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EDITED BY
Maurizio Canavari,
University of Bologna, Italy

REVIEWED BY
Robert Home,
Research Institute of Organic Agriculture (FiBL), Switzerland
Giovanna Sacchi,
Free University of Bozen-Bolzano, Italy
Erin Nelson,
University of Guelph, Canada

*CORRESPONDENCE
Sonja Kaufmann
✉ sonja.kaufmann@boku.ac.at

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Participatory Guarantee Systems, a more inclusive organic certification alternative? Unboxing certification costs and farm inspections in PGS based on a case study approach

Sonja Kaufmann*, Nikolaus Hruschka and Christian R. Vogl

Department of Sustainable Agricultural Systems, Institute of Organic Farming, University of Natural Resources and Life Sciences, Vienna, Austria

The importance of Participatory Guarantee Systems (PGS) as an alternative organic certification to third-party certification (TPC) has grown remarkably in recent years. PGS are argued to be less costly than TPC, and adopt the exchange of advice and knowledge as a key element of farm inspections. For these reasons, PGS are promoted as being more accessible for smallholder farmers in low-income countries and as a tool for supporting organic conversion and standard compliance, and ultimately contributing to food system sustainability. PGS certification costs have not yet been studied thoroughly and empirical studies on PGS farm inspections are rare. This paper applies a mixed-methods case study approach in a Costa Rican PGS initiative and explores explicit and implicit PGS certification costs and PGS farm inspections. The framework for assessing actor participation in PGS and transaction cost theory were used as the theoretical foundation. Semi-structured interviews (n=10), PGS member surveys (n=17), and participant observations of PGS farm inspections (n=11) were conducted and complemented with data from internal documents and informal interviews. The results showed that reduced explicit costs for PGS certification were accompanied by substantial implicit costs in terms of the time dedicated to the PGS certification process. These implicit costs were largely attributed to the legal requirements for PGS, and were borne by only a few members, resulting in differences in total certification costs between PGS members. Despite legal formalization, information exchange was an important part of PGS farm inspections. Against the backdrop of small audit teams and low participation in farm inspections, PGS members implementing farm inspections nurtured transparency and an exchange of experience within the PGS. The study provides novel insight into PGS, and defines cost components and PGS characteristics affecting PGS certification costs that may also be relevant to other PGS initiatives and related fields of action.

KEYWORDS

participatory guarantee systems, organic certification, transaction costs, farm inspection, peer learning, certification costs, collective action, participation

1. Introduction

The significant growth in organic agriculture in recent decades has been accompanied by ever-increasing pressure for regulation (Brito et al., 2022) and the growing importance of certification systems (Albersmeier et al., 2009b; Fouilleux and Loconto, 2017). To combat fraud, avoid free-riding, reduce information asymmetries and protect organic product claims (Jahn et al., 2005; Getz and Shreck, 2006; Albersmeier et al., 2009b), most countries have adopted third-party certification (TPC) as an organic conformity assessment mechanism (Iannucci and Sacchi, 2022). In TPC, standard compliance is verified by an independent, competent, public or private body (TPC body) (Hatanaka et al., 2005; Albersmeier et al., 2009a,b). TPC is valued for being neutral and objective, thus ensuring organic integrity and trust in organic agri-food value chains (Hatanaka et al., 2005).

However, TPC and related organic standard requirements are also the subject of criticism. High inspection and certification fees, which in many cases can only be sustained with external support (Jena and Grote, 2022), e.g., from buyers of the certified crop (Qiao et al., 2016), hamper smallholder farmers' access to organic certification, markets, and price premiums (Cáceres, 2005; Hatanaka et al., 2005; Torquati et al., 2021; Iannucci and Sacchi, 2022; Jacobi et al., 2022). Extensive requirements for documentation and paperwork (Raynolds, 2004; Cáceres, 2005) and a "technical mercantile" logic (Niederle et al., 2020) based on a "pass or fail" principle (Cuéllar-Padilla et al., 2022) complicate compliance with standards and certification, and are often associated with the conventionalization of organic farming (Nelson et al., 2010; Fouilleux and Loconto, 2017) and alternative food and agriculture movements (Hatanaka, 2014). In particular, TPC is deemed exclusionary for farmers in low-income countries (Raynolds, 2004; Cáceres, 2005), where cultures and forms of knowledge differ from those dominant in northern countries where TPC originated (Hatanaka, 2010), and access to organic extension services is limited (Moura e Castro et al., 2019).

As part of a wider endeavor to find solutions for these farmers, alternative approaches to organic certification have emerged or regained momentum. One such approach is Participatory Guarantee Systems (PGS). IFOAM-Organics International (2019, p.3) defines PGS as *"locally focused quality assurance systems"* that "*certify producers based on active participation of stakeholders and are built on a foundation of trust, social networks, and knowledge exchange*." The number of PGS-certified farmers has increased remarkably in recent years, from 6,000 in 2010 to 1.3 million in 2022 (Anselmi and Moura e Castro, 2023). In the same year, 15 countries (e.g., Brazil, Bolivia, Mexico and Costa Rica) had officially recognized PGS as an organic conformity assessment mechanism in their legal framework for organic agriculture (Hysa et al., 2023).

