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# Virtuous and Vicious Circles in Organic Agriculture: A Comparative Typology Between Denmark and Brazil

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**Abstract**

The recent IPCC reports have shown that climate crises are intensifying in the third decade of the 21st century; therefore, policies based on socioeconomic and ecological sustainability must be urgently executed. However, the production organization models and results differ significantly between countries. This paper aims to compare the organic production systems of Denmark, a successful organic player, and Brazil, which has great potential but is poorly structured. Methodologically, due to the lack of quantitative data on the Brazilian organic sector, a qualitative method (SWOT Analysis) was employed to evaluate the Strengths, Weaknesses, Opportunities, and Threats of Danish and Brazilian organic agriculture. Subsequently, eleven criteria were proposed to construct a factorial space in a quadrant system for evaluating scenarios of virtuous and vicious circles. The results have shown that in Denmark, a virtuous circle of interaction between public and private agents has led the country into the global spotlight. In contrast, a vicious circle in Brazil generates obstacles that hinder the growth of organic production. Therefore, identifying these limiting circles also creates opportunities for change, such as recommending actions and public policies to overcome the limitations of Brazil's organic sector. These findings have implications for Denmark and Brazil and can be replicated in Latin American and African countries, contributing to the global effort to enlarge sustainable food production.

**Keywords:** SWOT analysis; factorial space; organic agriculture; virtuous circle; vicious circle



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## 1. Introduction

Due to the global climate emergency [1], there is a growing effort to invest in policies that promote sustainable and ecological production and consumption systems [2–4]. A concrete example is the policy against hunger and the promotion of sustainable agriculture, which are outlined in the Sustainable Development Goals (SDGs) proposed by the United Nations in the 2030 Agenda [2]. Organic agriculture is, therefore, the central theme of this paper.

The global organic area has grown by over 500 percent since 2000, reaching 96.4 million hectares, and the organic market has expanded nearly eight times, from €15 billion to almost €135 billion by 2022 [4,5]. However, the forms of organization,

legislation, and institutional framework that regulate organic production, as well as the results obtained by these countries, are quite different.

This paper aims to compare the development of organic agriculture in Denmark and Brazil, seeking to gather lessons and knowledge from the experience of this European country, which is recognized as a key player in the sector, and to create conditions for replicating it in Latin America and African countries.

Denmark is a Nordic country in the European Union, formed by a peninsula and more than 400 small islands, with a total area of 43,094 $km^2$ (4,309,400 hectares), equivalent to the Brazilian state of Rio de Janeiro. It has approximately 5.6 million inhabitants as of 2020. In 2023, this country allocated 303,430 hectares for organic production, holding the largest market share globally and accounting for 11.8% of the world's organic market, which generated approximately €2.1 billion. It is also worth noting that Danes have the second-highest annual per capita consumption of organic products, at €362 [5].

Conversely, Brazil has an extensive agricultural area of 351,289,816 hectares and 5,073,324 rural establishments [6]. A small part of this area is dedicated to organic product cultivation (or is under conversion), representing approximately 1.0 million hectares, or around 0.4% of the country's total agricultural area. More than 24 thousand organic production units are registered in this area on the National Register of Organic Producers [7,8]. Although it is the 12th largest country in terms of organic production area, Brazil generated more than €778 million, and its annual per capita consumption was €4 in 2023 [5].

From the analysis of different organic agriculture realities between these two countries, it is fundamental to answer some questions: Is it possible to compare two disparate organic production systems? What are the obstacles to Brazilian organic production growth? What can be learned from the Danish experience? This paper aims to evaluate the following scenarios: (1) Denmark presents a virtuous circle of private and public agents' interaction, placing it at a global prominence in the sector; and (2) there is a vicious circle in Brazil, which means several obstacles make Brazilian organic agriculture growth harder.

Denmark's favorable scenario occurred due to a virtuous circle of public and private actions, such as: (1) actions focused on land conversion, soil preparation, equipment, and natural inputs purchase, new seed species development, and pests natural control; (2) agricultural education institutions financing for farmers training and qualification; (3) creation of organic food public purchase programs for canteens and schools; (4) actions for advertising and marketing the benefits of consuming organic food for the population's health and well-being; and (5) approximately €1.5 billion for credit to organic farmers [7,8].

In Brazil, the conditions are pretty different: (i) the land use structure is concentrated, and the financial resources destined for organic farmers are insufficient; (ii) there is no national monitoring and controlling system for organic production—that is, there is little information available about the quantity and quality of the organic production; (iii) there is a shortage in the access to the technical assistance and rural extension and, because of this, the organic farmers have difficulties of handling bio inputs correctly as well as adapting themselves to the production and storage sanitary rules; (iv) much of the consumption of organic products takes place in short circuits (municipal organic fairs), which are still too limited, once the production is not sold to all regions of Brazil; and (v) the organic products consumption is meager (€4 per capita per year), involving a middle- and upper-class population, characterized as a market niche, which generates low private investment in the sector. Despite that, the system benefits consumers by directly selling fresh products [8].

This paper is structured as follows. After this Introduction, the historical trajectory of organic agriculture development in Denmark and Brazil was thoroughly analyzed to evaluate two contrasting scenarios: virtuous and vicious circles (Section 2 Literature Review, respectively, Sections 2.1 and 2.2). However, it was not possible to conduct a quantitative

analysis of Brazilian organic production, similar to the one conducted in Denmark, due to the lack of available data on the product type, quantity, and locations of production and commercialization. To overcome this quantitative limitation, in Section 3 (Materials and Methods), a qualitative methodology was employed to compare the Brazilian and Danish realities, utilizing the SWOT Analysis to evaluate the Strengths, Weaknesses, Opportunities, and Threats (Section 3.1).

In Section 3.2, eleven criteria were used to build a Factorial Space in a quadrant system from the construction of a coordinate graphic, with Factor 1 represented by a positive X-Axis (Strengths) and negative X-Axis (Weaknesses), and Factor 2 represented by a positive Y-Axis (Opportunities) and negative Y-Axis (Threats). The location determination of each country was evaluated according to the Virtuous Circle (Virtuous Quadrant) and Vicious Circle (Vicious Quadrant) scenarios from eleven critical factors.

The results (Section 4) were presented in a Scatter Chart, which allowed for the measurement of the degree of virtuosity or viciousness of both countries. In Section 5 (Discussion), some actions and public policies focused on Brazilian organic agriculture were recommended. Lastly, some conclusions and bibliographical references were presented.

## 2. Literature Review

### *2.1. Danish Organic Production Development*

Denmark has undergone a remarkable agricultural evolution since the last quarter of the 19th century, when rural family producers typically exported cereals to England, and has since reached a prominent place in the organic products market in the 21st century. The evolution until the first quarter of the 20th century occurred through the organization and cooperation of rural family producers in "parceled-out communities". Until 1972, the main advances occurred through new agricultural regulations in the Danish Parliament and the growing search for agricultural productivity, exemplified by the emblematic sentence: "Eat your neighbor or be eaten" [9].

From the 1980s, organic agriculture evolved from experiments by some pioneering actors to an institutionalized part of Danish agriculture. For instance, in the first quarter of 1980, the Agricultural Study Group was invited to a public meeting at the cooperative mansion Svanholm. The purpose of the meeting was to establish a national organization for organic agriculture. The participants celebrated the initiative and recognized the need for such an organization. The National Association of Organic Agriculture—LØJ was created in 1981 [9].

There were two main tasks for LØJ in the early years: to establish production and marketing rules and standards, and to develop an inspection system and a product label. When establishing the rules and standards for the sector, LØJ emphasized the abandonment of chemical products and the need to respect the ecological logic of biological production processes. Furthermore, the organization emphasized the need for a more holistic approach, highlighting the importance of cooperation among consumers, conventional farmers, and research and teaching institutions as a goal [10]. Hence, in the 1980s, consumers could choose organic foods labeled with the LØJ logotype. Additionally, LØJ registered the Økologisk (Ecological) trademark, requiring farmers who wanted to sell organic food to join LØJ and its inspection system [11].

Another significant milestone was reached in 1982 when the Organic Agriculture National School (DØJ) was established. In Denmark, farmers were traditionally educated in agricultural schools, which were founded and managed by farmers' organizations on a regional basis but received financial support at the national level [9]. Symbolically, DØJ was a historic achievement for the professionalization of this sector, marking significant progress and development in organic agriculture. It was similar to other agricultural

schools that could offer official education to Danish farmers, despite focusing solely on organic production methods [7,10].

The steps towards professionalizing organic production progressed, and in 1987, the sector received official recognition from the government. The turning point was when the Danish Parliament approved a law on organic agriculture called "Økologilov" (Ecology Law in free translation). This initiative "symbolized the authoritative recognition of organic farms as a part of Danish agriculture and because it implied the entrance to a new era where the organic movement got access to the agri-political complex and then had to undertake the role as a responsible actor" [9] (p. 19).

