THE 2030 AGENDA AND THE BRAZILIAN VEGETABLE CHAIN: OPPORTUNITIES FOR A SUSTAINABLE FUTURE

Bruno Santos Florindo
Joana Gabriely Ferreira
Karen Mendes Nascimento Barbosa da Silva
Mariana Rodrigues Fontenelle
Carlos Eduardo Pacheco Lima

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A AGENDA 2030 E A CADEIA DE HORTALIÇAS NO BRASIL: OPORTUNIDADES PARA UM FUTURO SUSTENTÁVEL

LA AGENDA 2030 Y LA CADENA DE PRODUCCIÓN DE HORTALIZAS EN BRASIL: OPORTUNIDADES PARA UN FUTURO SOSTENIBLE

Bruno Santos Florindo[1]
Joana Gabriely Ferreira[2]
Karen Mendes Nascimento Barbosa da Silva[3]
Mariana Rodrigues Fontenelle[4]
Carlos Eduardo Pacheco Lima[5]

[1]Graduate student in Environmental Sciences (UNB), PIBIT-CNPq scholarship recipient, Embrapa Vegetables, Brasília – DF.

[2]Graduate student in Environmental Sciences (UNB), PIBIT-FAPDF scholarship recipient, Embrapa Vegetables, Brasília – DF.

[3]Graduate student in Agronomy (UNB); PIBIT-FAPDF scholarship recipient, Embrapa Vegetables, Brasília – DF.

[4]Phd Agricultural Microbiology, Researcher, Embrapa Hortaliças, Brasília – DF.
ORCID: https://orcid.org/0000-0001-8318-5933

[5]hd Soil and Plant Nutrition, Researcher, Embrapa Hortaliças, Brasília – DF.
CNPq's Productivity Fellow in Technological Development and Innovative Extension
ORCID: https://orcid.org/0000-0002-6975-8560

Abstract

The Brazilian vegetable production chain holds great socioeconomic importance, generating employment and income and being closely associated with family farming. However, the sector faces significant challenges, such as low *per capita* vegetable consumption, high vulnerability to Global Climate Change (GCC), and the low adoption of sustainable and resilient production systems. The current global situation regarding sustainability is searching for more sustainable and healthier products that can be traced back to their origin and production systems. This paper, through a systematic literature review and expert opinion, proposes development strategies for the Brazilian vegetable chain aligned with the 2030 Agenda and its Sustainable Development Goals (SDGs). Adherence to all SDGs can be observed. The adoption of innovation, workforce qualification, regenerative systems and practices, female leadership, chains' organization, cultivation in urban and peri-urban areas, improve nutraceutical potential, rational and renewable inputs as fertilizers, agricultural defensives and water emerges as examples of alternative for climate resilience, income generation, and socioeconomic inclusion. It is concluded that the 2030 Agenda, while challenging, generates important opportunities for a more innovative, resilient, sustainable, and climate-friendly sector in Brazil.

Keywords: sustainable development; vegetable crops; environmental quality; global climate change; sustainable development goals; challenges and opportunities

Resumen

A cadeia produtiva brasileira de hortaliças tem grande importância socioeconómica, gerando emprego e renda e estando intimamente associada à agricultura familiar. No entanto, o setor enfrenta desafios significativos, como o baixo consumo *per capita* de hortaliças, a alta vulnerabilidade às Alterações Climáticas Globais (ACG) e a baixa adoção de sistemas de produção sustentáveis e resilientes. A atual situação global em relação à sustentabilidade busca produtos mais sustentáveis e saudáveis, cuja origem e sistemas de produção possam ser rastreados. Este artigo, por meio de uma revisão sistemática da literatura e opinião de especialistas, propõe estratégias de desenvolvimento para a cadeia brasileira de hortaliças alinhadas com a Agenda 2030 e seus Objetivos de Desenvolvimento Sustentável (ODS). É possível observar a adesão a todos os ODS. A adoção de inovação, qualificação da força de trabalho, sistemas e práticas regenerativas, liderança feminina, organização das cadeias, cultivo em áreas urbanas e periurbanas, melhoria do potencial nutracêutico, insumos racionais e renováveis como fertilizantes, defensivos agrícolas e água surgem como exemplos de alternativas para resiliência climática, geração de renda e inclusão socioeconómica. Conclui-se que a Agenda 2030, embora desafiadora, gera oportunidades importantes para um setor mais inovador, resiliente, sustentável e favorável ao clima no Brasil.

