SDGS STUDIES REVIEW
e-ISSN: 2966-0548 | DOI: https://doi.org/10.37497/sdgs.v6istudies.29

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LITERATURE REVIEW

Geographical Indications and their Impacts on Sustainable Development: Literature Review

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ABSTRACT | Purpose: This article analyzes the role of the European Union (EU) in shaping an ethical and legal framework for the use of artificial intelligence (AI) in education. It investigates how European institutions aim to ensure trustworthy, transparent, and human-centered AI, while also addressing the challenges of implementation across Member States. **Methodology:** The study adopts a normative and documentary research design, drawing on EU policy strategies, legislative initiatives, and ethical guidelines. It further includes a case study of Romania, examining the extent to which European orientations are reflected in national education systems, with a focus on institutional readiness, digital capacity, and teacher training. **Findings:** The analysis reveals a gap between high-level EU strategies—such as the proposed AI Act, the Digital Education Action Plan, and the Ethics Guidelines for Trustworthy AI—and the practical preparedness of Member States. Romania exemplifies these challenges, showing deficiencies in digital infrastructure, lack of teacher training, and absence of clear ethical standards. These discrepancies highlight the risks of fragmented governance and inconsistent adoption of AI in education. **Originality/Contribution:** By combining normative analysis with a country-level case study, the article contributes to the academic debate on AI governance in education. It demonstrates the tension between innovation and fundamental rights and provides insights into the institutional and ethical conditions necessary for effective implementation. **Practical Implications:** The study offers policy recommendations to strengthen teacher training, ensure algorithmic transparency, and establish certification and oversight mechanisms. It underscores the need for coordinated governance to safeguard equity, trust, and democratic values in the integration of AI in education.

Keywords | European Union; Artificial intelligence; Education policy; Ethical regulation; Governance; Romania

Received: 10 May 2025
Revised: 12 September 2025
Accepted: 02 September 2025
e-ISSN: 2966-0548

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Editor in chief: Prof. Altieres Silva – ALUMNI IN, Florida (EUA).

How to cite this article: Malaguti , J. M. A., & Avrichir , I. (2025). Geographical indications and their impacts on sustainable development: literature review. *SDGs Studies Review*, 6(studies), e029. https://doi.org/10.37497/sdgs.v6istudies.29

1. INTRODUCTION

Geographical Indications (GIs) are industrial property instrument that seeks to distinguish the geographic origin of a specific product or service. As collective tools in the form of a record for valuing traditional products linked to particular territories, GIs have two main functions: adding value to the product and protecting the producing region.

GIs identify regions with reputations linked to products with notable quality and differentiated characteristics. This link between a product, a place and its inhabitants represents a heritage to be preserved. It has market value in its own right as consumers become increasingly interested in product quality and the social, environmental and economic impacts they acquire, as well as the traditions and typicality associated with these products. This is because one of the premises of GIs is to promote the sustainable development of a territory.

The Food and Agriculture Organization of the United Nations considers that GIs can contribute to developing agri-food systems if they fulfil their potential to promote economic development and food security(Emilie Vandecandelaere et al., 2010a). However, for this development to occur effectively, it must encompass economic, social and environmental aspects (Sachs, 2004).

In 2015, world leaders unanimously agreed on a shared vision for the future of humanity. They deliberated on a universal and integrated action plan called Agenda 2030, comprising a set of 17 Sustainable Development Goals (SDGs). They also agreed on 169 integrated and indivisible goals, which balance three dimensions of sustainable development: economic, social and environmental. From this perspective, it can be seen that these 17 SDGs constitute a guideline that can be used to assess whether or not any initiative that impacts development contributes to the achievement of sustainable development (Barrera, 2020). Therefore, this study addresses the 17 SDGs as dimensions to assess whether, according to academic literature, GIs contribute to the sustainable development of the regions where they are located.

Most studies on the relationship between GIs and development have emphasized the economic dimension. Despite the growth in the number of studies on GIs, most are still based on economic perspectives. Only a few studies connect the GIs and the SDGs (Kimura & Rigolot, 2021). Also, few studies still show the types of impacts – positive, neutral and negative – and how these impacts influence compliance with the SDGs. It is to overcome these gaps that this study intends to contribute.