In 1987, a governmental certification system was established to ensure that consumers could trust that organic products were produced and processed by specific standards. Therefore, the term "Ecological" (Økologisk) was chosen in Denmark to represent organic agriculture and serve as a governmental label, featuring the Danish letter Ø. The law expired in 1990. However, the Ministry of Agriculture proposed keeping it with only a few changes, among which are intensifying advertising and marketing actions. Simultaneously, it was suggested that the subsidies for converting conventional to organic land should be raised to 4200 Danish Krone (DKK) per hectare per year. Until then, the subsidies were 2600 DKK for farms without animals and 3800 DKK for farms with more than 0.7 animals per hectare [9].

In July 1993, the largest Danish supermarkets (retail group FDB) introduced 40 organic products at lower prices by 15–20%. This strategy yielded immediate results, and the supermarkets saw an increase in sales, particularly of milk and vegetables. Additionally, this action prompted smaller supermarkets to follow suit and encouraged other supermarket chains, which had previously avoided selling organic food, to do the same. Irma, a company linked to FDB, announced in the last quarter of 1993 that it would cease selling conventional carrots and instead trade only organic ones [9]. During this period, a study revealed that the discount strategy resulted in a 15% decrease in the prices of organic products for consumers over two years, while demand increased significantly. This research also revealed that approximately 40% of organic products had a price surplus of 30%, which represented the consumers' willingness to pay [9].

In 1997, the Danish government established a bill to buy and distribute organic food in public canteens, kindergartens, hospitals, and schools. The conservative parties in parliament were against this because they considered the law would mean conventional food was of low quality [9]. However, they understood and agreed with the government proposals [7]. In the following year, the Parliament approved a new tax on pesticides, and one part of this tax was addressed to LØJ to afford consulting, information, publicity, and marketing services. The Parliament authorized these subsidies in August 1998, totaling approximately 11.5 million DKK [9].

Moreover, two action plans for organic farming (AAP I and II) were launched in 1999. The first emphasizes the conversion of conventional land into organic land, while the second highlights the processing and commercialization of organic products [9].

From the 2000s, the adoption of policies promoting conventional land conversion to organic ones, as well as the expansion of organic food commercialization and production, has increased, positioning Denmark as a global leader [8]. The first important indicator is the growth of organic farms. The number of organic production units in 2015 was 2546; by 2021, it had increased to 4151, representing a 63% rise. Additionally, the organic area growth rate concerning the total agricultural area reached its peak in 2022, representing 12% [12]. These results were made possible by the adoption of policies promoting the conversion of conventional land to organic practices, as well as the increasing demand for organics.

Another important indicator is the annual per capita consumption of organic products, which reached €362 in Denmark, representing the second-highest per capita consumption worldwide in 2024 [5].

These results were achieved by implementing the Danish Organic Action Plan, coordinated by the Danish Ministry of Food, Agriculture, and Fisheries, which commenced in 2011. This plan aimed to double the area of Danish organic agriculture by 2020 [13]. The primary strategy was to increase domestic demand for organic food, thereby encouraging farmers to transition from conventional to organic production. Additionally, the government has conducted such conversions on public lands, increased efforts in public canteens, and supported the transformation of the land to provide organic food [8].

As a result, most organic product sales in 2023 were directed towards public institutions, including canteens, kindergartens, hospitals, and schools, accounting for almost 40% of the total public purchase programs. Also, the leading organic products marketed in Danish retail stores were groceries, dairy products, fruits and vegetables, and eggs [12]. In summary, public policies and public–private partnerships have positioned Denmark as a global leader in organic food production and commercialization.

### *2.2. Brazilian Organic Production Development*

The historical evolution of Brazilian organic production in the 20th and 21st centuries was different. The expansion of the Green Revolution occurred rapidly. It was primarily supported by national government entities (the Ministry of Agriculture and the Brazilian Agricultural Research Corporation—EMBRAPA), as well as global organizations such as the World Bank, the Inter-American Development Bank (IDB), the United States Agency for International Development (USAID), and the United Nations' Food and Agriculture Organization (FAO) [14]. According to [14,15], the technological package of the Green Revolution established a structure of subsidized rural credit, alongside a parallel structure of teaching, research, and rural extension associated with this model. Although the conventional agricultural model, also known as the agro-industrial or agribusiness model, has generated increased productivity in the countryside, it has been strongly criticized for being associated with various ecological and socio-environmental problems [14–18].

In response to the problems arising from this model of agricultural production, several environmental protection organizations, members of civil society, and scientists have spoken out against it. In Brazil, for instance, the debate was also intense, and researchers such as Adilson Paschoal, Ana Maria Primavesi, Luis Carlos Machado, and José Lutzemberger contributed to challenging the current model and proposing new methods of agriculture. These studies sparked public interest in the environmental issue and, consequently, led to alternative proposals for Brazilian agriculture [19,20].

During the 1980s, proposals for alternative agriculture expanded and gained momentum with the holding of four Brazilian Alternative Agriculture Meetings (EBAAs), which took place in 1981, 1984, 1987, and 1989, respectively [8,21].

It was also in the 1980s that various non-governmental organizations (NGOs) focused on agriculture emerged, articulated at a national level by the Alternative Technologies Project Network (PTA), which gave rise to AS-PTA (Advice and Services—Alternative Agriculture Project). "The term alternative technology was used during this period to designate the various experiments challenging conventional agriculture, and was replaced later by ecological agriculture, identified as part of agroecology" [8] (p. 5).

The proposal to adopt a sustainable development model is present in Brazil's Federal Constitution, promulgated in 1988 through Article 225: "Everyone has the right to an ecologically balanced environment, which is a common good and essential to a healthy

quality of life, and the public authorities and the community must defend and preserve it for present and future generations".

In the 1990s, concern about environmental issues gained greater expression, driven by the debates surrounding the United Nations Conference on Environment and Development (UNCED), which took place in Rio de Janeiro in 1992, also known as the Rio-92, Eco-92, or Earth Summit. From this conference onwards, "factors such as attention to environmental degradation, combined with the global expansion of organic production and the consolidation and expansion of productive experiences in Brazil, contributed to the expansion of agroecology in that decade" [22] (p. 28).

One result of this constant struggle in favor of organic farming came in 1999, when the Ministry of Agriculture, Livestock and Supply (MAPA) published Normative Instruction (IN) No. 007, resulting from a discussion between civil society and the executive branch. Subsequently, the procedures for certifying entities capable of assessing the quality and conformity of organic production were defined by Normative Instruction (IN) No. 006/2002 [22,23]. The results of the growing pressure from social movements and the favorable momentum of international agendas in favor of environmental causes "were responsible for driving several national initiatives between 1985 and 2002" [22] (p. 34).

In the 2000s, considerable progress was made in public actions and policies, with organic production being a key objective. Examples include the creation of the Zero Hunger Program (Law No. 10,696/2003) and the Food and Nutrition Security Policy [24].

National public policies have started to incorporate, at least in part, the organic approach to agricultural production [25]. One prominent example was the approval of Law No. 10,831/2003, which established the conditions for producing and marketing organic agricultural products. According to [22] (p. 35), "This law was passed after it had been going through the National Congress since 1996, and in the final phase of the process, from 2002 onwards, representatives of the sector and members of public and private organizations took part". This law was regulated by Decree 6323 of 27 December 2007, which was drafted in consultation with civil society. This decree created the Brazilian Organic Conformity Assessment System (SISOrg) seal.

In 2006, the Brazilian Agricultural Research Corporation (Embrapa) established its Reference Framework for Agroecology, signaling "a renewal movement that aligns with expectations created by significant portions of civil society in the Brazilian countryside mobilized around the defense of family-based production" [26] (p. 15).

Throughout the 2000s, Brazil expanded the public agenda for Food and Nutrition Security (SAN). One of the guidelines of the National Food and Nutrition Security Policy (PNSAN) was to "promote the supply and structuring of decentralized, agroecological and sustainable food production, extraction, processing, and distribution systems" [27] (p. 55). In this new cycle of formulating and implementing policies aimed at family farmers and peasants under the PNSAN, the structuring of mechanisms to support commercialization stands out, such as the Food Acquisition Program (PAA), the National School Feeding Program (PNAE), and the Minimum Price Guarantee Policy for Socio-Biodiversity Products (PGPM-Bio) [28].

To stimulate family farming in Brazil, the National Program to Strengthen Family Farming (PRONAF) was established by Decree No. 1946/1996, with "the aim of promoting the sustainable development of the rural segment made up of family farmers, to increase their productive capacity, create jobs and improve their income" [29]. To receive PRONAF credits, interested parties had to: "present financial agents with a financing project that included a management and transition plan from the conventional production system to the agri-ecological production system, with a maximum timeframe of four years" [22] (p. 40).

PRONAF Verde (Green PRONAF in free translation) aimed to create concrete conditions for transitioning from conventional to sustainable agriculture, using financial resources and technical assistance for family production units [30,31]. The agroecological transition projects were not well executed because, in addition to a lack of prioritization, little attention was paid to the natural complexity involved in agroecological production, the grace and payment periods, and the amount proposed for investment [22].

