatory frameworks emerge. No single innovation is sufficiently mature to fill the gap. As a result, multiple niche innovations coexist in the absence of stable rules, leading to several competing innovation trajectories. This situation is characterized by uncertainty, experimentation, and competition for attention and resources. Ultimately, one niche innovation may become dominant, followed by re-alignment into a new socio-technical regime.

Interestingly, the three main niche innovations identified in the Polish agri-food sector (Figure 1) share several common features. Ten elements define agroecology [161]: diversity, efficiency, recycling, resilience, synergy, human and social values, co-creation and sharing of knowledge, food culture and traditions, circular and solidarity economy, and responsible governance. This niche innovation is steadily gaining importance and market share. While the organic label is often perceived as merely a marketing strategy of large companies rather than an inclusive quality signal, agroecology, often, but not necessarily, associated with an organic label, is attracting a growing number of supporters. Although this segment is considerably smaller than the organic one, it involves creating communities, that "bring together people committed to working on family farming and agroecology-related issues, allowing them to share and co-create information, knowledge, and advice in order to achieve sustainable agriculture and food systems" [162]. This unique mode of operation and development is attractive but often so broad that it has begun to be unprofitable.

Short food supply chains, in contrast, refer primarily to modes of distribution rather than to methods of production. They encompass farmers' markets, farm shops, community-supported agriculture, solidarity purchase groups, and other configurations in which food is transported over short distances or with limited intermediaries. In Poland, leveraging family, friends, and neighbourhood connections is particularly important for obtaining affordable, high-quality food. People appear to trust acquaintances more than EU labelling. This system may embrace agroecology values and does not preclude the use of organic

labels. Nevertheless, food products often come from traditional and family farms near consumers' homes or place of origin, which enhances trust in the producers' reliability. This niche innovation is substantial and has significant growth potential, especially in the era of social media and online sales. However, difficulties in scaling and internationalization limit its further development.

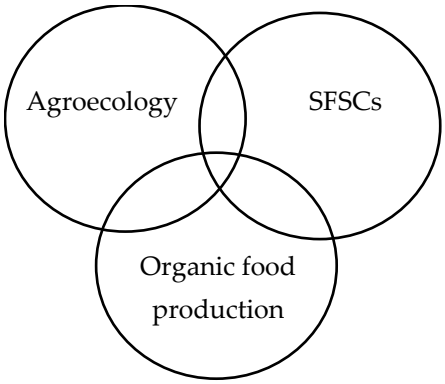

Figure 1. Three niche innovations competing for attention and resources.

4. Discussion

In the study, we sought to explain why the organic food niche develops so slowly in the Polish agri-food sector. Although we identified weaknesses and threads that hinder its development, as well as strengths and opportunities that accelerate it, only the application of the MLP framework made it possible to explain why a broader sustainability transition towards organic food production has not occurred in Poland. There has been neither a radical nor a long-term transformation. Instead, only incremental changes and adjustments have taken place. These changes are not sustainable across all dimensions of sustainability, namely, environmental, economic, social, and political. Conventional networks remain strong and stable.

First, when a transition is characterized by power tensions, conflicts, and disagreements, as is the case in the de-alignment and re-alignment pathway, other innovations may take the lead. Several alternative niche innovations also draw on sustainable production methods. The largest and most promising groups include agroecological producers and those operating within short food supply chains. The former often participate in various quality schemes, and their healthy food production aligns well with their broader lifestyle choices. Moreover, many organic practices overlap with conventional ones, particularly among small- and medium-sized food producers but increasingly also among large producers, who are beginning to recognize the economic benefits of sustainable production. For example, producers use integrated crop–livestock systems, crop rotation, legume cultivation, and intercropping. Importantly, the adoption of these practices has increased, as they have become conditions for receiving higher direct payments.

Nevertheless, efforts devoted to developing organic food production as an innovation niche should not be abandoned. Taking into account food safety considerations and possibilities for international expansion, organic certification appears to be more promising than agroecology and short food supply chains (SFSCs). Moreover, the prospect of signing a trade agreement with the MERCOSUR countries may further encourage the expansion of organic certification, with the aim of gaining a competitive advantage.

At the same time, benchmarking the Polish transition against other EU Member States with more advanced organic sectors will be necessary. According to an audit conducted by the European Court of Auditors covering the period 2014–2022, approximately EUR 12 billion of EU funds were spent on the conversion to or maintenance of organic farming.

A further 15 billion is planned to be allocated by 2027 under the CAP [163]. During this period, five member states accounted for 62% of CAP support for organic farming: Germany, Italy, France, Greece, and Spain, with Germany and Italy each receiving more than EUR 1.5 billion. Poland ranks seventh, with support amounting to less than EUR 0.5 billion. As the fourth-ranked country in the EU27 in terms of UAA, Poland should be able to anticipate higher levels of support.