PGS have been widely promoted and adopted as a conformity assessment system, complementary to TPC for domestic, regional and local markets (Bouagnimbeck, 2014; IFOAM-Organics International, 2019), that are more suitable for farmers in the Global South and able to overcome the drawbacks of TPC (IFOAM-Organics International, 2019; Torquati et al., 2021; Cuéllar-Padilla et al., 2022). They are therefore considered a tool for encouraging entry to organic farming and certification for farmers who would otherwise be excluded from the organic system (Bouagnimbeck, 2014; Bellante, 2017; Home et al., 2017). PGS have also been considered to depict a different form of governance of organic norms, quality assurance (Lemeilleur and Sermage, 2020), and markets (FAO, Alliance of Bioversity and CIAT, 2022). They are regarded as promoting family farming and food democracy, combat the conventionalization of organic farming, foster organic market development (Niederle et al., 2020) and support rural development, and the achievement of several Sustainable Development Goals (IFOAM-Organics International, 2019). PGS are said to contribute to food security, nutrition, and more sustainable food systems in different ways. Lower certification costs allow smallholder farmers to access organic price premiums and new, more stable and/or reliable markets, potentially leading to higher and/or more stable incomes (Home and Nelson, 2015; Moura e Castro et al., 2019). Capacity building embraced in PGS fosters improved, more diverse production systems that allow farmers to meet household nutritional needs more effectively (Home and Nelson, 2015), while certification of the whole production system (Moura e Castro et al., 2019) supports the diversity of farming systems (Jacobi et al., 2022) and active participation fosters farmer empowerment (Home and Nelson, 2015; Moura e Castro et al., 2019). PGS-certified products are often distributed via short supply chains and sold directly to consumers (Moura e Castro et al., 2019). Local markets are thus strengthened (Home and Nelson, 2015; Nelson et al., 2016), and access to fresh, locally produced, organic products can be improved even in rural areas (Home and Nelson, 2015; Moura e Castro et al., 2019). Reduced costs for organic certification often allow farmers to supply PGS-certified products at lower prices than TPC-certified products, thus potentially broadening the consumer segment that can afford organic products (Moura e Castro et al., 2019).

Narrowed down to conformity assessment, PGS are framed as being a more inclusive organic certification system specifically due to two characteristics: the design and implementation of conformity assessment, and the reduced certification costs for farmers. First, in contrast to TPC where inspection and certification is carried out by an independent third party (Hatanaka et al., 2005), PGS are based on the principle of stakeholder participation. Conformity assessment is carried out by the actors involved, such as farmers, consumers, and NGOs (IFOAM-Organics International, 2019), and intense personal social relationships between auditors and auditees are said to replace the principle of impartiality in TPC (Hirata et al., 2021). While mandatory compliance with ISO 17065 prohibits TPC bodies from providing consultancy to producers whom they inspect and certify (Austrian Standards Institute, 2013), knowledge exchange and peer learning are a promoted key element of PGS (IFOAM-Organics International, 2019), and the combination of control and advice in farm inspections is said not only to be allowed, but explicitly embraced (Moura e Castro et al., 2019). Prior research has found that PGS-certified farmers consider farm inspections important for peer learning, an advantage of PGS over TPC (Cuéllar Padilla and Ganuza-Fernandez, 2018; Cuéllar-Padilla et al., 2022), and a key benefit of participation in PGS farm inspections (Hruschka et al., 2021).

Abbreviations: CA, Central administration (*administración central*); AD, Audit day; ARAO, Unit for Accreditation and Registration in Organic Farming (*Unidad de Acreditación y Registro de Agricultura Orgánica*); CC, Certification committee (*comité de certificación*); MAG, Ministry of Agriculture and Livestock (*Ministerio de Agricultura y Ganadería*); PGS, Participatory Guarantee Systems; SIC, System of internal control (*sistema interno de control*); TPC, Third-party certification.

Second, the absence of private TPC bodies allows and requires PGS to substitute paid external professionals' work and related inspection and certification fees with the non-remunerated, voluntary work of PGS members and other engaged stakeholders (Cuéllar Padilla and Ganuza-Fernandez, 2018; IFOAM-Organics International, 2019; Moura e Castro et al., 2019), and to reduce or offset economic barriers to organic certification (Moura e Castro et al., 2019). Indeed, accessing cheap organic certification has been found to be a key motivation behind farmers joining PGS in Brazil (Zanasi et al., 2009; Niederle et al., 2020) and Costa Rica (Anselmi and Vignola, 2022). However, substantial time and effort from PGS members are required in order to uphold reliable conformity assessment practices (Cuéllar Padilla and Ganuza-Fernandez, 2018). Like other volunteer-based organizations, PGS need to continuously ensure the availability of sufficient time resources (Chinman and Wandersman, 1999). Many PGS initiatives depend on external support from NGOs or universities for this (Nelson et al., 2016; Home et al., 2017; Binder and Vogl, 2018; Montefrio and Johnson, 2019). Earlier research has identified the time investment required as a barrier to PGS development and PGS member participation as a challenge (López Cifuentes et al., 2018; Hirata et al., 2021; Anselmi and Vignola, 2022; Cuéllar-Padilla et al., 2022; Romagny et al., 2023), even just to uphold the guarantee process (Kaufmann and Vogl, 2018). Voices contradicting the notion of PGS as a low-cost, unbureaucratic organic certification alternative have only recently been raised. It is suggested that the time investment required can make PGS certification more difficult for farmers than TPC (Cuéllar Padilla and Ganuza-Fernandez, 2018) and that the costs of participation in a PGS risk offsetting the reduced inspection and certification fees that are a benefit of PGS (Cuéllar-Padilla et al., 2022). In this context, legal recognition of PGS as an organic conformity assessment system for domestic markets – an important achievement of the PGS movement in countries such as Chile, Costa Rica, and Mexico – has been found to increase administrative and documentary requirements, necessitate high registration fees, and result in complex, time-intensive and resource-intensive procedures that resemble those of TPC, thus creating obstacles to PGS certification (Bara et al., 2018; Hruschka et al., 2021; Anselmi and Vignola, 2022; Jacobi et al., 2022).

Studies that address PGS certification costs thoroughly – including both the monetary costs for farmers and PGS initiatives and the implicit costs in terms of time – have not yet been published. The same is true of an exploration of PGS farm inspections and the role of knowledge exchange. Recent publications have attempted to narrow the research gap on PGS participation (Hirata et al., 2021; Hruschka et al., 2021; Torquati et al., 2021), but few have attempted to determine the monetary costs of PGS farm inspections (Chaparro-Africano and Naranjo, 2020) and PGS certification fees for farmers (Lemeilleur and Allaire, 2019; Cuéllar-Padilla et al., 2022). PGS farm inspections have been studied based on documentary analysis (Cuéllar-Padilla et al., 2022) and with a focus on social capital formation (Hirata et al., 2021).