Given this context, the research problem aims to answer: "*How does academic literature evaluate the impacts caused by GIs on the sustainable development of regions that can be classified as GIs? Does the literature evaluate these impacts as positive, neutral or negative?*

The study contributes to the academic literature by showing the predominantly positive position of GIs on sustainable development. It summarizes the points about the positive and negative results found in the literature review. These syntheses bring managerial implications that can guide managers to learn from the experiences of other GIs, multiplying successes and avoiding repetition of mistakes.

2. THEORETICAL FRAMEWORK

2.1. The relevance of GIs in the global context

It is observed that GIs are becoming a global phenomenon. There are more than 8,000 recognized GIs worldwide, of which 2,000 are in China, 1,000 in the Americas, including those in the United States of America and more than 3,300 in the European Union. Drinks and agri-food products, whose names are protected by the

European Union as GIs, represent a sales value of 74,760 million euros, more than a fifth of European Union exports (Comissão Europeia, 2020).

The European Commission, in a recent statement, also highlighted that GIs constitute an essential element of the region's trade agreements and that their use protects European brands from fraudulent use. It also contributes to preserving the good reputation of European beverages and agri-food products. He stated that GIs protect local values globally.

GIs have recently developed in emerging markets, such as Brazil. However, GI development mechanisms have been discussed and recognized as relevant factors for territorial development strategies. They mean valorizing goods, services and agri-food products linked to promoting local culture, growing demand for differentiated products and appealing to tourist activities (Flores, 2006).

In Brazil, the INPI registered until September 2023, a total of 106 GIs. The Industrial Property Law defines two types of GIs: the Denomination of Origin (DO) and the Indication of Origin (IP). The DO refers to the geographic name of a country, region, city, or other location, which designates the service or product whose characteristics or qualities are due essentially or exclusively to the geographic environment, including human and natural factors. IP is the geographical name of a region or location which has become known as a centre for manufacturing, extraction, production or a particular service ((Instituto Nacional da Propriedade Industrial (INPI)., 1996)((Mafra & Wilkinson, 2008).

GIs correspond to a seal of authenticity granted to products or services that became known through their place of origin. This gives them a reputation, intrinsic value and their own identity. It means that they have a unique quality depending on the natural resources and production method, distinguishing them from their similar counterparts available on the market.(Mafra & Wilkinson, 2008)

The GI seal is used by several countries and regions to differentiate and protect their products, as the registration of a GI has a set of legal actions that aim to protect the product or service that holds it. The presence of GIs in developing countries and emerging markets has been a frequent research topic in various disciplines, mainly regarding their role in driving and accelerating economic development. GIs have characteristics of a collective production dimension, which serves as an organizational mechanism for adding added value and marketing to local products, favouring the integration of rural, indigenous and disadvantaged communities on the margins of commerce (Chabrol et al., 2017). FAO considers that GIs can be used to support sustainable development in agri-food systems, if they fulfill their potential to promote economic development and food security (Vandecandelaere et al., 2010).

2.2. Sustainable development and sustainability

For the United Nations, sustainable development seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future. For there to be sustainable development, it is necessary to meet the basic needs of solidarity with future generations, the participation of the population involved, the preservation of natural resources and the environment, the development of a social system that guarantees employment, social security and respect for other cultures, and education programs (Sachs, 2004).

Sustainability is based on three dimensions: environmental, social and economic (Elkington, 1998). While ecological sustainability refers to the development and balance of nature through the maintenance and conservation of ecosystems and biodiversity, social sustainability concerns social development, aiming for greater equality and economic sustainability relates to economic development linked to social needs and environmental issues aimed at profit, well-being and quality of life of the population, that is, a form of sustainable economy.

Even if a territory has considerable economic growth, this issue may not be enough for development in all three dimensions of sustainability. Economic growth does not mean that its population will enjoy this growth homogeneously. On the contrary, economic growth, without sustainable development, without considering the social, economic and environmental dimensions, can cause social segregation to the extent that no equitable income distribution is encompassed within the social aspect of development (Ramos et al., 2016).