In 2020, a study was conducted and found a massive disparity in the resource volume for PRONAF Verde and conventional rural credit. In other words, Rural Credit for Conventional Agriculture (SNCR) in 2018 exceeded R$156 billion (about US$32 billion). On the other hand, in the same year, credit earmarked for sustainable agriculture, PRONAF amounted to just over R$23 billion (approximately US$4.7 billion), representing 14.7% of the total amount of the SNCR. Exclusively for PRONAF Verde, the total amount was about R$193 million (approximately US$38.6 million), representing 0.12% of Brazil's rural credit this year. These amounts changed in 2023. The total budget for conventional agriculture (SNCR) was R$340.9 billion (approximately US$68.1 billion). The resources earmarked for family farming (PRONAF) totaled R$53.6 billion (approximately US$10.8 billion), accounting for 15.7% of the SNCR budget [32]. However, specifically for sustainable agriculture (PRONAF Verde), the total funds were only R$320.7 million (around US$64.1 million), representing around 0.1% of Brazil's rural credit this year [33].

So, the paradox remains. In other words, although the state has broadened the debate on sustainable rural development and stimulated actions aimed at increasing production using an agroecological approach for family farming, the volume of resources allocated under PRONAF remains small compared to policies promoting conventional agriculture via SNCR [34].

## 3. Materials and Methods

After the Introduction and Literature Review sections, it has been clear that it was not possible to conduct a quantitative analysis of Brazilian organic production, similar to the one conducted in Denmark, due to the lack of available data on the product type, quantity, and locations of production and commercialization. In other words, there is no national monitoring and quantification system for production. In addition, the information follow-up and inspection systems vary in each state or municipality of Brazil, making a national synthesis extremely challenging, costly, unreliable, and inaccurate. To overcome this quantitative limitation, a typology was created in Section 3.1 for evaluating and comparing organic agriculture based on Lamarche's typology [35,36]. In other words, a comparative qualitative analysis was conducted using a SWOT Analysis to assess the Strengths, Weaknesses, Opportunities, and Threats of the organic sector in these two countries.

The SWOT Analysis and the Eleven Critical Factors selection proceedings were raised by a brainstorming meeting that was based on the principles of Multicriteria Decision Analysis (MCDA), where the selection, scoring, and weighting of multiple criteria were carried out in constructivist and participatory decision conferences with experts of the Organic Production Commission of São Paulo (CPOrg) and researchers of the Brazilian Agricultural Research Corporation (EMBRAPA). In MCDA, the biases of the methodology's applicators (facilitators) are completely controlled in the initial phase of structuring the theoretical model [37–39].

The authors [35,36] created a typology to assess the distribution of farms according to their production logic. Based on this, ref. [40] developed a four-quadrant Factorial Space to evaluate the technical systems of agricultural production in a Brazilian municipality. The methodology used in this article was based on these references and adapted for organic agriculture.

In Section 3.2, eleven criteria were used to build a factorial space in a quadrant system from the construction of a coordinate graphic with the following factors: Factor 1 (positive *X*-Axis: Strengths; negative *X*-Axis: Weaknesses) and Factor 2 (positive *Y*-Axis: Opportunities; negative *Y*-Axis: Threats). The location determination of each country was evaluated according to the Virtuous Circle (Virtuous Quadrant) and Vicious Circle (Vicious Quadrant) scenarios from eleven critical factors. For the country to be in the Virtuous Quadrant, it was assessed as having scores of +1 or 0 in all determining variables related to the critical factors. On the other hand, for the country to be in the Vicious Quadrant, it was evaluated as having scores of −1 or 0 in all determining variables related to the critical factors. Subsequently, the variable numbers were divided to form a qualitative value scale (very low, low, medium, high, and very high) on the virtuous and vicious value scale. It was possible to identify that the greater the number of positive variables, the more virtuous the country was, and inversely, the greater the number of negative variables, the more vicious the country was.

### *3.1. SWOT Analysis Applied to the Danish and Brazilian Organic Production*

The SWOT analysis was applied using an initially blank matrix containing the four factors (Strengths, Weaknesses, Opportunities, and Threats). This matrix was filled in through a brainstorming process, in which stakeholders pointed out variables relevant to that reality. Subsequently, institutional strategies and actions are recommended that aim to provide the timeliest guidance possible among the scenarios raised, considering the strengths and weaknesses in an environment of opportunities and threats. The authors [41,42] applied SWOT analysis to the Brazilian organic agriculture, and a similar method was used in this paper.

In both countries, some important aspects of the institutional trajectory of organic agriculture were raised, placing Denmark in a prominent position and Brazil in a fragile situation. The SWOT Analysis application was necessary to organize these aspects into four quadrants (Strengths, Weaknesses, Opportunities, and Threats) and to create conditions for conducting comparative analyses with the Brazilian reality (Figure 1).

### *3.2. Factorial Space Construction*

After the SWOT Analysis, two different scenarios were assessed. The first was the Virtuous Circle, whose strengths and opportunities were considered as positive critical factors, and the second was the Vicious Circle scenario, whose weaknesses and threats were considered as negative critical factors.

This analysis was conducted considering eleven criteria of critical factors regarding demand, supply, trade and international negotiations, product safety, research support, technical assistance, rural extension, access to rural credit, education support, market access, the relationship between public and private agents, and the climate crisis and its effects on agriculture. Subsequently, the factor space was constructed based on a coordinate graph with the following factors: Factor 1 (positive *X*-axis: strengths; negative *X*-axis: weaknesses) and Factor 2 (positive *Y*-axis: opportunities; negative *Y*-axis: threats), as presented in Figure 2.

Based on the SWOT Analysis indicators, the locational determination was evaluated according to the Virtuous Circle (Virtuous Quadrant) or Vicious Circle (Vicious Quadrant) scenarios.

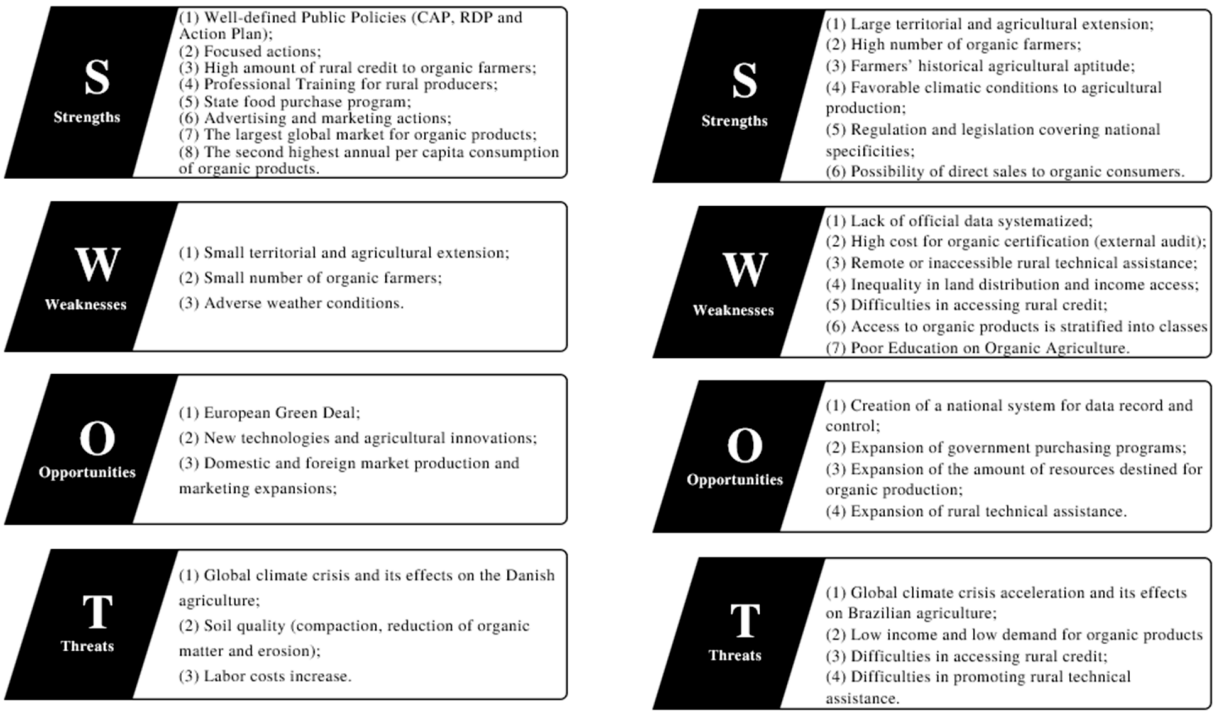


**Figure 1.** SWOT Analysis for Danish and Brazilian organic production. It presents a comparative SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) of organic production in Denmark and Brazil. (**a**) Denmark exhibits several Strengths and Opportunities, driven by well-defined public policies (CAP, RDP, and Action Plan), a substantial volume of rural credit for organic farmers, and effective advertising and marketing initiatives, which stimulate the organic sector. (**b**) Brazil faces several Weaknesses and Threats, characterized by obstacles such as a lack of data, limited access to credit and technical assistance, and very low per capita demand, which hinders the growth of the organic sector. Source: authors' own elaboration.