Palavras-chave: desenvolvimento sustentável; cultivos de hortaliças; qualidade ambiental; mudanças climáticas globais; objetivos de desenvolvimento sustentável; desafios e oportunidades

Resumen

La cadena de producción de hortalizas brasileña tiene una gran importancia socioeconómica, ya que genera empleo e ingresos y está estrechamente relacionada con la agricultura familiar. Sin embargo, el sector se enfrenta a importantes retos, como el bajo consumo de hortalizas *per cápita*, la alta vulnerabilidad al cambio climático global (CCG) y la escasa adopción de sistemas de producción sostenibles y resilientes. La situación mundial actual en materia de sostenibilidad busca productos más sostenibles y saludables, cuyo origen y sistemas de producción puedan rastrearse. Este documento, a través de una revisión sistemática de la literatura y la opinión de expertos, propone estrategias de desarrollo para la cadena hortícola brasileña alineadas con la Agenda 2030 y sus Objetivos de Desarrollo Sostenible (ODS). Se observa el cumplimiento de todos los ODS. La adopción de la innovación, la cualificación de la mano de obra, los sistemas y prácticas regenerativos, el liderazgo femenino, la organización de las cadenas, el cultivo en zonas urbanas y periurbanas, la mejora del potencial nutracéutico, los insumos racionales y renovables como fertilizantes, los defensivos agrícolas y el agua surgen como ejemplos de alternativas para la resiliencia climática, la generación de ingresos y la inclusión socioeconómica. Se concluye que la Agenda 2030, aunque supone un reto, genera importantes oportunidades para un sector más innovador, resiliente, sostenible y respetuoso con el clima en Brasil.

Palabras clave: desarrollo sostenible; cultivos hortícolas; calidad medioambiental; cambio climático global; objetivos de desarrollo sostenible; retos y oportunidades.

1. INTRODUÇÃO

The vegetable production chain is of great socioeconomic importance to Brazil. It also plays a significant role in maintaining food security and, especially, nutritional security. Despite its relevance, it has low investment potential and is dominated by low-income family farms that are highly vulnerable to recent phenomena such as global climate change (GCC). It is still poorly adapted to this new scenario, mainly due to the low adoption of regenerative production systems (Lima *et al.,* 2015; IPCC, 2021; IPCC, 2023).

The United Nations (UN) 2030 Agenda, in turn, represents an important milestone for achieving sustainability through its 17 Sustainable Development Goals (SDGs), defined as an action plan for people, the planet, and prosperity, seeking to strengthen universal peace with greater freedom. It also recognizes that poverty eradication is the greatest

global challenge and an indispensable requirement for sustainable development (UN Brazil, 2015). In Brazil, specifically, an eighteenth SDG was adopted.

The 18 Brazilian SDGs are: SDG 1 - poverty eradication; SDG 2 - zero hunger and sustainable agriculture; SDG 3 - health and well-being; SDG 4 - quality education; SDG 5 - gender equality; SDG 6 - clean water and sanitation; SDG 7 - clean and affordable energy; SDG 8 - decent work and economic growth; SDG 9 - industry, innovation, and infrastructure; SDG 10 - reduced inequalities; SDG 11 - sustainable cities and communities; SDG 12 - responsible consumption and production; SDG 13 - climate action; SDG 14 - life below water; SDG 15 - life on land; SDG 16 - peace, justice, and strong institutions; SDG 17 - partnerships and means of implementation; and SDG 18 - ethnic and racial equality (MIR, 2024).

Internationally, 169 targets were defined to achieve the 17 SDGs (UN Brazil, 2015). In Brazil, a compilation of national targets to achieve the original 17 SDGs can be found in IPEA (2018). Of the 169 global targets, 167 were considered aligned with the country's reality. However, many were altered in their wording (128 targets). Eight new targets were also created to adapt them to the Brazilian reality, totaling 175 national targets.