However, expanding the knowledge base on PGS certification costs and PGS farm inspections is important for improving our understanding of PGS. Determining and accounting for PGS certification costs is important in order to make an informed decision in favor of or against PGS certification and to support effective PGS design and implementation (McCann et al., 2005). Accounting for required time resources is crucial if volunteer-based organizations such as PGS are to remain viable (Chinman and Wandersman, 1999), reinforcing the need to determine the resources required in the first place. Knowledge exchange in farm inspections is relevant to the role of PGS in supporting organic conversion processes and enhancing the diversity of organic farming systems (IFOAM-Organics International, 2019; Moura e Castro et al., 2019). It can also provide an important tangible benefit (Enengel et al., 2011), outweighing participation costs and upholding voluntary engagement (Chinman and Wandersman, 1999; Enengel et al., 2011; Cuéllar Padilla and Ganuza-Fernandez, 2018; Romagny et al., 2023).

Consequently, this paper explores PGS certification costs and farm inspections based on a mixed-methods case study approach in a Costa Rican PGS initiative. Although it uses a single case study design, it addresses aspects not previously studied in PGS research and presents first-of-its-kind empirical evidence on PGS certification costs and farm inspections. The case study presented could also represent a revelatory case to stimulate further research on the topic (Yin, 2018). The research presented was driven by the following research questions: (i) What are the explicit and implicit costs of PGS certification? and (ii) How are PGS farm inspections structured and what is the relevance of information exchange as the inspections are being carried out?. Section 2 briefly broadens the state of the art and conceptualizes PGS certification costs and PGS farm inspections within the scope of this study. Section 3 introduces the Costa Rican PGS background, and describes the case study and the applied methods. The results are presented in section 4, followed by the discussion (section 5) and conclusions (section 6).

2. Conceptualizing PGS certification costs and farm inspections

2.1. PGS certification costs

The reduction in information costs in organic markets is a major achievement of organic certification systems. However, as the responsibility for supervising organic production has been transferred from consumers to producers (Zorn, 2008), in an attempt to prevent free-riding (Musole, 2009) organic certification systems have simultaneously created transaction costs on the production side of organic value chains (Zorn, 2008). Transaction costs – "*the resources used to establish and maintain property rights*" (Allen, 1991, p. 3) – have been conceptualized for the evaluation of environmental policies by McCann et al. (2005), for organic TPC by Zorn (2008), and studied for landscape co-management (Enengel et al., 2011, 2014) and, in the food and farming sector, for farmer cooperatives (Blanc and Kledal, 2012) and geographical indications (Quiñones-Ruiz et al., 2016).

Zorn (2008) considers market transaction costs to be the most important transaction cost category in organic TPC. Among these, the costs that differentiate organic TPC the most from conventional markets are: (i) the search and information costs associated with changing organic requirements, and (ii) supervision and enforcement costs (Zorn, 2008). While different types of transaction costs have been described as a barrier to smallholder farmers accessing TPC and organic markets (Blanc and Kledal, 2012; Montefrio and Johnson, 2019), the discourse on TPC cost intensity and PGS as a cheaper

alternative usually focuses on the TPC fees charged to farmers. In PGS, however, as certification fees for farmers are reduced, responsibilities and efforts are shifted to the local level (Enengel et al., 2011), creating organizational level transaction costs (Blanc and Kledal, 2012) for the PGS initiative.

By focusing on the costs of implementing the PGS certification process, the present study examined the monitoring, supervision and enforcement transaction costs (McCann et al., 2005; Zorn, 2008) in a well-established PGS initiative, with a fully and routinely implemented PGS certification process. Consequently, the monitoring, supervision and enforcement costs of the established certification process and administration costs represent the most relevant transaction cost categories (McCann et al., 2005). The focus is also on ex post transaction costs (McCann et al., 2005; Blanc and Kledal, 2012) within a timeframe of one year of PGS certification. Following McCann et al. (2005) and PGS literature, these costs can either be incurred as explicit monetary costs (McCann et al., 2005; Cuéllar Padilla and Ganuza-Fernandez, 2018; Chaparro-Africano and Naranjo, 2020) or as implicit costs in the form of time invested (McCann et al., 2005) in participating in the PGS (Bara et al., 2018; Hruschka et al., 2021) or as material resources given to the certification process (Kaufmann et al., 2020).

To determine the cost components relevant to the study (McCann et al., 2005), particularly those resulting in implicit costs as time dedicated by PGS members, we drew on the framework for assessing PGS participation developed by Kaufmann et al. (2020). In line with the different dimensions, elements and sub-elements of PGS participation defined within this framework, we focused on the extent of participation, consisting of the range of activities relevant to PGS certification and the time involved in implementing these activities, and the element of resource contribution, focusing on time, material, and monetary resources. Consequently, in the first instance, we determine the range of activities comprised in the PGS certification process, i.e., all the tasks and activities directly entailed in the process, required to implement it (e.g., coordination, administration, decision-making), or mandatory according to the applicable organic regulation in order to uphold a PGS. While PGS are locally adapted and context-specific in nature (Bouagnimbeck, 2014), a thorough description of the PGS certification process and background information on the PGS initiative will support the sound interpretation of results and broaden insights for the wider PGS community.

As the study focus was on PGS certification costs, other types of transaction costs, although relevant to TPC and PGS, such as farm-level transaction costs (Quiñones-Ruiz et al., 2016) for search, information or compliance, or bargaining costs (Zorn, 2008) for the marketing of PGS products, did not fall within the scope of this study.