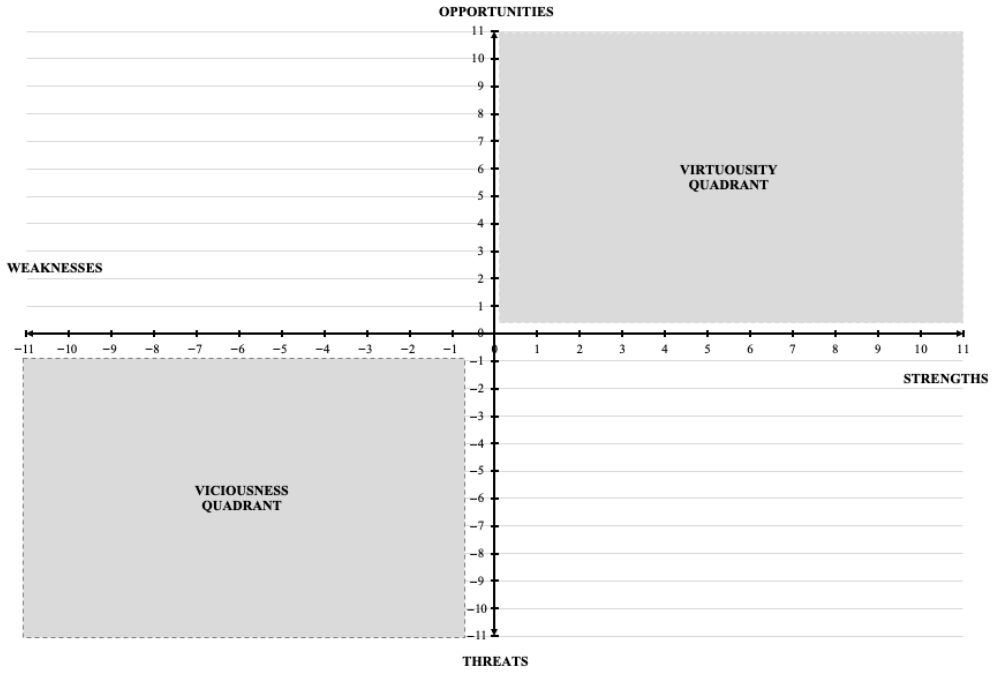


**Figure 2.** Factorial Space in Quadrant Frames. This Figure represents a Cartesian coordinate system used to evaluate and position countries within 'Virtuous Circle' or 'Vicious Circle' scenarios in the context of organic agriculture. Source: authors' own elaboration.

**Virtuous Quadrant:** Factor 1: Strengths (positive X-Axis) versus Factor 2: Opportunities (positive Y-Axis). This factorial space was determined as the Virtuous Quadrant. To be in this quadrant, the country should receive scores of +1 (plus 1) or 0 (zero) in all determinant variables of the critical factors.
**Vicious Quadrant:** Factor 1: Weaknesses (negative X-Axis) versus Factor 2: Threats (negative Y-Axis). This factorial space was determined to be the Vicious Quadrant. To be in this quadrant, the country should receive scores of −1 (minus 1) or 0 (zero) in all determinant variables of the critical factors.

Subsequently, the variable numbers were divided into a qualitative value scale: very low, low, moderate, high, and very high on the virtuous and vicious value scale (Table 1).

**Table 1.** Qualitative value scale.

| Scale | Virtuosity (Number of Scores +1) | Viciousness (Number of Scores −1) |
|---|---|---|
| Very Low | up to 2 variables | up to 2 variables |
| Low | between 3 and 4 variables | between 3 and 4 variables |
| Moderate | between 5 and 6 variables | between 5 and 6 variables |
| High | between 7 and 8 variables | between 7 and 8 variables |
| Very High | between 9 and 11 variables | between 9 and 11 variables |

Source: authors' own elaboration.

It is concluded that the greater the number of positive variables, the more virtuous the country is; conversely, the greater the number of negative variables, the more vicious the country. The qualitative value scale was also visualized in a scatter plot (Figure 3), allowing for the measurement of the virtuosity or viciousness of Brazilian and Danish organic agriculture.

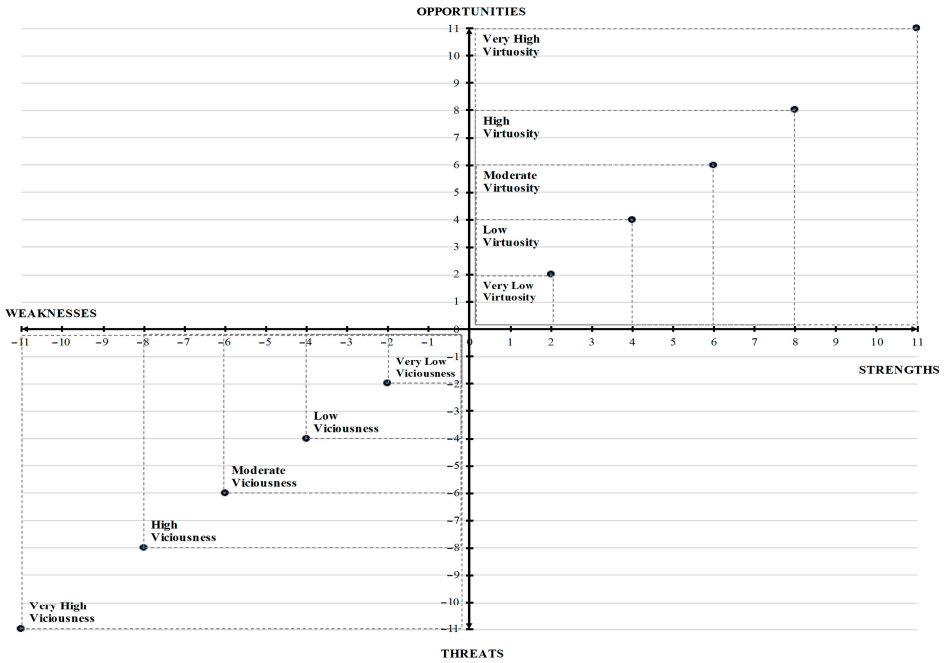


**Figure 3.** Qualitative value scale in a scatter plot. This Figure presents a scatter plot that visually represents the degree of virtuosity or viciousness of Danish and Brazilian organic agriculture. It is based on the factorial space introduced in Figure 2, which maps the scale of qualitative values (very low, low, moderate, high, very high) onto the coordinate system. Source: authors' own elaboration.

After the theoretical demonstration of Factorial Space construction, the results of the Virtuous and Vicious Circles scenarios were presented in Section 3.

## 4. Results

### *4.1. Danish Organic Agriculture*

The Virtuosity scenario was performed using Factor 1, which is composed of Strengths and Opportunities, where scores of +1 (plus 1) or 0 (zero) were assigned to all variables. Scores +1 (plus 1) were considered for the criterion that is strong and has good opportunities to boost Danish organic agriculture. Scores of 0 (zero) indicate that these factors had no positive impact on the Danish reality. It is concluded, through Table 2, that Denmark presented scores +1 (plus 1) for nine critical factors regarding demand, trade, and international negotiations, product safety, research support, technical assistance, rural extension, access to rural credit, education support, market access, and the relationship between public and private agents. This means that, for Denmark, these nine criteria were considered vital and represented good opportunities to boost organic agriculture.

**Table 2.** Critical Factors for Danish Organic Agriculture.

| Denmark | | | | |
|---|---|---|---|---|
| **Critical Factors** | **Strengths (Scores: +1 or 0)** | **Opportunities (Scores: +1 or 0)** | **Weaknesses (Scores: −1 or 0)** | **Threats (Scores: −1 or 0)** |
| 1. Demand | 1 | 1 | 0 | 0 |
| 2. Supply | 0 | 0 | −1 | 0 |
| 3. Trade and International Negotiations | 1 | 1 | 0 | 0 |
| 4. Product Safety | 1 | 1 | 0 | 0 |
| 5. Research Support | 1 | 1 | 0 | 0 |
| 6. Technical Assistance and Rural Extension | 1 | 1 | 0 | 0 |
| 7. Access to Rural Credit | 1 | 1 | 0 | 0 |
| 8. Education Support | 1 | 1 | 0 | 0 |
| 9. Market Access | 1 | 1 | 0 | 0 |
| 10. Relationship between public and private agents | 1 | 1 | 0 | 0 |
| 11. Climate crisis and its effects on agriculture | 0 | 0 | 0 | −1 |
| **Results** | **9** | **9** | **−1** | **−1** |

Source: authors' own elaboration.