Although managers may initially imagine that sustainability agendas bring problems for productive sectors, the modern view of this issue makes it clear that they also bring important opportunities (Shourkaei, 2025), which will be described in the following topics.

Thus, the aim of this paper is to propose strategies for developing the vegetable production chain based on the principles established by Agenda 2030 and its SDGs, drawing on a review of the literature. This paper is a combination of a systematic review of literature and the authors' opinions.

2. METODOLOGIA

The systematic literature review aimed to characterize the current state of the vegetable production chain in Brazil, as well as to present challenges and opportunities for the sector posed by the 2030 Agenda and its SDGs.

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To achieve this objective, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method was followed, which is the state of the art in terms of literature review papers.

To achieve the proposed results, only peer-reviewed articles in indexed journals, technical and scientific documents, reports, and official data from institutions linked to the Brazilian government, international organizations, or private companies and entities linked to the sector were used. The search was restricted, preferably, to the last 10 years of publication.

The literature search was conducted on the Capes Journals portal, using Perplexity.ai artificial intelligence, and search engines such as Google. For the use of Generative Artificial Intelligence (AI), Prompt Engineering and Command Chaining strategies were used, as well as verification of data such as title, published journal, and whether the document addresses and cites the topic necessary for use, always returned through links and DOIs.

The following terms were used: vegetable growing, vegetables, vegetable production sector, vegetable production chain, 2030 agenda, sustainable development goals, Brazilian SDG targets, climate change, climate emergency, vegetable production systems, among others.

3. RESULTADOS E DISCUSSÃO

Current context

The term vegetable crops can be understood as any edible plant that is grown in a vegetable garden, has a short cycle, and requires intensive labor for cultivation, that is, when it comes to this chain, it is understood that various products are being considered, ranging from leafy vegetables such as lettuce and cabbage to roots that play an important role in human and animal nutrition, such as carrots (CNA, 2017). The vegetable production chain, on the other hand, ranges from seed and seedling production to final commercialization (Ahmed *et al.,* 2024).

It is estimated that the Brazilian fruit and vegetable sector employs around 13 million workers, with 3.3 million producers dedicated to the cultivation of the 24 main agricultural

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crops linked to this sector, occupying around 5.1 million hectares that lead to the production of around 53 million tons annually (Carvalho et al., 2020). These data reveal the socioeconomic importance of the sector, not only because of its great capacity to generate jobs, but also because most vegetable producers are family farmers (Santos *et al*., 2025).

In addition, the fruit and vegetable sector is responsible for the production and commercialization of products with high nutritional potential and is therefore also very important for maintaining the health and well-being of the Brazilian population.

At national level, family farmers produced 64.4% lettuce, 70.8% bell pepper, 52.5% onion and 18.8% tomatoes. At regional level, these producers are responsible per 53.7% pumpkin, 69.2% sweet potatoes and 55.6% watermelon on Brazilian semiarid, for example (Araújo *et al.,* 2024).

It is estimated also that the area cultivated with the main vegetable crops in Brazil is around 821,000 hectares. Around 5.5 million tons were handled in the country's main supply centers of the main vegetables (Fardin et al., 2025), generating about R$ 20 billion in transaction values.

The Gross Production Value (GPV) of the three main vegetables (potatoes, tomatoes, and onions) reached R$ 30.7 billion. Horticulture also stands out for its ability to generate jobs throughout its chain (production, logistics, marketing, and processing), increase the retention of producers in the field, and provide fresh food with high nutritional value.

In addition, 95% of production is destined for the domestic market, highlighting its importance for the food and nutritional security for Brazilians. Processes such as certifications of good agricultural practices and sustainability have advanced in the sector, adding value and competitiveness (Kist & Beling, 2023).

Analysis of data from the 2017 Agricultural Census conducted by the Brazilian Institute of Geography and Statistics (IBGE) led Carvalho *et al.* (2020) to conclude that 1,232,576 production units generate approximately 12 million tons annually of 57 products classified as vegetables.