2.2. PGS farm inspections

PGS farm inspections have been described as events that verify compliance with standards, while simultaneously creating spaces for dialogue and shared learning (IFOAM-Organics International, 2019). The exchange of experience of organic management practices (Hirata et al., 2021) and a collective quest for solutions to production problems that comply with organic standards are said to foster continuous improvement in agricultural practices and capacity-building, and reduce extension gaps in organic farming (IFOAM-Organics International, 2019; Moura e Castro et al., 2019; Cuéllar-Padilla et al., 2022).

To date, very few empirical studies address PGS farm inspections. Consequently, this study took an exploratory approach, while being informed by prior PGS research and guided by ISO 19011:2018 (Austrian Standards International, 2018) as the theoretical foundation (Figure 1). ISO19011:2018 *Guidelines for auditing management systems* is a European norm that includes requirements for conducting audits, and defines different phases and activities of management system audits (Austrian Standards International, 2018). It is considered suitable within the scope of this study as it provides generic, flexible guidance "*for all sizes and types of organizations and audits of varying scopes and scales*" (Austrian Standards International, 2018, p.vi), and is "*applicable to all organizations that need to plan and conduct internal and external audits*" (Austrian Standards International, 2018, p. 1).

3. Methods

Data were collected by the first author between March and July 2022 in the Costa Rican PGS initiative "*Asociación de productores orgánicos las Brumas*" (hereafter referred to as "*Las Brumas*" or "the PGS"). A mixed-methods approach consisting of semi-structured interviews, participant observation of internal farm inspections, and surveys was applied and further complemented by data derived from internal *Las Brumas* documents and informal interviews. Throughout the text, the following abbreviations are used to cite from data sources: semi-structured interviews - 'I', informal interviews – 'II', participant observation – 'PO', survey pre-tests – 'SP', surveys – 'S', documents – 'D' (Appendix A).

3.1. Case study

3.1.1. Regulatory background of PGS in Costa Rica

PGS have been legally recognized as organic conformity assessment system in Costa Rica since 2007. The country's legal framework for organic farming recognizes three ways in which farmers can achieve organic certification: individual TPC, TPC as an organized producer group (hereafter also referred to as group TPC), or PGS certification as an organized producer group. While the first two options allow farmers to export certified organic products, PGS certification only provides access to the domestic market.

Minimum requirements for Costa Rican PGS initiatives are laid down in law 8591 on the development, promotion and support of organic farming and decree 35242. PGS initiatives must be legally constituted (Article 15, Law N°8591, 2007) and are required to establish three organizational bodies: (1) a central administration (CA, *administración central*) responsible for the organic integrity of the producer group, (2) a system of internal control (SIC, *sistema interno de control*) responsible for monitoring and training group members and managing information (Article 5d, Law N°8591, 2007), and (3) a certification committee (CC, *comité de certificación*) consisting of at least two producers and two consumers and in charge of taking certification

decisions (Article 24, Decree N°35242-MAG-H-MEIC, 2009). While Article 5d, law N°8591 on the establishment of the CA and the SIC applies to all organized producer groups, both third-party certified and PGS, the CC is mandatory only for PGS. The SIC is the body in charge of conducting internal farm inspections of PGS members annually (Anselmi and Vignola, 2022). Actors implementing the PGS must be adequately trained (Article 14, Law N°8591, 2007). Proof of training of SIC and CC members (SFE, 2021) and an annual training program (SFE, 2021, p. I10) comprising two mandatory training courses per year for all PGS members (I6-7; S13) have to be presented as part of the registration process (SFE, 2021). This registration process is mandatory for all PGS initiatives, is handled by the unit for accreditation and registration in organic farming (ARAO, *Unidad de Acreditación y Registro de Agricultura Orgánica*) of the Ministry of Agriculture and Livestock (MAG, *Ministerio de Agricultura y Ganadería*) (Article 5d, Law N°8591, 2007), renewed annually, and includes payment of an annual registration fee (Article 27, Decree N°35242-MAG-H-MEIC, 2009). The registration process is the same for both PGS initiatives and third-party certified organized producer groups (I9). As part of the registration process, ARAO is in charge of monitoring PGS initiatives (Article 25, Decree N°35242-MAG-H-MEIC, 2009), based on PGS documentation such as internal farm inspection reports (I1; I6; I9), and conducting annual monitoring audits of PGS initiatives (referred to below as the annual *external inspection* as opposed to internal inspections of PGS member farms conducted by the SIC of the PGS) (Article 14, Law N°8591, 2007; Article 25, Decree N°35242-MAG-H-MEIC, 2009). As of February 2022, six PGS initiatives in the country were registered with ARAO (SFE, 2022b).

3.1.2. Case study description

Las Brumas was founded in 2010 and registered as a PGS with ARAO in 2014, following 1 year of group TPC (I4; I6; D2). The organization is legally formed as an agricultural association (I1; S14) and is run exclusively by its members who are all farmers (hereafter referred to as PGS members). When data collection started, *Las Brumas* had 22 members managing 18 farms registered with the PGS (II2). Twelve member farms were certified organic with the PGS and six were converting to organic, of which five were at least in their third year of the conversion process (D1). One PGS member was out of country at the time of the 2022 internal inspections, hence only 17 member farms were inspected. Following the external inspection by ARAO, this PGS member was excluded from PGS registration with ARAO (I8).

The SIC of *Las Brumas* comprised two PGS members: the president and another PGS member. The CC was composed of three PGS members and two consumers (I2; I6), who were members of the CC but not of *Las Brumas* (I5). Internal inspections to the farms of PGS members were carried out by two members of the SIC and one member of the CC, depending on time availability (I1). Until the outbreak of the COVID-19 pandemic, one consumer member of the CC had participated in internal inspections (II2). Although PGS initiatives are not legally obliged to inspect members in the process of conversion, *Las Brumas* had made annual internal inspections of all PGS member farms by the SIC an obligation (I1; I6). The role of the CA was assumed by the directive board (I6). The directive board, a legal requirement for agricultural associations (S14), was composed of the president, a vice-president, a secretary and a treasurer, and its work was overseen by a supervisor (I1). The directive board was elected every 2 years by the General Assembly of all PGS members (S14), which met once a year (I1). In addition, bi-monthly meetings were held where participation was mandatory for all PGS members (S14). All PGS expenses were covered by the initial affiliation and monthly membership fees paid by PGS members (I2; I8).