The slow growth of organic farming in Poland despite the availability of funding indicates inefficiencies in the support. It may be insufficient or inadequately designed. In many countries, in order to help organic food producers offset the higher production costs or transitional losses associated with organic conversation, governments offer not only financial subsidies but also extended advisory services, certification incentives, and support along the supply chain. This is not the case in Poland, where supply chains remain poorly developed and advisory services have been awaiting reform for many years.

What is also lacking in Poland, compared to other EU countries, is stability and predictability, which often matter more than subsidies. Long-term planning, sustained commitment, and comprehensive support, including market development, certification, processing, and demand simulation, are urgently needed for organic farming to move beyond a niche status. The Polish agri-food sector requires a much more supportive framework for organic food production. This should include reliable and sufficiently high area-based payments for conversion and maintenance, support for certification, inspection and compliance costs, the development of advisory and extension services, and training tailored to organic food production, as well as long-term strategic plans with clear targets and support along the entire value chain. Incentives to integrate organic products into public procurement, such as schools or hospitals, are also highly underdeveloped in Poland, despite their potential to create stable demand.

The implications of the study relate primarily to governance rather than to policy-making alone. However, for the sustainability transition to enter an acceleration phase, regulatory change is necessary. With regard to transition pathways, replacing the current de-alignment and re-alignment trajectory with technological substitution could address many existing challenges. In this pathway, strong landscape pressures enable the replacement of the incumbent regime by a sufficiently developed niche innovation. The war in Ukraine has generated substantial landscape pressure, while the rapid development of artificial intelligence may provide new technological solutions. Therefore, a technological substitution pathway may be the most appropriate scenario for Poland in the near future.

5. Conclusions

Sustainability transitions have not been a widely analyzed subject in the Polish literature, particularly with regard to the agri-food sector. To the best of our knowledge, this study is the first to introduce an MLP-based analytical perspective and to present a comprehensive systemic review of the transition process in the Polish agri-food sector. Addressing the two research questions, which aimed to capture the overall transition dynamics in this sector, proved challenging and required certain simplifications. Consequently, the study has several limitations while also opening avenues for further research.

First, the analysis was based solely on the Web of Science database. Extending the review to other databases, such as Scopus, could provide additional material for analysis. Second, to better identify factors hindering and accelerating organic food development, semi-structured interviews with stakeholders involved in organic food production across several EU counties should be conducted and compared. Third, a systemic review based exclusively on scientific articles proved insufficient, as up-to-date data were necessary to illustrate current trends. Moreover, several questions remained unanswered, particularly

those related to regulatory details that are often not covered in academic studies. Therefore, future research would benefit from combining primary quantitative analysis with qualitative approaches, including semi-structured interviews with key stakeholders and participatory methods. Such a mixed-methods design would better capture the complexity of Polish food system analysis within the framework of the MLP approach.

The main conclusion of this research is that, for a transition in the Polish agri-food sector to occur, it should be better governed. Appropriate policy instruments and governance mechanisms are required to ease tensions and resolve conflicts along the de-alignment and re-alignment pathway. The Polish agri-food sector undoubtedly needs a just and inclusive transition management toward sustainable food systems. More specifically, new policy instruments and governance mechanisms, innovative financing schemes, alternative and hybrid organizational and ownership structures, and institutional as well as transformative change approaches are required.

However, the results of the analysis are of limited direct use for the government when it comes to modifying general regulations. The sustainability transition of the agri-food sector is a complex and long-term project that requires the involvement of all stakeholders. The Polish food system needs a new vision and clearly defined transition pathways guiding development in the direction of this vision. The entire food system must be taken into consideration, including its core activities such as storage, production, transportation, consumption, retailing and food service provision, trading, processing and manufacturing, and the management of waste and surplus food, as well as the environmental, social, economic, and systemic conditions and the interdependencies between them.

Beyond the broader transition process, several actionable policy recommendations related to organic food production can be formulated. As indicated in the title, the study addresses the question of why organic food production is developing so slowly in Poland. First, public support has focused primarily on organic agricultural land area. As a result, the organic food sector has not been supported as an integrated system. This is particularly problematic in Poland, where cooperation along supply chains is very limited, leading to negative outcomes. Second, CAP support has mainly aimed to compensate farmers for additional costs and income losses associated with the shift from conventional to organic farming. Because payments were not linked to production, organic food has achieved only a very small market share, below 4% at the EU level [163]. Moreover, a post-2030 vision for organic food production in the EU is lacking, as are adequate and measurable targets. Most importantly, European sustainable food production needs clear and credible labelling. Greater emphasis should therefore be placed on developing innovative programs that support the transformation of European sustainable food production into a dynamic industry with well-informed and conscious consumers.

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