The vegetable production chain is very complex, with different flowcharts possible when analyzing the various species that make up this group. It can be divided into four main links: “Before the farms,” “On the farms,” “Food Industry,” and “Distribution and Facilitating Agents.” Activities “before the farms” include the entire chain of production,

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distribution, and marketing of inputs. In turn, the “on the farms” stage includes the entire agricultural production system, as well as operations carried out on farms, such as pre-washing and packaging, among others, which normally occur in structures defined for this purpose, commonly referred to as packing houses.

The “food industry” stage, which does not apply to all vegetables and all producers, includes all processes for processing products, which can be divided into processed food industry and minimally processed food industry. Distribution comprises all channels that bring fresh or processed products to the end consumer, food services, or retailers.

Facilitating agents include analysis laboratories, technical assistance and training, associations and unions, management advisory and consulting services, machinery and improvements insurance, and freight/shipping.

Data from 2016 show that the highest turnover was observed for processed vegetables, followed by fresh vegetables and minimally processed vegetables (CNA, 2017).

Activities related to “pre-farm” operations generate approximately US$ 3.2 billion annually. These include the consumption and use of fertilizers and soil conditioners, pesticides, seedlings, fuel, and electricity.

It is estimated that pesticides alone generate around US$ 460 million per year. The sale of seeds and seedlings, in turn, generates around R$ 900 million annually. Another highlight is the dependence on equipment and electricity, especially in irrigated horticulture, which represents around 80% of production systems.

Activities classified as “on farms” are already carried out in a highly diversified market, with more than 100 cultivars and a predominance of family labor. They also constitute a wide diversification of regional crops, production systems, and consumer preferences. Post-harvest losses at this stage vary between 5% and 35%, with a weighted average of around 20%, which could represent around US$ 5 billion. The “post-farm” stage is characterized by industrial processing, whether large or small scale, generating around US$ 2 billion annually.

Finally, the distribution and marketing of vegetables generate around US$ 6 billion annually, with processed products having the highest added value (CNA, 2017).

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Challenges to the sustainability of the vegetable production chain

In our understanding, the main challenge faced by the vegetable production chain, in terms of sustainability, is the low per capita consumption by Brazilians. Canella *et al.* (2018), when evaluating this variable, demonstrated that per capita consumption in Brazil is 46.1 g/day.

Oliveira *et al.* (2021) present figures that are even more worrying than those presented by Canella *et al.* (2018), pointing out that per capita consumption of vegetables in Brazil fell from 42.7 g/day in the period between 2008 and 2009 to 37.4 g/day between 2017 and 2018. Nascimento (2020), on the other hand, points to a higher figure, 141 g/day.

These numbers are significantly lower than the quantity of vegetables recommended by the World Health Organization (WHO) for daily consumption, which is 400 g/person, with a view to healthy eating. OECD&FAO (2021) show that the average consumption of vegetables in developed countries varies between 250 and 400 g/person/day, values that are also significantly higher than those observed for Brazil.

Canella *et al.* (2018) also show that there is little diversification in the consumption of vegetables by Brazilians, concentrating on only ten products, namely: tomatoes, onions, carrots, cabbage, lettuce, pumpkin, chayote, bell peppers, garlic, and beets. According to these authors, in 2018, 42.1% of Brazilians interviewed stated that they had not consumed vegetables during the year, a very worrying scenario in terms of nutritional security.

This scenario is linked to social inequality and the presence of a large socioeconomically vulnerable population, cultural aspects, and increased consumption of ultra-processed products. The population with higher average income tends to consume more vegetables than those with lower income.

Frequent economic crises faced by the country further worsen the situation. Despite the low per capita consumption of vegetables in Brazil, data from the Ministry of Health point to an improvement in the purchase of these foods in the last decade, a behavior linked to the search for healthier habits led mainly, but not exclusively, by women (Carvalho *et al.,* 2020).

Another fundamental challenge for the production chain is the climate issue. Agriculture is considered an economic activity that is highly dependent on weather

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conditions. Climate is the biggest risk factor for agriculture, with an estimated 80% productivity variability linked to seasonal and interannual climate variability.

Factors such as temperature, solar radiation, rainfall, air humidity, wind speed, and soil water availability influence the quantity and quality of agricultural production. They also influence pollinators, predators, the occurrence of pests and diseases, water scarcity, among others (MMA, 2016).