3.2. Data collection

3.2.1. Semi-structured interviews and surveys

Semi-structured interviews were conducted with the association's president, who was a member of the SIC and the CA, led the planning and implementation of internal inspections of PGS member farms, and was responsible for the PGS registration process. Initial online interviews prior to the field research stay in Costa Rica covered questions about the general structure, activities and functioning of the PGS, and served to prepare data collection tools. Additional semi-structured interviews were conducted on site and in person, and covered information about tasks and activities that influence PGS certification costs (McCann et al., 2005) and the related explicit and implicit costs. In addition, semi-structured interviews were conducted with one consumer member of the CC, and key informants from ARAO and the MAG Department for Organic Production. In total, 10 semi-structured interviews were held (Appendix A). Finally, surveys were conducted with $n = 14$ PGS members after pre-testing with $n = 3$ PGS members. When survey participants held roles relevant to the PGS certification process, respondents were asked to list the tasks associated with this position and estimate the annual time investment for these tasks.

3.2.2. Participant observation

Internal inspections of PGS member farms were carried out on seven audit days (AD) in May and June 2022. Participant observation was conducted during five of the seven audit days (AD3–AD7), corresponding to 11 inspections (PO1–PO11) or 64.7% of all the internal inspections conducted in 2022 (Appendix B). A participant observation protocol template was developed by operationalizing "*EN ISO19011:2018 Guidelines for auditing management systems*," chapter six on "*conducting an audit*," and was adapted based on PGS literature, legal requirements for PGS, and initial online interviews. The template used contained nine elements, seven of which corresponded to the stages and activities of the internal inspection and were covered by the participant observation. Elements #1 and #9 (Figure 1) could not be observed, but data were collected in semi-structured interviews with key informants.

The participant observation protocol template allowed information on time investment, transport, meals, and additional qualitative information to be documented. The starting and end times of each stage of the internal inspection were documented. For meals, the location, participants, expenses and information on reimbursement of expenses were also documented. For transport, information on the location and time of departure and arrival, transport used, estimated expenses, and reimbursement of expenses was documented for each participant and each route during the audit day. Transport time was documented by the first author, who travelled

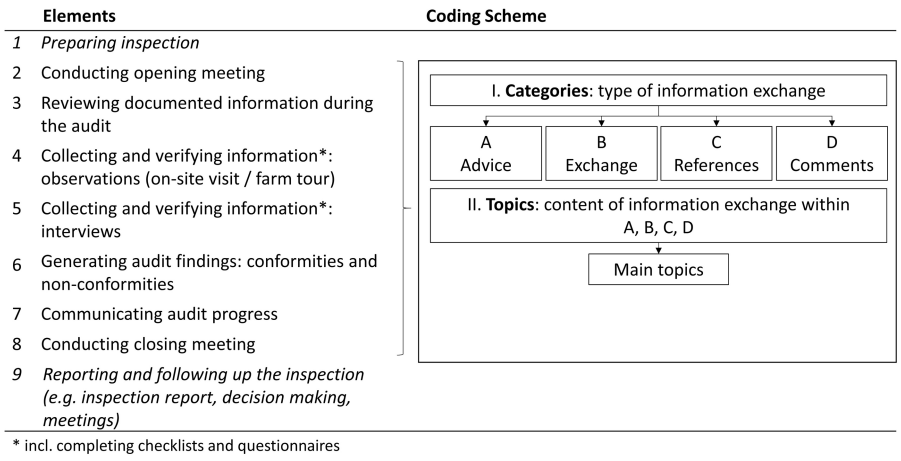

FIGURE 1
Elements covered by the participant observation protocol template operationalized from EN ISO 19011:2018 (left), and overview of the coding scheme for qualitative data about the exchange of information (right).

with the audit team and was picked up and dropped off on the way. The driver sent a text to the first author giving the departure time at the starting location before pick up.

3.3. Data analysis

All semi-structured interviews and surveys were recorded using a digital voice recorder, following a verbal confidentiality agreement and informed consent being given by the interview partners, and transcribed. Participant observations were documented on paper and digitalized immediately after the audit day. Quantitative data were transferred to Microsoft Excel, where all further calculations were made.

Transport times were calculated based on the information provided by the interviewees (itinerary of audit day, GPS data of PGS member farms inspected) with the Google Maps route planner. For this, the audit day was subdivided into partial routes travelled during the day, for example from the point of departure to the first member farm inspected, and from the first member farm inspected to the second member farm inspected. For a sample of partial routes, these results were compared with participant observation data from AD3-AD7. On these partial routes, the mean deviation between the transport time documented during the observation and the transport time calculated with the Google Maps route planner was 5 min, with a total time difference of 17 min ($n = 13$). For the final calculation of transport times, observational data were used for AD3-AD7 and calculated data were used for AD1 and AD2. The time invested in internal farm inspections was documented during observations on AD3-AD7. Inspection times on AD1 and AD2 were approximated based on interview data and the arithmetic mean of internal inspections on AD3-AD7, adjusted for extreme outliers in terms of farm size and thus inspection time.

For qualitative data, provisional coding (first-cycle coding) and further sub-coding with descriptive coding (second-cycle coding) in Atlas.ti (Version 8.0) were used. The co-occurrence explorer and codes-primary-documents tables were applied for further analysis (Friese, 2012; Friese, 2020). Inductive coding of qualitative observational data from farm inspections of PGS member farms resulted in four main categories of information exchange between the audit team and the inspected PGS member (Figure 1). For the content of information exchange, first descriptive codes were grouped further to identify the main topics across the four categories. Data were only coded if a specific issue occurred for the first time, e.g., the same advice repeated throughout the visit would only be coded once. Second, two types of frequency counts were calculated and are displayed in the results section: the total occurrence frequency per main topic in each category across all participant observation protocols, and the number of participant observation protocols in which the main topic per category occurred. Comments made by the audit team and references to other internal inspections were also magnitude coded to distinguish between positive/encouraging, neutral and negative comments and references (Saldaña, 2013). As several participants took part in the internal farm inspections and observations were made by only one observer, the data cannot provide an exhaustive representation of all the topics presented during the inspection.