To guarantee sustainability in its three dimensions, the 2030 Agenda was created, which aims to guide the planet's nations towards sustainable development, eradicating extreme poverty and strengthening world peace. For this to happen, several programs and actions were developed by member countries of the United Nations (UN) from 2016 to 2030.

The 2030 Agenda was concluded in September 2015 in New York after debates and meetings between delegates from UN member countries. It reinforces the agreement between the parties committed to advancing and establishing actions towards sustainable development across the planet. In this sense, the Department of Economic and Social Affairs for Social Inclusion stated:

> We are determined to take the bold, transformative steps urgently needed to steer the world onto a sustainable and resilient path. As we embark on this collective journey, we commit that no one is left behind (United Nations, 2015).

In this way, the 2030 Agenda is based on 17 SDGs and 169 complementary goals that aim to achieve the three dimensions of sustainability: economic, social and environmental.

3. METHODOLOGY

The approach is qualitative, and the research follows four steps of analysis: data collection, coding (categorization), analysis and interpretation of content (Gaur & Kumar, 2018). Content analysis consists of technical communications analyses using systematic procedures and objective descriptions of the message content. It is also a technique that works with the collected data to identify what is being said about a topic (Bardin, 2006).

3.1. Data collection and coding

Scopus database. It was chosen because it is the most extensive database covering peer-reviewed journals in various areas of study (Pisoni et al., 2018). The period between 2005 and 2021 was considered, retrieving the latest studies on the topic. The keywords were searched in a single step, using the terms: *"geographic * indication"* OR *"protected designation" and "sustainab * development"* OR *"economic * impact"* OR *"environmental * impact"* OR *"social impact"*. Keywords were searched in titles and abstracts. No research areas were selected or other filters applied.

The search returned 74 articles. After reading the abstracts, a selection was made regarding the relevance and adherence to the objective proposed for this research. In this process, 45 articles were excluded, resulting in the final sample of 29 articles for review.

Coding is fundamental to research excellence (Denzin & Strauss, 1988). The manual content analysis technique was applied. No software was used for coding and analysis. The recommendations for separating the coding phases and classifying impacts into positive, neutral and negative were followed (Gaur & Kumar, 2018). Magnitude coding (Miles et al., 2014) was used to code the impact. In this case, it consisted of assigning values ranging from -1 to 1 depending on the intensity and nature of the direction of the relationship and the author's

position on the impact of the GI on one of the SDGs. A similar form of coding was used in an article recently published in a high-impact journal. (Navarrete et al., 2020)Table 1 presents the criteria for coding these impacts.

Table 1. Criteria for coding impacts in the economic, environmental and social dimensions.

Economic/environmental/social dimensions	Punctuation
Positive impact: The author takes the position or provides evidence that GI contributes to sustainable development.	1
Positive impact with reservations: The author takes the position/gives evidence that GI contributes to sustainable development but makes reservations.	0.5
Neutral impact: The author remains neutral or reports no impact or reports positive and negative impacts at more or less the same frequency and intensity.	0
Negative impact with reservations: The author maintains that the impact is predominantly unfavourable but makes reservations.	-0.5
Negative impact: The author has a negative view regarding the contribution of GI to sustainable development.	-1

Source: Prepared by the authors (2023).

4. RESULTS

The results of the content analysis are presented in Table 2. A brief description of the impact each article has on each SDG follows.

Table 2. Results of the impacts of GIs on sustainable development according to the SDGs.

	Criteria	17 GOALS OF SUSTAINABLE DEVELOPMENT																	TOTAL
		1	two	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Positive	1	two	3	1	two	3	1	two	3	1		1	1			two	1	4	**27**
Positive with reservations	0.5						1		1				4			two			**8**
Neutral	0																		**0**
Negative with reservations	-0.5										1	1	two				1		**5**
Negative	-1								1		1		4	1		1		1	**9**
Total mentions		**two**	**3**	**1**	**two**	**3**	**two**	**two**	**5**	**1**	**two**	**two**	**11**	**1**	**0**	**5**	**two**	**5**	**49**

Source: Prepared by the authors (2023) based on the assessment of the position of the articles reviewed.