According to the sixth IPCC report (AR6) (IPCC, 2021; IPCC, 2023), the global average temperature (GAT) increased by 1.1°C between 2011 and 2020 compared to the pre-industrial period (1850 to 1900), with the greatest increase observed on the continents (1.59°C).

However, recent data show that 2024 was the first year to exceed the target set by the Paris Agreement (IPCC, 2018), which is 1.5°C (Copernicus, 2025a). In 2025, GAT continued to be above this value (Copernicus, 2025b). This scenario intensifies the climate problem and its effects on crops, especially vegetables, most of which originate in regions with cold or mild climates.

The increase in GAT should lead to an increase in the occurrence of extreme events such as rain, drought, and heat waves. The frequency, intensity, and duration of these events are expected to increase.

In fact, observed data already show an increase in variables such as the Precipitation Concentration Index (PCI) and the Rainfall Severity Index (RSI) in an area in the city of Brasília, Federal District, Brazil, increasing the erosivity of rainfall (Lima *et al.,* 2025).

IPCC (2021) and IPCC (2023) also show that extreme heat wave events are expected to become 5.1°C hotter and 9.4 times more frequent with an increase in GAT above 4°C, with a recurrence time of 10 years. Extreme rainfall events, on the other hand, are expected to become 30.2% stronger and 2.7 times more frequent in the same scenario.

Agricultural droughts, in turn, are expected to increase by 1.0 sd and become 4.1 times more frequent. All of this has the potential to impact agricultural production, increasing the need for water for irrigation, leading to a drop in productivity and quality of the final product, causing a reduction in soil fertility due to erosion, as well as making the scenario of pests and diseases more complex.

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Furthermore, they can alter post-harvest losses and transport logistics. All of this tends to reduce supply and cause an increase in the prices of commercialized vegetables (Mattos *et al.,* 2014; Kuo *et al.,* 2020; Ibrahim, 2021; Tchonkouang *et al.,* 2024).

The limited scope of current public policies, such as the availability of efficient rural extension services, and the limited scope of the current legal framework, such as the National Policy on Climate Change (PNMC), the National Adaptation Plan (PNA), and the Plan for Adaptation and Low Carbon Emissions in Agriculture - ABC+, also pose additional challenges to achieving sustainability in the sector.

The inclusion of regenerative strategies as a selection criterion in programs such as the National Program for Strengthening Family Agriculture and the improvement of existing programs designed for this purpose, such as the National Bioinputs Program, the National Policy on Organic Agriculture and Agroecology, and the National Program for Urban and Peri-urban Agriculture, are also desirable.

Finally, the valuation of ecosystem services provided by family farming, such as carbon sequestration, water production, and the preservation of biodiversity and the environment, also needs to be implemented (CONTAG & Observatório do Clima, 2025).

The need to generate information to support production planning, such as the geo spatialization of future climate scenarios for horticulture, is another key point. Other Research, Development, and Innovation (RD&I) actions, such as the development of equipment and machinery, the Internet of Things (IoT), applied Artificial Intelligence (AI), among other strategies related to precision agriculture, are also important gaps that still exist for the development and achievement of sustainability in the horticultural sector (Akhter & Sofi, 2022; Kumar *et al.,* 2024; Sharma *et al.,* 2024; Mansoor *et al.,* 2025).

Another point that stands out, not only in Brazil but worldwide, is the low adoption of sustainable and resilient systems for growing vegetables. Although there is a scarcity of systematic global studies on the subject, case studies, as well as daily observations in the field, show that these systems are still very little used. Data from Lemke *et al*. (2024) show that, for vegetables grown in the state of California, United States of America (USA), only 7% use the organic production system.

A study conducted in Nepal points out that only a small portion of vegetable producers use some type of protected environment production system, accounting for about 20% in

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Asia (Subedi *et al.,* 2023). Studies conducted in Brazil, for example, on lettuce crops, indicate that more than 90% of the planted area is cultivated conventionally (Resende *et al.,* 2007; Silva *et al.,* 2023; Santos *et al.,* 2024).