The Viciousness scenario was performed using Factor 2 (Weaknesses and Threats), in which scores of −1 (minus one) or 0 (zero) were indicated for all variables. A score of −1 (minus one) was considered for the criterion that presents itself as a weakness and constitutes a threat to Denmark's organic food production sector. Scores of 0 (zero) indicate that these factors had no negative impact on the Danish reality.

The weaknesses and threats in the supply criterion were physical factors, such as territorial extension and labor shortages, which limited the possibility of expanding the supply of Danish organic products. According to Table 2, the climate crisis and its effects on agriculture constituted the primary threat to Danish organic agriculture [43,44].

Figure 4 shows that of the eleven critical success factors, Denmark presented Strengths and Opportunities in 9 (nine) of them; in other words, nine critical factors showed scores of +1 (plus 1) for Strengths and Opportunities (Factor 1). For Factor 2, Denmark scored −1 (minus 1) on only one critical factor for Weaknesses and one for Threats, demonstrating the very high virtuosity level.

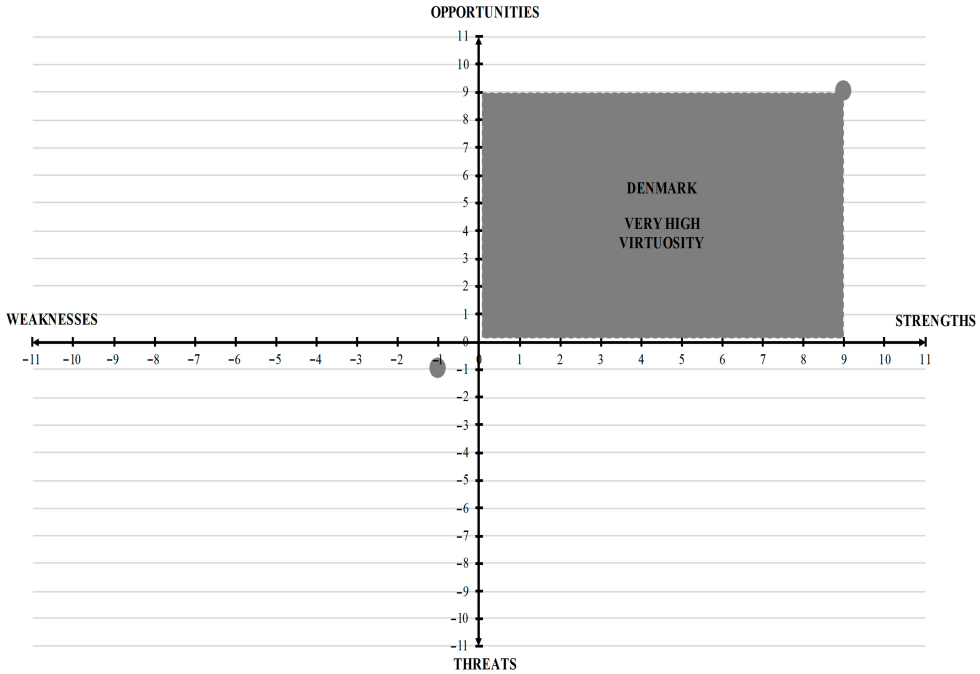


**Figure 4.** Factorial Space for Danish Organic Agriculture. This figure visually summarizes Denmark's performance in organic agriculture based on SWOT analysis (strengths, weaknesses, opportunities, and threats). Source: authors' own elaboration.

### *4.2. Brazilian Organic Agriculture*

The Virtuosity scenario was performed using Factor 1, which is composed of Strengths and Opportunities, where grades of +1 (plus 1) or 0 (zero) were assigned to all variables, referred to as critical success factors. Scores +1 (plus 1) were considered for the criterion that is strong and has good opportunities to boost Brazilian agriculture. Scores of 0 (zero) indicate that these factors had no positive impact on Brazilian reality. It is concluded, based on Table 2, that Brazil presented grades of +1 (plus 1) only for one critical factor, specifically the safety of the product. This criterion is substantial and represents good opportunities to leverage Brazilian organic agriculture.

Through Factor 2, the Viciousness scenario comprised Weaknesses and Threats, in which scores of −1 (minus one) or 0 (zero) were indicated for all variables. A score of −1 (minus one) was considered for the criterion that presents itself as a weakness and constitutes a threat to the Brazilian organic food production sector. Scores of 0 (zero) convey that these factors did not negatively impact the Brazilian reality.

Weaknesses and threats were identified in nine criteria: demand, supply, trade and international negotiations, research support, technical assistance, rural extension, access to rural credit, education support, market access, the relationship between public and private agents, and the climate crisis and its effects on agriculture. The possibility of expanding and dynamizing Brazilian organic production is minimal, and immediate actions must be taken. Threats are also factors that draw attention to the reality of Brazil. The seven criteria considered Threats were demand, supply, trade and international negotiations, research support, technical assistance, rural extension, access to rural credit, and the climate crisis and its effects on agriculture (Table 3).

**Table 3.** Critical Factors for Brazilian Organic Agriculture.

| Brazil | | | | |
|---|---|---|---|---|
| **Critical Factors** | **Strengths (Scores: +1 or 0)** | **Opportunities (Scores: +1 or 0)** | **Weaknesses (Scores: −1 or 0)** | **Threats (Scores: −1 or 0)** |
| 1. Demand | 0 | 0 | −1 | −1 |
| 2. Supply | 0 | 0 | −1 | −1 |
| 3. Trade and International Negotiations | 0 | 0 | −1 | −1 |
| 4. Product Safety | 1 | 1 | 0 | 0 |
| 5. Research Support | 0 | 0 | −1 | −1 |
| 6. Technical Assistance and Rural Extension | 0 | 0 | −1 | −1 |
| 7. Access to Rural Credit | 0 | 0 | −1 | 0 |
| 8. Education Support | 0 | 0 | −1 | −1 |
| 9. Market Access | 0 | 0 | −1 | 0 |
| 10. Relationship between public and private agents | 0 | 0 | −1 | 0 |
| 11. Climate crisis and its effects on agriculture | 0 | 0 | 0 | −1 |
| **Results** | **1** | **1** | **−9** | **−7** |

Source: authors' own elaboration.

Considering the scale of qualitative values shown in Table 1, it was concluded that Brazil presented very low Virtuosity (scores +1 for only one critical factor) and Very High Viciousness (scores −1 for ten critical factors) (Figure 5).

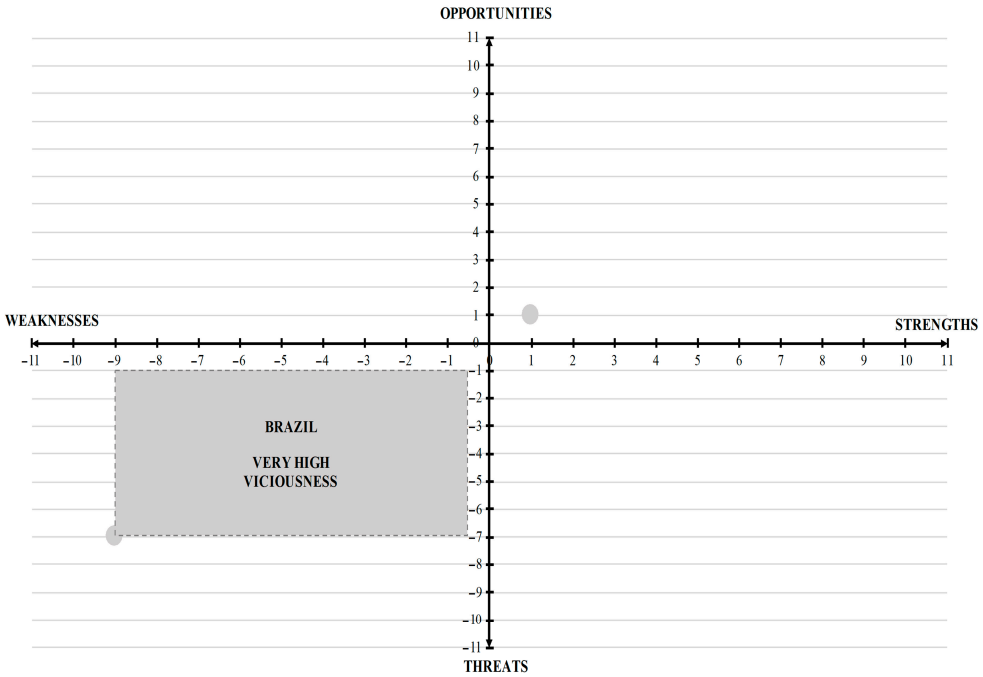


**Figure 5.** Factorial Space for Brazilian Organic Agriculture. This figure visually summarizes Brazil's performance in organic agriculture based on SWOT analysis (strengths, weaknesses, opportunities, and threats). Source: Authors' own elaboration.