4.1. The impact of GIs on the SDGs

The results show that the only SDG not mentioned in the articles analyzed is SDG 14, which consists of "conserving and sustainably using the oceans, seas and marine resources for sustainable development" (Nations et al., 2010). Below, the GIs and their impacts on the dimensions of sustainable development related to the other SDGs are presented.

4.2. SDG 1 – Eradicate poverty

Bareisho Potato GI from the city of Mishima in Japan was found to contribute to the employment of women and disabled people and also to people with Asperger's, who grow potatoes in the field, helping them to become

economically and socially independent (Kimura & Rigolot, 2021) (Kimura & Rigolot, 2021). In the same sense, the GI of Chinese Gentian cultivation reinforces the propensity of cooperatives to promote the technological efficiency of rural families. It contributes to the management of the local GI brand and poverty reduction (Wang et al., 2021).

4.3. SDG 2 – Zero hunger and sustainable agriculture

Studies have shown positive impacts of GIs on sustainable development. The GI of Shea butter favoured the development of rural communities in Ghana in Africa (Vecchio et al., 2020). In the six years since the formalization of Korea's Boseong Green Tea as a GI, production in the region has doubled, and the number of tourists has tripled. Prices have increased by over 90%, significantly impacting and revitalizing the regional economy (Suh & MacPherson, 2007). Bérard & Marchenay, (2006) states that GIs make essential contributions to the conservation of local ecosystems, microbial ecosystems and landscapes.

4.4. SDG 3 – Ensure healthy lives and promote well-being for all, at all ages

Analysis of the production process of Japan's Mishima Bareisho Potato, which is air-dried, increases the nutritional value of the potato and makes it potentially useful for improving the diet of the elderly and other vulnerable groups who have metabolic problems (Kimura & Rigolot, 2021).

4.5. SDG 4 – Quality Education

Moroccan Argan Oil GI led to the creation of a program to combat illiteracy for women (Charrouf & Guillaume, 2018) The Mishima croquettes processing company sells its product for snacks in public schools and teaches food balance and safety, while the products become familiar to children, as well as using them in education farms to promote the product to children as the "Next Generation of Consumers" (Kimura & Rigolot, 2021).

4.6. SDG 5 – Achieve gender equality and empower all women and girls

Three articles pointed out positive impacts of GIs on sustainable development. The GI analysis of Argan oil from Morocco showed the improvement in the quality of the product that allows the development of Moroccan rural areas through women's cooperatives. These cooperatives, in turn, facilitate women's access to education and professional qualifications (Charrouf & Guillaume, 2018). Mishima Bareisho 's potato GI from Japan has empowered women farmers (Kimura & Rigolot, 2021). The GI of Shea butter in Ghana, Africa, contributes to the empowerment of rural women, alleviating rural poverty and improving environmental sustainability by engaging producers to preserve Shea nuts (Vecchio et al., 2020)

4.7. SDG 6 – Ensure availability, sustainable management and sanitation of water for all

(Hoang et al. (2020)report that the GI of Cao Phong oranges in Vietnam contributed to the achievement of SDG 6, as farmers became aware that conserving and enriching natural resources, such as water sources and soil, leads to the maintenance of product characteristics (Hoang et al., 2020).

Flinzberger et al. (2020), in a study using the Delphi method with experts, conclude that GIpositively impacts several aspects of sustainability and explicitly mentions water management as one of them. According to the authors, experts indicated that GI is the best method of labelling products for this purpose. However, the study

also suggests that in GIs, the initial costs and the lack of consumer awareness regarding agroforestry make their implementation difficult. As a result, we consider that the article points to the impact of positive statement from the GIs on this SDG, but with reservations.

4.8. SDG 7 – Ensure reliable, sustainable, modern and affordable access to energy for all

Regarding the GI of Argan oil from Morocco, Charrouf & Guillaume (2018) found a positive impact of GIs on this SDG. In addition to contributing to financial independence for women, it also brought, in the case studied by them, new means of communication, new roads and access to electricity.