Finally, value addition and coordination of production chains are still factors to be addressed. The use of "middlemen" for marketing is still very common, which is not the only reason, but one of the reasons why prices are often much lower than those paid to rural producers in final sales.

Another important point is the population's search for increasingly healthy, traceable, and at least minimally processed foods, as shown by studies such as those by Mattos et al. (2009), Lopes & Pedroso (2017) and Nascimento (2023).

How can the 2030 Agenda positively impact the vegetable production chain in Brazil?

In the specific case of the vegetable production chain, adherence to the SDGs is evident. Its products are directly linked to the daily healthy diet, and its workforce is largely composed of low-income family farmers, who depend on this activity as employment and income source. Thus, the products in this chain are clearly linked with SDG 1, SDG 2, and SDG 3.

The growing importance of issues related to the type of employment generated by the sector is also evident. New technological solutions such as digital and sustainable technologies, new equipment, process automation, among others, can change the profile of workers in the sector, requiring their training, thus also aligning with SDGs 4, 8, and 9. This movement can also help keep young people in rural areas, reducing pressure on cities and reducing inequalities, factors that are aligned with SDGs 10 and 11.

Greater sustainability of horticultural production systems should also be sought. The adoption of regenerative, resilient, and adapted systems and practices such as the No-Till for Vegetables (SPDH), Agroforestry Systems (SAFs), Organic System (SORG), Agroecological Systems (SACs), crop rotation, and bio-inputs use should be considered as a strategy for improving soil and environmental health, as well as adapting to the projected climate scenario under MCG conditions.

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Other aspects such as rational fertilization and irrigation management, the use of protected, soilless, and controlled environment production systems, traceability, Integrated Pest and Disease Management (IPM), and reduction of post-harvest losses should also be considered as opportunities provided by the sector in the context of the 2030 Agenda, with the potential to add value by increasing responsible consumption and in the context of actions against climate change, as set out in SDGs 12 and 13.

Such actions also have an impact on biodiversity, aligning with SDGs 14 and 15. In addition, with regard to environmental sustainability, increasing the use of renewable energy sources, rural sanitation conditions, water conservation, and reuse should also be considered a priority, linking to SDGs 6 and 7.

The rational use of water resources in irrigation and food processing should also be carefully implemented. The adoption of agricultural practices and systems such as no-till vegetable farming, the use of biofertilizers, sustainable irrigation systems, and agroforestry systems capable of reducing greenhouse gas emissions, increasing carbon sequestration in the soil, climate resilience and adaptation, for example, can lead to the possibility of acquiring cheaper credit in accordance with current legislation, such as the ABC+ Plan, in addition to opening up space for receiving payments for ecosystem services in the future.

The demand for nutraceuticals (products with greater nutritional potential) is likely to grow in the context of the search for healthy eating and unique health, especially among the middle and upper classes. It is worth remembering that vegetables are important sources of nutrients such as calcium, iron, vitamin C, provitamin A, carotenoids, carbohydrates, lycopene, fiber, among others. The nutritional potential of cultivated vegetables can be improved through actions such as plant genetic breeding, changes in agricultural production systems, and improvements in logistics, storage, and commercial conditions.

This search is linked to improving health and well-being and, therefore, to SDG 3. However, it should be noted that this process should not be disconnected from increasing access to vegetables for consumption by the population, even those with low incomes, contributing to the fight not only against hunger as we conventionally know it, but also against what has come to be known as hidden or nutritional hunger (SDG 2).

Organizing the sector in different formats, such as cooperatives, would also ensure strength in negotiations and improve the quality of life of rural producers. This point is linked to SDGs 16 and 17. Furthermore, social organization and training of employees to perform daily and current tasks is related to SDG 4. The possibility of including women, including in management positions, increases gender equality, linking to SDG 5. Improvements in income and the characteristics of jobs generated by the sector can also lead to a stronger link with SDGs 1, 2, and 8.

It is also important to remember that vegetables are well suited to cultivation in urban and peri-urban areas. In this regard, Decree 11,700 of 2023, which establishes the National Program for Urban and Peri-Urban Agriculture (PNAUP), defines, in Article 2, this type of agriculture as that which is linked to agricultural activities and small-scale animal husbandry carried out in urban or peri-urban areas, including: I - the stages of production, processing, distribution, and marketing of food, medicinal plants, aromatic and ornamental plants, herbal medicines, and inputs, for self-consumption or commercialization; and II - organic waste management processes.