4. Results

The results are presented in three sections: first, the range of activities and tasks of the PGS certification process, as implemented by *Las Brumas* in 2022, are identified and described. The second section presents data on time (implicit costs) and explicit costs related to these tasks and activities. The final section focuses on the structure of and information exchange in internal inspections of PGS member farms.

4.1. Activities in the PGS certification process

4.1.1. Internal inspections of PGS member farms

Internal inspections in 2022 were carried out by the president, who was a member of the SIC, and one producer member of the

CC (I2), as the consumer member of the CC had not yet resumed participation since the outbreak of the COVID-19 pandemic (I5). The president's car was used for transportation. The point of departure for the internal inspections was the president's farm. While the president would pick up the CC member on most audit days, on three audit days (AD1, AD2, AD6) the CC member used his own vehicle to drive to the president's farm in the morning and return in the evening (I6; PO7). No specific decision-making procedures were implemented after the internal inspections (I3; II2). The checklist, completed during the internal inspections, served as the inspection report unless non-conformities were identified, when an additional report would be raised to support the follow-up of non-conformities (I2). In 2022, no non-conformities were identified during the internal inspections, hence no follow-up work was necessary (I6; PO1-11).

4.1.2. PGS registration process and external inspection

The annual external inspection by ARAO is the key activity in the PGS registration process. External inspection encompasses inspection of a sample of PGS member farms and verification of PGS-level documentation (I1; I6; I9). After the external inspection, ARAO presents a report that includes all detected non-conformities (I8-9), followed by a period of 10 working days for the PGS to present either proof of corrections or action plans (I9). The external inspection is usually accompanied by a PGS representative. In 2022, the president and the CC member who participated in the internal inspections each attended one external inspection audit day (I6). All other tasks and responsibilities related to the PGS registration process were fulfilled by the president (II2). Most of the paperwork was completed during the follow-up of the external inspection, together with providing proof of corrections of non-conformities detected during the external inspection (Table 1; I3; I6).

4.1.3. Directive board

The directive board's work related to maintaining the legal form of the PGS included notarization of annual general assembly meeting minutes and of renewals of the directive board, undertaken by the president and the secretary (I3; I6; S14), and the tasks of the treasurer related to payments, reimbursements and work with the accountant (I6; Table 1).

4.1.4. Training courses

Training courses for PGS members related to the organic regulation were organized and facilitated by the PGS and implemented by personnel from the MAG's regional extension agency (I6-7). Participation in training was mandatory for all PGS members (S14). More specific training for SIC and CC members was not arranged, but all of them had been in their positions for a couple of years (I5; S13-14). Consequently, SIC and CC members did not invest additional time in specific training courses (I6).

4.2. PGS certification costs

Audit team members invested 25.27 h per person for *internal inspections* of PGS member farms and 19.89 h per person for transportation ($n = 17$). In total, internal inspections and transport in 2022 amounted to 5.65 working days per person (Table 2).

During the interviews, the president emphasized the difference in time investment between existing PGS members and new PGS members. Internal inspections of new PGS members were not usually combined with other inspections, and would take double the average inspection time that they did for existing PGS members due to the audit team's unfamiliarity with the inspected farm and additional support regarding farm-level documentation provided to the new PGS member (I8). As compensation for the time investment, audit team members received a daily payment equal to the daily salary of a farm worker to give audit team members the means to replace their own workforce on their farms during the days they spent on internal inspections (I1; I7). Expenses for food on the road and travel expenses were reimbursed by the PGS (I8; II3). Other PGS members or consumers who participated in the internal inspections were only reimbursed for travel expenses and food (I1; I5).

TABLE 1 Overview of the tasks and activities that influence PGS certification costs (SIC=system of internal control; CC=certification committee; italics=not relevant for 2022 inspections; I2-3; I6-7; S24; II1).

Tasks within the PGS certification process influencing PGS certification costs	
Internal inspections of PGS member farms	PGS registration process and external inspection by ARAO
■ Inspections ■ Transport ■ Meals ■ Preparation of internal inspections ■ Coordination of internal inspections ■ *Follow-up of internal inspections in the event of non-conformities*	■ Preparation: sorting and review of PGS member record folders ■ Inspection of a sample of PGS member farms ■ Verification of PGS-level documentation ■ Follow-up: PGS documentation: - completion and update of PGS registration form - update of PGS management plan - calculation of PGS mass balance Implementation of corrective measures and preparation of proof of corrective measures ■ Coordination with ARAO ■ Internal coordination
Directive board	
■ Notarization of minutes and directive board ■ Work of treasurer	
Training	
■ Training of *SIC* and CC members ■ Organizing training for PGS members	

TABLE 2 Time invested by audit team members in internal inspections in 2022 (NA=not applicable; *N*=total number of internal inspections, $n_{observed}$=number of internal inspections observed–data based on observations; $n_{calculated}$=number of internal inspections not observed–data based on calculations).

Time invested for internal inspections			
	Inspections	Transport	Sum of inspections and transport
N	17	17	17
$n_{observed}$	11	11	11
$n_{calculated}$	6	6	6
Hours per person/ audit team for all N	25.27/50.53*	19.89/39.79	45.16/90.32
8-h workday equivalent per person/audit team for all N	3.16/6.32*	2.49/4.97	5.65/11.29
Minimum/ maximum hours per person	0.58/3.22** *per inspection*	0.89/4.77 *per audit day*	2.64/10.11 ** *per audit day*
Arithmetic mean hours per person/ audit team	1.59/3.18** *per inspection*	2.84/5.68 *per audit day*	6.69/13.38 ** *per audit day*

*Arithmetic mean for observed inspections PO1–PO3, PO5, PO7–PO11 assumed for inspections V1–V6 on AD1 and AD2 (Appendix B) to calculate time for inspections.
**Based on PO1–PO11.