Other research (Kimura & Rigolot, 2021) attributes favorable impacts of Japan's Mishima Potato GI to this SDG. As potatoes continue to be planted manually, depending on the GI, it has a positive impact on reducing the environmental burden because harvesting is done manually without the use of machines. Drying also does not consume these resources, as it is done in the wind for one to two weeks.

4.9. SDG 8 – Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Three articles referred to the impacts of GIs on this SDG. One pointed out positive impacts with reservations and another negative impact,

Analyzing the GI of Mishima Bareisho Potato from Japan (Kimura & Rigolot, 2021) found that young farmers are forming groups called "*Nomins*". The work is carried out by these teams of young people, who promote the development of high-quality products by exchanging information and encouraging each other. IG also contributes to the achievement of this SDG by promoting local tourism through its products (Kimura & Rigolot, 2021). Considerations on the GI of Argan Oil from Morocco (Charrouf & Guillaume, 2018) showed that, through investments in research, there was a promotion from basically cheap and edible oil to a cosmetic oil with high commercial value, arousing interest in the cosmetic industry in European countries.

An analysis of an olive oil GI in northern Italy showed positive considerations but with caveats (Menozzi, 2014). Specific problems to be faced were detected, such as the lack of technical assistance and coordination and difficulties in creating an organization for the IG, such as a consortium responsible for preparing the formal rules for guaranteeing the system, which would improve the sense of collective engagement chain operators and also the sustainable development of this product (Menozzi, 2014). A fifth article mentions this DS, this time mentioning a negative impact. In the case described, a cheese GI located on the Greek island of Lesvos it does not show economic growth. The authors attribute this lack of growth, despite there being demand, to the inability of farmers to cooperate or realize the potential of a product with a Protected Designation of Origin (Vakoufaris, 2010).

4.10. SDG 9 – Industry, innovation and infrastructure

Samper & Quiñones-Ruiz (2017)argue that because consumers and marketing trends are demanding information about origin as necessary, this gives GIs additional incentives to develop sustainability indicators. Connecting these indicators to marketing content and offering information about sustainability can help regions sell products from these sources. GIs would be particularly well-positioned to take advantage of this trend, as they are governed by strong institutions. The differentiation of an origin would not be based only on the consistency and quality of the product but on the commitment to the sustainability of the GI. Sustainability manifestos

launched by IGs can become useful instruments for differentiating products. Because the marketing trend is particularly strong with this product, Coffee GIs would be in a position to lead and show other industries how to achieve significant progress and provide the necessary scale for transformations in these industries.

4.11. SDG 10 – Reduce inequality within and between countries

Two studies showed totally or partially negative impacts of GIs on sustainable development. Bowen (2010) reports that the GI of Comté cheese in France generated many benefits in terms of income for small milk producers, as the association of local producers prevented the concentration of production. In contrast, in agave for the tequila industry in Mexico, the GI did not avoid the concentration of production in the hands of a few large buyers. It occurred due to the lack of solid legislation, making this concentration difficult and the fragility of mobilization of local producers. This substantially undermined the potential for GIs to help small farmers and contributed to rural development, favouring only large local companies.

Ghos (2016)reports that the rural population in the Himalayan region of India, which has a very diverse ethnic culture and produces hundreds of products, lacks knowledge of rules and regulations and is therefore not able to compete with the national and international market despite having good products. They trade through cooperatives or directly on the market. They do not have a representation mechanism. This makes it difficult for them to become aware of the benefits of GI.

It is observed that these GIs do not contribute to the sustainable development of this SDG. However, the negative impacts suggested are more linked to institutional issues, such as the formal environment (North. D., 1990)and especially the regulatory environment (Scott, 2008).

4.12. SDG 11 – Sustainable cities and communities. Make cities and human settlements inclusive, safe, resilient and sustainable

Barrera (202) mentions the SDG twice in an article that proposes laying the foundations for monitoring a global relationship between GIs and sustainability. One positive and the other negative with reservations. Regarding the first case, it refers to the case of Comté cheese. The article's author mentions that the GI significantly reduced rural immigration from the region. The second situation it refers to is Colombian coffee. Despite several successful GIs of the product in the country and their impact on emigration, existing data does not yet allow us to support that rural emigration towards cities originates from that context.