Figure 5 shows that of the eleven critical success factors, Brazil presented Strengths and Opportunities in only 2 (two) of them; in other words, two critical factors showed scores of −1 (minus 1) for Strengths and Opportunities (Factor 1). For Factor 2, Brazil scored −1 (minus 1) for 9 (nine) critical factors for Weaknesses and 7 (seven) for Threats,

demonstrating the very high viciousness level. The aggregated results were organized in Factorial Space, as shown in Figure 6.

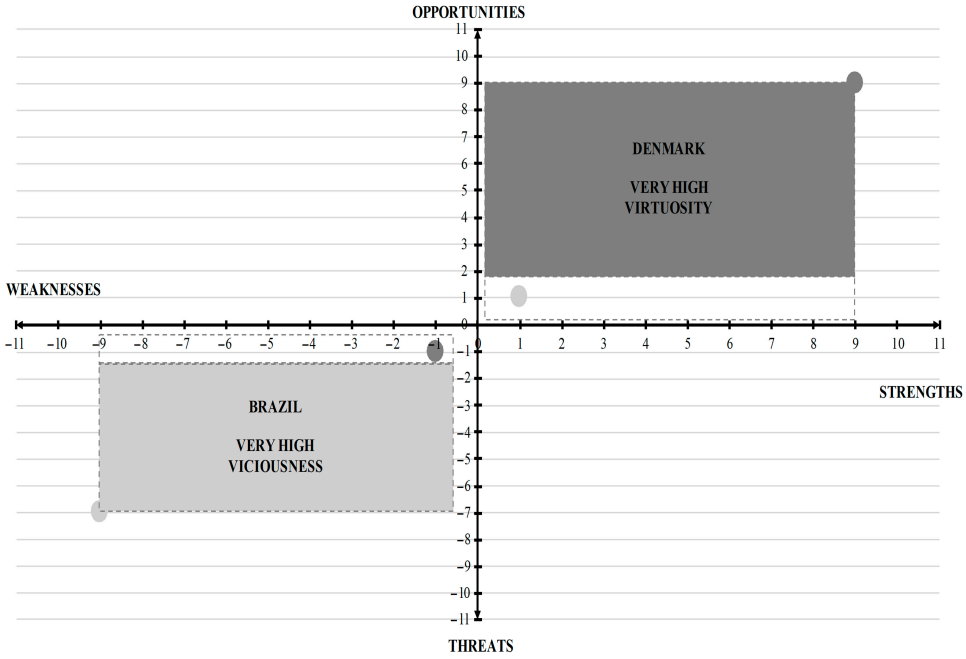


**Figure 6.** Factorial Space for Danish and Brazilian organic agriculture. Source: Authors' own elaboration.

Figure 6 shows Denmark positioned in the Very High Virtuosity quadrant (upper right corner), indicating a strong alignment with the strengths and opportunities in its organic agriculture sector. In contrast, Brazil is located in the Very High Viciousness quadrant (lower left corner), signifying a system plagued by numerous weaknesses and threats.

## 5. Discussion

### *5.1. The Danish Context*

Denmark is a global leader in the organic sector for several reasons. Firstly, successful public policies were implemented for the sector, such as the Common Agricultural Policy (CAP) of the European Union and, at the national level, the Rural Development Plan (RDP) and the Organic Action Plan. These policies contain incentive actions for converting conventional to organic land, support for soil preparation, purchase of agricultural equipment and machinery, and natural inputs, as well as funding for new species development and strategies for natural pest control.

In addition, a high volume of rural credit is allocated to European organic producers, including those in Denmark. For example, CAP's second pillar budget (2014–2020) exceeded €300 billion. This represented an annual average of more than €50 billion directed toward conserving and managing natural resources, including incentives for the continent's organic production. The total allocation for the Common Agricultural Policy (CAP 2021–2027) amounts to €386.6 billion [8].

Another outstanding action is the training and qualification of Danish organic producers. These farmers were traditionally educated at the National School of Organic Agriculture (DØJ), founded and managed by the Association of Danish Organic Farmers (LØJ). Between 2015 and 2019, the Organic Action Plan for Denmark allocated resources to support agricultural education institutions and technical training actions for organic producers. It aimed to reduce 0.5 million tonnes of $CO_2e$ by doubling the organic area until 2030 [7]. As an encouragement to the sector, the creation of government purchase programs stands out, which in 2023 were responsible for 41% of the domestic demand for

organic products. These products were intended for hospitals, kindergartens, and public schools [12].

According to [5], Denmark holds the largest market share globally, accounting for 11.8% of the world's organic product market, which reached approximately €2.1 billion in 2023. Additionally, in the same year, the country reported a high annual per capita consumption of organic products (€362). This study also raised weaknesses and threats to the sector. For example, it was found that Denmark has a limited potential to expand the supply of organic products due to the small area available for growing these products, which was approximately 303,000 hectares in 2023.

Additionally, the resurgence of the global climate crisis and its impact on Danish organic agriculture pose threats to the sector. Some studies have shown that climate change may affect the frequency of extreme heat waves and changes in precipitation patterns, including more intense rainfall events and longer dry periods in the country [45].

Two other factors can impact local organic production. The first concerns soil quality regarding compaction, reduction in organic matter, and erosion. Based on [46], it is possible to verify that (i) the soil presented a high level of compaction due to the intensive use of heavy agricultural machinery; (ii) the soil also presented a lower amount of organic matter due to the intensive agricultural production process; (iii) an advanced process of water erosion was also verified, due to the irrigation process, the rains and the thaw. Finally, European Union countries, including Denmark, have experienced a critical scenario: an aging workforce, seasonal labor shortages, and some low unemployment rates [47].

To summarize, the intensification of climate events, combined with the decline in soil quality and challenges in recruiting rural labor, could have a negative impact on the production and commercialization of Danish organic products.

### *5.2. The Brazilian Scenario*

The Brazilian scenario contrasts with the Danish reality. Brazilian organic agriculture has exhibited a vicious circle of interaction between public and private agents that has weakened and threatened the sector's continuity.

This fragility occurred, firstly, due to the meager Brazilian Technical Assistance and Rural Extension services. This was due to the country's sizeable agricultural territory, approximately 351 million hectares in 2017 [6], and the Federal Government's budget cuts in recent years. For example, between 2019 and 2021, the federal budget for such services was reduced by 74%. Secondly, there are obstacles to national organic product development due to the need for more readily available data, including the types of products, quantities produced, and locations of production and commercialization. In other words, there needs to be systematic production monitoring and quantification at the national level [8].

Additionally, access to land proved to be a significant weakness in Brazilian reality. Organic farmers, primarily considered family farmers, account for 77% of rural establishments in Brazil; however, they occupy only 23% of the total arable land [6]. Still analyzing the supply side, organic farmers have difficulties in accessing rural financing due to some factors, such as the default of family farmers, the lack of technical assistance and rural extension, the high demand for technical documents (bureaucracy), the cadastral family farmer restriction; the lack of knowledge of the norms and rules of the family rural financing program [48]. From a demand perspective, it was found that a low income level leads to a low level of organic product demand, which in 2023 was only 4 Euros per capita [5].

Finally, accentuating global climate change can generate perverse effects on organic agriculture. Specifically in Brazil, climate change may affect precipitation levels and the volume of water resources available in groundwater, which can also lead to the loss of

biodiversity in tropical forests, as well as the occurrence of extreme weather events that cause natural disasters, such as droughts, floods, and frosts [43,44,49,50].

To summarize, the possibility of expanding and boosting Brazilian organic production is minimal, and immediate actions and policies must be taken. Twelve (12) public policies to overcome the vicious circle of Brazilian organic agriculture were presented in Table 4.

**Table 4.** Public Policy Proposals for Brazilian Organic Agriculture.

| Public Policies | Impacted Critical Factors | Responsible for Policy Implementation |
|---|---|---|
| Promotion of production (support for land transfers and tax incentives) | 2, 3, 7, 9, 10 | Federal Government |
| Rural infrastructure (electrification, roads, internet, and water) | 2, 3, 6, 9, 10 | Federal and State Governments |
| Technical assistance and rural extension | 2, 5, 6, 8 | Federal, State, and Municipal Governments |
| Support for fairs and short marketing circuits | 1, 2, 3, 4, 9, 10 | Municipal Governments |
| Government purchases and other demand-generation instruments for family farming production | 2, 9, 10 | Federal, State, and Municipal Governments |
| Policies for the recognition and protection of Indigenous and Traditional Communities' Territories | 2, 5, 8, 11 | Federal Government |
| Support for the rescue and multiplication of creole seeds (Community Seed Banks—CSB) | 2, 5, 6, 11 | Federal, State, and Municipal Governments and NGO's |
| Support for rural women and youth groups | 1, 2, 7, 10 | Federal, State, and Municipal Governments |
| Promotion of adequate and healthy food by marketing and advertising | 1, 2, 5, 8, 10 | Federal Government |
| Degraded areas recovery | 2, 3, 11 | Federal, State, and Municipal governments |
| Urban Agriculture | 1, 2, 9, 7 | Municipal Governments and NGO's |
| Expansion of the Organic Production Commission action scope | 2, 4, 5, 8, 9, 10 | Federal Government |

Source: authors' own elaboration.