Specific preparation of internal inspections consisted of printing off the inspection checklists (II1). It was not possible to determine the time invested. Internal inspections were coordinated during one of the bi-monthly PGS meetings, where the inspection program was coordinated and discussed with all PGS members (I3; Table 3).

The time required for the PGS *registration process* included two audit days for the *external inspection* by ARAO (I6), preparation and follow-up of the external inspection, and PGS-level documentation. The preparation of the external inspection was limited to one afternoon for sorting and checking PGS member record folders, while the majority of the time was invested in following up the external inspection and documentation (Table 4). The time required for follow-up is heavily dependent on the number and type of non-conformities detected. The total time needed to close non-conformities was estimated to be a maximum of 3 days, or 4 to 5 h per non-conformity (I3; I6). As pointed out by the president, the time investment for closing non-conformities had been higher when most of the PGS members were still undergoing conversion and the PGS was still responsible for the conversion process. Internal coordination was limited to informing PGS members that they were to be inspected. There were no additional coordination efforts with ARAO (I3).

For their participation in the external inspection, audit team members received the same daily rate as for internal inspections (I6). All other tasks related to the PGS registration process were not remunerated (I3; I6). Transport to and from the external inspections of PGS members was provided by ARAO (I6).

TABLE 3 Group activities (GA) during which tasks related to the PGS certification process are conducted and estimated duration per activity (SIC=system of internal control; CC=certification committee; I3; I6; I8; S1-13).

Activity / task	Hours per activity*
Annual General Assembly	2.20
Coordination of internal inspections: PGS meeting	2.20
Organization and coordination of training for PGS members: PGS meeting	2.20
Training of SIC and CC members: training for PGS members 2x/year	4.00
Sum per person and year	14.60
8-h workday equivalent per person per year	1.8

*Transport not included.

For the work of the *directive board*, the majority of the 137.5 h invested could be attributed to the treasurer's work (S7). The minimum legally required work by the president and the secretary included writing and notarizing general assembly minutes (S4; S11). The work of the supervisor was limited to attendance of PGS meetings and assemblies (S13).

Training courses were organized during one of the bi-monthly PGS meetings (Table 3; S14; I7). Training on specific topics would last approximately 4 h. Personnel from the MAG's regional extension agency were not financially compensated for training on organic regulation and certification (I7). The president also had to review and distribute information received from ARAO. However, this was not a frequent task and was unevenly distributed throughout the year, hence no time investment was determined (I6).

Based on PO, SSI and survey data, the total time invested in the PGS certification process in 2022 was 277 h or an equivalent of 35 eight-hour working days (Table 4), excluding group activities.

About 63% of the time invested was not remunerated. The daily rate paid to audit team members was perceived as an acknowledgement of the time, effort and energy invested in the PGS certification process, rather than full compensation:

> *"For me, it's something symbolic. (…) it doesn't add any more money into my pocket, it rather takes my time. (…) So I take what they give me as something very symbolic (S13, p.2 l74-80)."*

> *"This has to [be done by] someone who wants this to work. If it's not someone who wants this to work, he will charge for everything and we will never grow (I6, p.6 l243-245)."*

The tasks of the directive board in particular required a great deal of voluntary, non-remunerated work. As stressed by the president:

> *"These are activities we do not charge for. That's where the donated time is. But these are the basics (I6, p.8 l353-354)."*

Group activities (GA) essential to the PGS certification process (Table 3) amounted to 14.6 h per PGS member per year. All group activities mandatory for PGS members, i.e., the General Assembly, all bi-monthly meetings, and the two mandatory training courses

TABLE 4 Overview of tasks and activities within the PGS certification process and summary of time invested (implicit costs) in 2022 (ND=no data, NA=not applicable, GA=done as part of group activity – see Table 3; SIC=system of internal control; CC=certification committee; PO1-11; I3; I6; S7; S11; S13-14).

Task	Hours per person	Total hours all persons	8-h workday equivalent	Compensation for time [yes / no]
Internal inspections of PGS member farms				
Preparation	ND	ND	ND	no
Coordination	GA	GA	GA	no
Inspections	45.16	90.32	11.29	yes
PGS registration and external inspection by ARAO				
Preparation of external inspection	4.00	4.00	0.5	no
Internal coordination	ND	ND	ND	no
External coordination	ND	ND	ND	no
External inspection	13.00	13.00	1.63	yes
Follow-up of external inspection and PGS documentation	32.42	32.42	4.05	no
Directive board				
President, treasurer, secretary, supervisor	NA	137.50	17.19	no
Training of PGS members				
Organization and coordination of training for PGS members	GA	GA	GA	no
Training time invested by SIC and CC members	GA	GA	GA	no
Total time invested		277.24	34.65	
Thereof compensated		103.32	12.92	
Thereof not compensated		173.92	21.74	
Total time invested per PGS member farm		16.31	2.04	

amounted to 23.4 h per member per year, with participation in all activities provided and individual transport not included.

Adding up the daily rates for audit days, reimbursements, the annual registration fee, and additional expenses for legal and accounting matters of the association (lawyer, accountant), the total explicit costs paid for the PGS certification process in 2022 amounted to 1,453 USD, or 85 USD per PGS member farm. These costs were covered by the membership fees charged to each PGS member farm. Implicit costs in terms of time dedicated to the PGS certification process varied between PGS members (Table 5).