The positive impact is related to the social dimension of sustainability (Elkington, 1998), while the negative impact, with reservations, shows the need to better develop the economic and environmental dimensions.

4.13. SDG 12 – Responsible consumption and production

A case reported in the literature in which GI contributes to the responsible consumption of resources in production and that of the Mishima Bareisho Potato from Japan. Kimura & Rigolot (2021) show that GI contributed to responsible consumption and production. Farmers do not use machines as potatoes are grown in mountainous areas, so planting and harvesting are manual. These production processes do not consume oil resources or pollute the air.

Four examples from the literature were interpreted by us as indicating a positive impact with reservations. Regarding the supply chain of certified GI Grano Padano cheese products in Italy, León-Bravo et al. (2022) noted that sustainability assessment is hardly implemented in its entirety. However, many indicators and measures are

proposed in the literature. Wine GIs also impact the environment, mainly in terms of atmospheric emissions and high water consumption (Dede et al., 2020). From the same perspective, it was found that although agri-food sustainability issues have been developed and strengthened considerably for a long time, from an operational point of view, sustainable agriculture is still evolving, and improvements in production systems are increasingly necessary (Falcone et al., 2015). Environmental concerns are not considered to a large extent in product specifications, as they result more from the need to achieve specific product qualities than from any concern for the environment(Belletti et al., 2017)

Cheese value chains need to review their specifications to address environmental protection issues, especially at the farm level and natural resources such as pastures water, among other inputs. However, environmental protection should not be sought at the expense of (Rey-Cadilhac et al., 2021). economic sustainability and social properties. When analyzing the case of the GI of Corsigan Grapefruit in France, it was found that the fruit, when harvested before reaching its peak maturity to meet the expectations of visual quality required by consumers, leads to high levels of food waste, high costs of production and financial and environmental losses(Millet et al., 2020)

The negative impacts are highlighted regarding GIs that produce European cheeses and derivatives, which, despite their economic importance, cause negative impacts (Famiglietti et al., 2019). This is because cheese production generates environmental impact, waste of water, gas emissions and high energy expenditure. Therefore, the need for cheese factories to improve milk production's environmental sustainability through technical support and dissemination of good practices is reinforced (Bava et al., 2018). As a recommendation, it is necessary to improve the sustainability of the dairy cheese sector, which is recognized as a global problem, to reduce the impacts of this sector on the environment (Dalla Riva et al., 2018). In this sense, the need to pay special attention to three stages was highlighted: the smoking process, the heating system and wastewater treatment (González-García et al., 2013).

All reported impacts affect the environmental dimension and reinforce the need to evolve in this dimension. However, this must not overlap with the development of the economic and social dimensions.

4.14. SDG 13 – Action against global climate change. Take urgent action to combat climate change and its impacts

The GI analysis of Asiago cheese in Italy showed negative impacts. The environmental impacts of manufacturing this type of cheese were evaluated, and reports that the greatest negative effect resides in the production of raw milk, the use of energy and fuel, which have repercussions on the depletion of the ozone layer, climate change, the cumulative demand for energy, in terrestrial acidification and in the presence of photochemical oxidant (Dalla Riva et al., 2018). Therefore, this GI does not contribute to sustainable development concerning this SDG, and it is necessary to pay attention to the environmental dimension of sustainability.

4.15. SDG 15 – Life on Earth

Moroccan Argan Oil GI integrated sustainable development with socio-economic progress, with the strategy of developing actions to protect the Argan forest in Morocco Charrouf & Guillaume, 2018). Japan's Mishima Potato GI encouraged farmers to preserve local specialities and use land in mountainous and cold regions (Kimura & Rigolot, 2021).

The evaluation by the Spanish wine GI Utiel-Requena, pointed out positive impacts with caveats because regardless of the type of grape cultivation, organic systems are more environmentally correct than conventional ones (Sinisterra-Solís et al., 2022). The analysis of Spanish olive oil-producing GIs showed the importance of the

sector and the need for local governance to contribute to improving the sustainability of rural areas, encouraging innovation and entrepreneurship, as well as the expansion of organic and integrated production systems (Egea & Pérez y Pérez, 2016).