Some examples of actions and public policies to encourage organic production were highlighted, such as support for land transition and tax incentives; rural infrastructure policies like electrification, road paving, internet, and irrigation; technical assistance and rural extension policies; support for fairs and short commercialization circuits; the government purchase programs; policies for the recognition and protection of Indigenous and traditional communities' territories; support for the rescue and multiplication of creole seeds carried out by community creole seed banks (Community Seed Banks—CSB); support for rural women and youth groups; promotion of adequate and healthy food by marketing and advertising; recovery of degraded areas; policies to encourage urban and peri-urban agriculture; and the expansion of the Organic Production Commissions action scope.

## 6. Conclusions

This paper compares two opposite organic production systems, the Danish and the Brazilian. However, owing to the impossibility of making a quantitative comparison and the need for more information and data on the Brazilian reality, a comparative typology was built through methodological integration between the SWOT Analysis and a factorial space embedded in a quadrant system.

The virtuosity and viciousness scenarios were performed for both countries, and Denmark achieved a very high level of virtuosity; however, a scenario of very high viciousness was identified in Brazil. In other words, the interaction between public and private agents in Denmark brought the country into a global spotlight, and, unlike in Brazil, this interaction was marked by conflict, with several obstacles (weaknesses and threats) being identified. Therefore, twelve (12) actions and effective public policies were recommended to positively impact the critical factors that received negative scores in the viciousness scenario, thereby overcoming the vicious circle of Brazilian organic agriculture.

Despite significant advances in public policy management focused on organic production since the 2000s, this article has shown that there are still obstacles and challenges to expanding the sector's dynamics and that effective action by the public and private sectors is needed to overcome these challenges. The results evidenced the need to increase the amount of resources and reduce the bureaucracy of rural family credit policy. In addition, technical assistance and marketing programs should be expanded for all farmers who take the risk of converting from conventional to organic agriculture.

Actions are also needed to accelerate the transition to low-carbon agriculture, including the implementation of policies that stimulate food biodiversity and its specific characteristics. In addition, public policies should be designed and implemented to improve the performance of organic food systems, facilitating the integration of multidisciplinary sciences and the traditional knowledge of farmers, forest dwellers, and the production of local innovations. Furthermore, effective policies are needed to restore degraded areas and stimulate urban and peri-urban agriculture, which, in addition to providing important ecosystem services (carbon sequestration, for example), increase the supply and marketing of healthy foods.

However, all these efforts to develop and implement public policies require a systematic recording and active monitoring system by MAPA and CPOrgs technicians. This monitoring will provide a robust database that will serve as a basis for promoting organic agriculture in Brazil.

As a suggestion for future research, it is recommended that this methodology be adapted and reproduced for comparative analyses of organic agriculture intra- and internationally. These findings can also be replicated in Latin American and Caribbean countries, contributing to the expansion of sustainable food production.

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## Abbreviations

The following abbreviations are used in this manuscript:

| | |
|---|---|
| AAP | Danish action plans for organic farming |
| AS-PTA | Advice and Services-Alternative Agriculture Project |
| DKK | Danish Krone (Danish currency) |
| CPOrg | Organic Production Commission of São Paulo |
| DØJ | Danish Organic Agriculture National School |
| EBAA | Brazilian Alternative Agriculture Meetings |
| EMBRAPA | Brazilian Agricultural Research Corporation |
| FAO | Food and Agriculture Organization of the United Nations |
| FDB | Danish retail group (supermarket) |
| IDB | Inter-American Development Bank |
| LØJ | Danish National Association of Organic Agriculture |
| MAPA | Brazilian Ministry of Agriculture, Livestock, and Supply |
| NGO's | Non-Governmental Organizations |
| PGPM-Bio | Brazilian Minimum Price Guarantee Policy for Socio-Biodiversity Products |
| PNAE | Brazilian National School Feeding Program |
| PNSAN | Brazilian National Food and Nutrition Security Policy |
| PRONAF | Brazilian National Program to Strengthen Family Farming |
| PTA | Alternative Technologies Project Network |
| SDG | Sustainable Development Goals |
| SISOrg | Brazilian Organic Conformity Assessment System |
| SNCR | Brazilian National Program for Rural Credit for Conventional Agriculture |
| SWOT | Strengths, Weaknesses, Opportunities, and Threats |
| UNCED | United Nations Conference on Environment and Development |
| USAID | United States Agency for International Development |

## References

1. Pörtner, H.-O.; Roberts, D.; Tignor, M.; Poloczanska, E.; Mintenbeck, K.; Alegría, A.; Craig, M.; Langsdorf, S.; Löschke, S.; Möller, V.; et al. *Climate Change 2022: Impacts, Adaptation, and Vulnerability*; IPCC: Geneva, Switzerland, 2022; p. 3056.
2. United Nations. General Assembly Resolution A/RES/70/1. *Transforming Our World, the 2030 Agenda for Sustainable Development*. 2015. Available online: https://sdgs.un.org/publications/transforming-our-world-2030-agenda-sustainable-development-17981 (accessed on 7 August 2025).
3. UNEP. *United Nations Environment Programme. Global Resources Outlook 2024: Bend the Trend—Pathways to a Liveable Planet as Resource Use Spikes*; International Resource Panel: Nairobi, Kenya, 2024.
4. Helga, W.; Trávníček, J.; Schlatter, B. (Eds.) *The World of Organic Agriculture. Statistics and Emerging Trends 2024*; Research Institute of Organic Agriculture FiBL, Frick, and IFOAM—Organics International: Bonn, Germany, 2024.
5. Helga, W.; Trávníček, J.; Schlatter, B. (Eds.) *The World of Organic Agriculture. Statistics and Emerging Trends 2025*; Research Institute of Organic Agriculture FiBL, Frick, and IFOAM—Organics International: Bonn, Germany, 2025.
6. IBGE. *Agricultural Census 2017*; Brazilian Institute of Geography and Statistics: Rio de Janeiro, Brazil, 2018.
7. Lima, L.F.; Abreu, L.S.; Romeiro, A.R. Políticas públicas e o desenvolvimento de sistemas agroalimentares orgânicos: O caso da Dinamarca. *Rev. Bras. Agroecol.* **2023**, *18*, 724–740. [CrossRef]
8. Lima, L.F. Análise Comparada da Trajetória do Desenvolvimento da Agricultura Orgânica no Brasil e na Dinamarca. Ph.D. Thesis, Universidade Estadual de Campinas, Instituto de Economia, Campinas, Brasil, 2021.
9. Ingemann, J.H. *The Evolution of Organic Agriculture in Denmark*; OASE Working Paper No. 2006: 4. Economics, Politics and Public Administration; Aalborg University: Aalborg, Denmark, 2006.
10. Christensen, J. *Alternativer-Natur-Landbrug*; Akademisk Forlag: Copenhagen, Denmark, 1998.
11. Geer, T.; Jørgensen, T.V. *Ø-Mærket*; Erhvervsskolernes Forlag: Copenhagen, Denmark, 1996.