Article 4 establishes the following principles of the program: I - the human right to adequate food; II - the right to health; III - the right to the city; IV - popular and social participation; V - the popular and solidarity economy; VI - cooperativism and associative; VII - agroecology and organic production; VIII - healthy and sustainable food systems; IX - short marketing circuits; X - sustainable use of soil, water, ecosystems, and agrosociobiodiversity; XI - respect for socio-environmental and cultural diversity; XII - food as a cultural and social practice; and XIII - the bioeconomy.

Article 5, in turn, sets out the objectives of the PNAUP: I - sustainable agriculture in urban areas and peri-urban regions; II - access to adequate and healthy food and the guarantee of food and nutritional security for the urban population; III - socioeconomic inclusion and income generation; IV - environmental conservation and sustainable management, in order to support agroecological transition and water and soil conservation, and restrict the use of highly toxic pesticides and chemical inputs in urban areas and peri-urban regions; V - food circularity, through actions related to production, distribution, consumption, and recycling of organic waste, in order to reduce food loss and waste; VI - the development of healthier, more sustainable cities that are resilient to climate

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change, in order to combat environmental racism and encourage the adoption of climate change adaptation and mitigation practices; VII - youth participation in various urban and peri-urban agriculture activities; VIII - the marketing and supply of healthy food, mainly through short supply chains; IX - the role of women in urban and peri-urban agriculture; and X - combating food insecurity resulting from social inequalities related to race, ethnicity, and gender.

Finally, Article 6 establishes the lines of action as follows: I - agroecological or organic production; II - processing, supply, and marketing of urban and peri-urban agricultural products; III - management of organic solid waste throughout the production chain; IV - food, nutrition, and environmental education; V - assistance and strengthening of the productive, technical, and managerial capacities of urban and peri-urban farmers; VI - training processes and knowledge and information building; VII - protection and conservation of the environment, biodiversity, and water sources to promote environmental quality in urban and peri-urban areas; VIII - recovery of degraded areas and maintenance and sustainable management of green areas integrated with food production; IX - promotion of technologies for water reuse, rainwater harvesting, and revitalization of rivers, streams, and urban springs; X - research, development, and innovation; and XI - support for educational and community initiatives.

It is also important to emphasize that urban and peri-urban agricultural areas can be understood as nature-based solutions (NBS) capable of mitigating the effects of heat waves and temperature ranges, as well as increasing the capacity for water infiltration into the soil and reducing the negative impacts of flooding in cities, being one of the recommended strategies for controlling extreme events in these urban ecosystems.

That said, in conjunction with the other aspects already mentioned in relation to the PNAUP, vegetable crops present in urban and peri-urban areas encompasses all SDGs and constitute an important alternative for income generation, job creation, and increased climate resilience and adaptation in municipalities.

Thus, the aim of this paper is to propose strategies for developing the vegetable production chain based on the principles established by Agenda 2030 and its SDGs, drawing on a review of the literature. This paper is a combination of a systematic review of literature and the authors' opinions.

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4. CONSIDERAÇÕES FINAIS

- The aim of this paper is to propose strategies for developing the vegetable production chain based on the principles established by Agenda 2030 and its SDGs, drawing on a review of the literature.
- Although, at first, the tendency is for actors to view the implementation of the 2030 Agenda and its SDGs as an obstacle, this article clearly demonstrates that several opportunities arise within this context.
- Although opportunities exist, they require in-depth knowledge of the subject, investment in qualified human and financial resources, cultural change in how the different stages of the production chain are conducted, and, in many cases, changes to the existing legal framework to include sustainability as a criterion for adding value.
- This work also strongly adheres to the IPCC benchmarks for mitigation, resilience, adaptation, and climate justice, as well as those for a just transition. Furthermore, it is aligned with various Brazilian public policies related to sustainable development, agricultural production, rural sanitation, social inclusion, science, technology and innovation and climate change.

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