Negative GI impacts of Serra Magina olive oils have been reported due to soil erosion being a number one environmental problem in olive farming (Sanz Cañada & Macías Vázquez, 2005). The intensification of production led producers to adopt a productive paradigm of maximizing production at any cost, with excessive use of fertilizers and synthetic plant protection products that harmed the environment, particularly the soil and aquifers.

The GI analysis of Argan oil from Morocco (Charrouf & Guillaume, 2018)showed compliance with the three dimensions of sustainability (Elkington, 19 and the relationship with this SDG. Other research pointed to meeting the environmental and economic dimensions. However, the negative aspect shows that the profitability arising from the olive growing activity is placed above this dimension and the others. Therefore, finding ways to minimize the reported negative impacts is necessary.

4.16. SDG 16 – Peace, justice and strong institutions

GIs contribute favourably to strengthening peace, justice and institutions by establishing a national legal framework of characterized GIs, which can be a robust association mechanism that emerges, organizes and defends the collective dimension of GI (Barrera, 2020). Negative impacts with caveats were reported on Salak's GI Pondoh Sleman, as farmers are required to register their land with the Sleman Department of Agriculture, Food and Fisheries to obtain the traceability requirement if they want to internationalize. After registration, the farmer is entitled to a special certificate. However, only about 20% of farmer groups in the observed area had the certificate. The low number is caused by the high standard of export quality and the reluctance of farmers to comply with administrative requirements (Nuary et al., 2019).

It is noted that these GIs do not directly contribute to the sustainable development of this SDG, but rather to issues related to the formal institutional environment, especially the regulatory environment (Scott, 2008). In this sense, for this SDG, it is necessary to develop the three dimensions of sustainability.

4.17. SDG 17 – Partnerships and means of implementation

Positive impacts were observed in the articles listed below. The Moroccan Argan Oil GI helped create cooperatives in rural areas, an expensive project made possible thanks to government and non-governmental initiatives and subsidies (Charrouf & Guillaume, 2018). The support of the Hoa Binh provincial government and the recognition and protection of the Cao Phong orange GI in Vietnam has contributed to the conservation of biodiversity and traditional culture in local areas (Hoang et al., 2020). The processing company that produces Mishima croquettes purchases class B potatoes without reducing the price for farmers, which contributes to their economic support (Kimura & Rigolot, 2021). GI products affect public goods through names/identifiers, such as products, rights, institutional definitions, etc. Therefore, it is necessary to analyze which aspects and which public goods are connected to GI products to justify their regulation so that it is more efficient to support GI production systems(Belletti et al., 2015)

The observed negative impact on the agave-tequila industry's GI for tequila stemmed from the lack of strong GI legislation in Mexico, substantially harming the potential for this GI to help small farmers and contribute to rural development (Bowen, 2010). The studies analyzed together show that the social, economic and environmental dimensions are achieved and denote the importance of a well-developed institutional environment for achieving this SDG.

5. DISCUSSION

Applying the criteria established in Table 1 resulted in the analysis of the 29 articles reviewed, which show a total of 49 impacts. Of these, 27 articles show positive impacts (+1); seven articles point to positive impacts with reservations (+0.5); none indicate neutral results (0); five articles present negative impacts with reservations (-0.5). Finally, nine articles show negative impacts (-1) of GIs with sustainable development and achievement of the SDGs. Table 3 summarizes these results.

Table 3. Impacts of GIs on sustainable development in relation to the SDGs.

Positive impacts (+1)	**27**	**55.10%**
Positive impacts with reservations (+0.5)	8	**16.33%**
Neutral impact (0)	0	-
Negative impacts with reservations (-0.5)	5	**10.20%**
Negative impacts (-1)	9	**18.37%**
Total	**49**	**100%**

Source: Prepared by the authors (2023).

The numerical precision of these data must be viewed with caution, because they are percentages obtained from a sample of articles, published in a database and interpreted by the authors in terms of their impact. However, they suggest some conclusions. Even though the literature is critical of the impacts of GIs on the SDGs, it still points to a much greater number of positive than negative impacts of the SDGs. This, in our opinion, happens because articles that mainly point out problems are rare. In general, problems are preceded, relativized or compared with positive results.