12. Statistik Danmarks. Organic Production and Trade—2025. 2025. Available online: https://www.dst.dk/en/Statistik/emner/miljoe-og-energi/oekologi (accessed on 7 August 2025).
13. Sørensen, N.N.; Lassen, A.D.; Løje, H.; Tetens, I. The Danish Organic Action Plan 2020: Assessment method and baseline status of organic procurement in public kitchens. *Public Health Nutr.* **2015**, *18*, 23502357. [CrossRef] [PubMed]
14. Ehlers, E. *Agricultura Sustentável: Origens e Perspectivas de um Novo Paradigma*; Livros da Terra: São Paulo, Brazil, 1996.
15. Ehlers, E. A agricultura alternativa: Uma visão histórica. *Estud. Econômicos* **1994**, *24*, 231–262.
16. Carneiro, F.F.; Rigotto, R.M.; da Silva Augusto, L.G.; Friedrich, K.; Burigo, A.C. *Dossiê ABRASCO: Um Alerta Sobre os Impactos dos Agrotóxicos na Saúde*; EPSJV: Rio de Janeiro, Brazil; Expressão Popular: São Paulo, Brazil, 2015.
17. Bombardi, L.M. *Geografia do Uso de Agrotóxicos no Brasil e Conexões com a União Europeia*; FFLCH-USP: São Paulo, Brazil, 2017.
18. Bombardi, L.M. *Agrotóxicos e Colonialismo Químico*; Editora Elefante: São Paulo, Brazil, 2023.
19. Abreu, L.S.; Bellon, S.; Brandenburg, A.; Ollivier, G.; Lamine, C.; Darolt, M.R.; Aventurier, P. Relações entre agricultura orgânica e agroecologia: Desafios atuais em torno dos princípios da agroecologia. *Desenvolv. Meio Ambiente* **2012**, *26*, 143–160. [CrossRef]
20. Assis, R.L.; Romeiro, A.R. Agroecologia e agricultura orgânica: Controvérsias e tendências. *Desenvolv. Meio Ambiente* **2002**, *6*, 67–80. [CrossRef]
21. Pianna, A. Agricultura Orgânica: A Subjacente Construção de Relações Sociais e Saberes. Master's Thesis, CPDA/UFRRJ, Rio de Janeiro, Brazil, 1999.
22. Moura, I.F. Antecedentes e aspectos fundantes da agroecologia e da produção orgânica na agenda das políticas públicas no Brasil. In *A Política Nacional de Agroecologia e Produção Orgânica no Brasil: Uma Trajetória de Luta Pelo Desenvolvimento Rural Sustentável*; Sambuichi, R.H.R., Moura, I.F.d., Mattos, L.M.d., Avila, M.L.d., Spinola, P.A.C., Silva, A.P.M.d., Eds.; IPEA: Brasília, Brazil, 2017; pp. 25–51.
23. Fonseca, M.F.A.C. *Agricultura Orgânica: Regulamentos Técnicos para Acesso aos Mercados dos Produtos Orgânicos no Brasil*; Pesagro-Rio: Niterói, Brazil, 2009.
24. Grisa, C.; Schneider, S. *Políticas Públicas de Desenvolvimento Rural no Brasil*; Editora da UFRGS: Porto Alegre, Brazil, 2015.
25. Von Der Weid, J.M. Construindo políticas públicas em apoio à agroecologia. *Agric. Práticas Políticas Públicas* **2006**, *3*, 4–6.
26. EMBRAPA. *Empresa Brasileira de Pesquisa Agropecuária. Marco Referencial em Agroecologia*; Embrapa Informação Tecnológica: Brasília, Brazil, 2006.
27. Brasil. *Decreto N.º 7.272, de 25 de Agosto de 2010. Regulamenta a Lei no 11.346, de 15 de Setembro de 2006, que cria o Sistema Nacional de Segurança Alimentar e Nutricional—Sisan, com Vistas a Assegurar o Direito Humano à Alimentação Adequada, Institui a Política Nacional de Segurança Alimentar e Nutricional—PNSAN, Estabelece os Parâmetros para a Elaboração do Plano Nacional de Segurança Alimentar e Nutricional, e dá Outras Providências*; Presidência da República: Brasília, Brazil, 2010.
28. Schmitt, C.J.; Grisa, C. Agroecologia, mercados e políticas públicas: Uma análise a partir dos instrumentos de ação governamental. In *Agroecologia: Práticas, Mercados e Políticas Para uma Nova Agricultura*; Nierdele, P.A., Almeida, L., Vezzani, F.M., Eds.; Kairós: Curitiba, Brazil, 2013; pp. 215–266.
29. Brasil. *Decreto Nº 1.946, de 28 de Junho de 1996. Cria o Programa Nacional de Fortalecimento da Agricultura Familiar—PRONAF e dá Outras Providências*; Presidência da República: Brasília, Brazil, 1996.
30. Bojanic, A.J.; França, C.G.D.; Marques, V.P.M.D.A.; Del Grossi, M.E. *Superação da Fome e da Pobreza Rural: Iniciativas Brasileiras*; Organização das Nações Unidas para a Alimentação e a Agricultura (FAO): Brasília, Brazil, 2016.
31. Brasil. *Plano Nacional de Agroecologia e Produção Orgânica: Relatório de Balanço 2013–2015*; MDA: Brasília, Brazil, 2016.
32. Wesz Junior, V.J. O PRONAF pós-2014: Intensificando a sua seletividade? Dossiê: PRONAF 25 anos: Histórico, transformações e tendências. *Revista Grifos-Unochapecó* **2020**, 89–113. [CrossRef]
33. Fossá, J.L.; da Luz, A.A.; Renk, A.A.; Villwock, A.P.S.; Matte, A. A falta de financiamento de crédito rural: Reflexões a partir do PRONAF linhas "verdes". *Colóquio-Rev. Desenvolv. Reg.* **2023**, *20*, 189–203.
34. Lima, L.; Romeiro, A.R.; Abreu, L.S.; Mangabeira, J.A.C. Construção de uma tipologia para a produção orgânica no Brasil. In Proceedings of the Congresso da Sociedade Brasileira de Economia, Administração e Sociologia Rural, Brasília, Brazil, 2 September 2021. [CrossRef]
35. Lamarche, H. *A Agricultura Familiar, Comparação Internacional*; Unicamp: Campinas, Brazil, 1993.
36. Lamarche, H. *L'Agriculture Familiale II: Du Mythe à la Réalité*; L'Harmattan: Paris, France, 1994.
37. Phillips, L.D.; Bana e Costa, C.A. Transparent prioritisation, budgeting, and resource allocation with multi-criteria decision analysis and decision conferencing. *Ann. Oper. Res.* **2007**, *154*, 51–68. [CrossRef]
38. Bana e Costa, C.A.B.; Ensslin, L.; Cornêa, É.C.; Vansnick, J.C. Decision support systems in action: Integrated application in a multicriteria decision aid process. *Eur. J. Oper. Res.* **1999**, *113*, 315–335. [CrossRef]
39. Bana e Costa, C.A.B.; Vansnick, J.C. MACBETH—An Interactive Path Towards the Construction of Cardinal Value Functions. *Int. Trans. Oper. Res.* **1994**, *1*, 489–500. [CrossRef]
40. Marchioro, N.P.X. Sistemas Técnicos de Produção Agrícola: O caso do município de Morretes. In *Desenvolvimento e Meio Ambiente-em Busca da Interdisciplinaridade*; Raynaut, C., Ed.; UFPR: Curitiba, Brazil, 2002; Capter 3; pp. 195–211.

41. Buainain, A.M.; Batalha, M.O. Cadeia Produtiva de Produtos Orgânicos. Série Agronegócios, Brasília, 2007. Available online: https://repositorio-dspace.agricultura.gov.br/bitstream/1/497/1/BR0704923.pdf (accessed on 7 August 2025).
42. Assad, E.D.; Lopes-Assad, M.L. Mudanças do clima e agropecuária: Impactos, mitigação e adaptação. Desafios e oportunidades. *Estud. Avançados* **2024**, *38*, 271–292. [CrossRef]
43. Asai, M. Exploring Policy Approaches for Further Development of Organic Farming in Denmark. *J. Rural Probl.* **2024**, *60*, 11–18. [CrossRef]
44. IFOAM Organics Europe. Environmental Impacts of Achieving the EU's 25% Organic Land Target by 2030: A Preliminary Assessment. Report for IFOAM Organics Europe, Brussels, 2022. Available online: https://www.organicseurope.bio/library/environmental-impacts-of-achieving-the-eus-25-organic-land-by-2030-target-a-preliminary-assessment/ (accessed on 7 August 2025).
45. Olesen, J.E. Organic farming and the challenges of climate change. *Ecol. Farming* **2009**, *44*, 2–5.
46. Schjønning, P.G.; Heckrath, G.; Christensen, B.T. *Threats to Soil Quality in Denmark: A Review of Existing Knowledge in the EU Soil Thematic Strategy Context*; DJF Report Plant Science No. 143; Aarhus University, Det Jordbrugsvidenskabelige Fakultet: Aarhus, Denmark, 2009.
47. Godfrey, J.; Bones, C.; Clinton, L.; Dodgson, C.; Bennett, T.; Bragg, N.; Cross, J.; Houston, S.; Stevenson, A.; Tipples, J.; et al. Agriculture and Horticulture Development Board Annual Report and Accounts 2011/12. 2011. Available online: https://assets.publishing.service.gov.uk/media/5a7b7d9d40f0b62826a03ec7/0238.pdf (accessed on 7 August 2025).
48. Lima, L.O.; Medeiros, M.B.; Silva, M.J.R. Identificação das dificuldades de acesso ao PRONAF pelos agricultores familiares no Nordeste brasileiro. *Rev. Extensão Univasf Pet.* **2019**, *7*, 6–25.
49. Paiva, R.d.S.; Rodrigues, M.S.; de Souza, R.F.; Olinda, D.R. Challenges and perspectives related to climate change and food security in Brazil. *Rev. Multidiscip. Nordeste Min.* **2025**, *1*, 1–13. [CrossRef]
50. Fiorini, A.C.O.; Angelkorte, G.B.; Bakman, T.; Baptista, L.B.; Cruz, T.; Diuana, F.A.; Morais, T.N.; Rathmann, R.; Silva, F.d.; Tagomori, I.S.; et al. How climate change is impacting the Brazilian agricultural sector: Evidence from a systematic literature review. *Environ. Res. Lett.* **2024**, *19*, 083001. [CrossRef]