For development to be considered "sustainable" it is necessary that the three dimensions of sustainability are met (Elkington, 1998). In this sense, it appears that, although the studies analyzed show that GIs generate impacts on sustainable development, the three dimensions of sustainability are not always present. Furthermore, it seems that even when the three dimensions are present, this service often results from analyzing more than one GI and not one GI in isolation.

Few GIs analyzed in the studies mentioned can effectively develop the three dimensions of sustainability, examples of which are the Cao Phong Orange GIs from Vietnam, the (Hoang et al., 2020)Argan Oil GI from Morocco, the (Charrouf & Guillaume, 2018)Shea Butter GI from Ghana in Africa and the Mishima (Vecchio et al., 2020)Bareisho Potato GI from Japan (Kimura & Rigolot, 2021).

The SDG most mentioned in the literature as being impacted by GIs is 12, with more than twice as many notes as the next one. This is quite understandable, given that one of GI's central promises positively impacts responsible consumption and production. These results confirm that GIs can support sustainable development in agri-food systems and help achieve several SDGs, even if only with the development of some dimensions of sustainability. Based on these results, it is suggested that future studies develop analyses of other GIs to identify what is missing so that they can advance in their contribution to sustainable development. It is necessary to understand the best way for GIs to achieve the three sustainability dimensions to help meet some SDGs.

The GIs analyzed contribute negatively to sustainable development in SDGs 10, 12,13 and 16 due to the observed impacts. Therefore, future studies can seek to discover what actions should be taken to identify and minimize the negative impacts that occurred, aiming to assist in the sustainable development of the locations affected by these GIs and how to promote more sustainable and targeted actions to meet the millennium goals.

The results found for SDGs 10, 16 and 17 point to the need to develop future studies that analyze how the institutional environment impacts GIs and sustainable development and what can be done to improve the SDGs.

6. FINAL CONSIDERATIONS

The literature identifies positive and negative impacts of GIs on sustainable development related to meeting the SDGs. However, not all GIs can develop the three dimensions of sustainability. Even if developing only one or two dimensions, the impacts caused are primarily positive or positive with reservations. Negative or negative impacts with reservations appeared in 28.57% of the cases analyzed compared to 71.43% of positive impacts. Among the negative impacts, GIs were mentioned in the literature as contributing to the concentration of power in the hands of small groups, the destruction of local cultures and the intensification of conflicts in subgroups of stakeholders with interests in the GI.

GIs must promote consumer safety, for example, by assuring them that the goods and services they purchase are those they claim they have. For suppliers, GIs must ensure that their supply integrates production chains responsibly. However, it is in the relationship with producers, the stakeholders most directly involved with GIs, where they should produce the most significant impact: Increased income, reduction of poverty, retention of the population in the countryside, reduction of rural exodus, and opportunities for women, among others. Therefore, It is unsurprising that most of the literature focuses on these stakeholders. Added to this is that the literature prioritizes GIs from countries with emerging economies in East Asia, Latin America and Africa. These are countries where the institute of GIs is still relatively new and is struggling to consolidate itself. This helps to understand why the literature is focusing on primary stakeholders and not secondary ones,

GIs can become strategic tools to promote the sustainable development of a given region. Although it is necessary to improve how they are implemented, most studies on the relationship between GI and sustainable development have yielded positive results, even though greater emphasis can be observed on the economic dimension, leaving the social dimensions in second place and the environmental dimension as the least prestigious of the three. However, meeting just one or two dimensions is not enough to achieve full sustainable development in the literal sense of the concept. However, it indicates a positive direction that can be explored by developing a model for implementing and managing GIs in Brazil.

The article contributes to the literature by elucidating and compiling the positive and negative impacts generated by the activities of GIs in the specific dimensions of sustainable development, focusing on the SDGs. Although existing research addresses these impacts, as far as we know, the strength of these impacts has not yet been analyzed. Therefore, this research highlights a tendency that GIs positively benefit sustainable development since more than half of the literature analyzed reflected this result.

As managerial implications, GI managers can learn from reported success stories how to develop the dimensions of sustainability and pay attention to the reasons that led GIs to cause negative impacts.

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