The total sum of explicit costs paid by the PGS and the implicit costs of non-remunerated time for PGS participation of all members in 2022 amounted to 3,133 USD, assuming the participation of one PGS member per farm in all group activities ($n = 17$). Based on interview and observational data, additional non-reimbursed expenses for printing internal inspection checklists (II1) and individual transport costs (gas, vehicle wear) of the CC member for internal inspections on AD1, AD2 and AD6 (II3), was estimated to be 4 USD and 61 USD, respectively. Adding these costs, the total costs amounted to 3,198 USD, not including additional costs for paper and ink and costs for group activities (meals, individual transport).

During the interviews, the president emphasized that a return to group TPC would not have any implications on the internal processes of *Las Brumas* (internal inspections, group activities) or the registration process with ARAO. Consequently, the explicit and implicit costs for PGS certification would only be supplemented by inspection and certification fees charged by the TPC body (explicit costs) and implicit costs for inspection and certification by the TPC body (I6). The explicit costs for group TPC of *Las Brumas* in 2013 were 700 USD for the group of 10 members at that time. For a familiar and comparable association in the region, the explicit costs for group TPC were indicated to be 120 USD per farm in 2021 (I7).

4.3. Internal inspections of PGS member farms

4.3.1. The structure of internal farm inspections

Internal inspections of PGS member farms were split into a farm tour and a review of farm-level documentation. *Opening and closing meetings* (Figure 1, Element #2, #8) in the sense of EN ISO 19011 could not be observed. The audit team would either start the inspection with the farm tour directly upon arrival, or have a friendly discussion with the inspected PGS member, sometimes in the presence of the member's family. Internal inspections ended, for example, with discussions on specific topics (PO7; PO9), a summary and feedback on a specific topic (PO4; PO11) or personal chats and plans for get-togethers (PO7; PO10).

Document verification (Element #3) had a mean duration of 25.5 min (SD = 20.3; $n = 11$). Verified documents included farm management plans, farm activity logs, sales invoices, and input purchase invoices. The mean duration of *farm tours* (Element # 4) was 46.7 min (SD = 31.2; $n = 11$). *Interviews* (Element #5) took place during the farm tour and the document review, and covered topics such as farm area, water sources, harvest estimates, crops

TABLE 5 Summary of PGS certification costs in 2022 (*currency exchange rate: 1 CRC=0.0016 USD, exchange rate as of 14 September 2022, https://fxtop.com; ** daily rate for compensation of audit team members used for converting implicit costs in terms of time to explicit costs).

Cost component	Costs in USD*
I. Explicit costs for PGS	
Internal inspections of PGS member farms	$ 780.04
PGS registration and external inspection	
External inspection compensation for audit team members	$ 48.00
Registration fee (SFE, 2022c,d)	$ 105.02
Legal and accounting matters of the association	$ 520
Total costs paid by PGS/average per PGS member farm	$ 1453.06/$ 85.47
II. Explicit costs for PGS members: membership fees paid per PGS member farm per year (I8)	$ 96.00
III. Implicit costs for PGS members: non-remunerated time for PGS participation**	
PGS member (all group activities)	$ 70.20
Additional costs president	$ 81.79
Additional costs other Directive Board members	$ 45.00/$ 360

grown, and origin of seeds and seedlings. Completion of the internal inspection checklist and *generation of conformities and non-conformities* (Element #6) occurred in most cases during the document review at the end of the inspection. In some cases, the checklist was already partly filled out during the farm tour, specifically the section on cultivated crops (PO5-6; PO11). The checklist was completed by the president, and signed by the president, the CC member and the inspected PGS member at the end of the inspection.

Communication (Element #7) between the inspected PGS member and the audit team regarding the progress of the inspection was observed during six internal inspections (PO4-5; PO7-10). On four occasions, breakfast, lunch or an afternoon snack and coffee were served by the inspected PGS member. Friendly chats and personal conversations between the audit team and the inspected PGS member, sometimes with the participation of family members, were observed during these meals (PO1; PO6; PO10-11). Even during the inspections – in the course of the farm tours and document review – friendly relationships and close personal ties between audit team members and the inspected PGS member were frequently evident.

4.3.2. Information exchange during internal farm inspections

Inductive coding of participant observation protocols resulted in four main categories further describing information exchange during internal farm inspections (Table 6).

Advice, i.e., specific recommendations, was most frequently given about soil, crop management, and pest and disease management (Figure 2). Recommendations directly related to certification and compliance regarded the admissibility of specific methods and inputs ($f = 2$) and advice regarding farm-level documentation ($f = 4$). The majority of advice observed, however, was not directly related to compliance with the organic regulation or issues of certification, but rather concerned continuous improvement of production techniques. Moreover, on three visits, the inspected PGS member gave recommendations to the audit team. Three documented recommendations referred to a specific plant nutrition issue that the CC member was experiencing with his own crop (PO4; PO8-9). In one case, the PGS member shared a specific recipe for pest management when learning about the challenges another PGS member was experiencing.

TABLE 6 Four main categories of information exchange during internal farm inspections: category, description, total occurrence frequency and number of internal inspections concerned (n=11).

Category	Description	Total occurrence frequency	Number of internal inspections concerned
Advice	Specific recommendations given to the inspected PGS member by a member of the audit team	50	10
Exchange	Exchange between the inspected PGS member and a member of the audit team, not related to specific recommendation	29	6
Reference	Exchange between the inspected PGS member and a member of the audit team involving a reference to another PGS member and/or an earlier internal inspection	17	8
Comment	Specific comments regarding the inspected member farm made by a member of the audit team, not related to advice or exchange about a topic	37	9

References to other internal inspections and PGS members were made for diverse topics, but most frequently to share positive experiences ($f = 13$), for example regarding fertilization or pest and disease management. Success stories with certain crops were also shared. In two cases, an exchange of seeds and seedlings between the audit team and the inspected PGS member was observed (PO8; PO11). Comments were mostly positive and encouraging ($f = 10$), highlighting the quality of crops, yields, and soils, or pointing out a positive development on the PGS member's farm observed by the audit team.

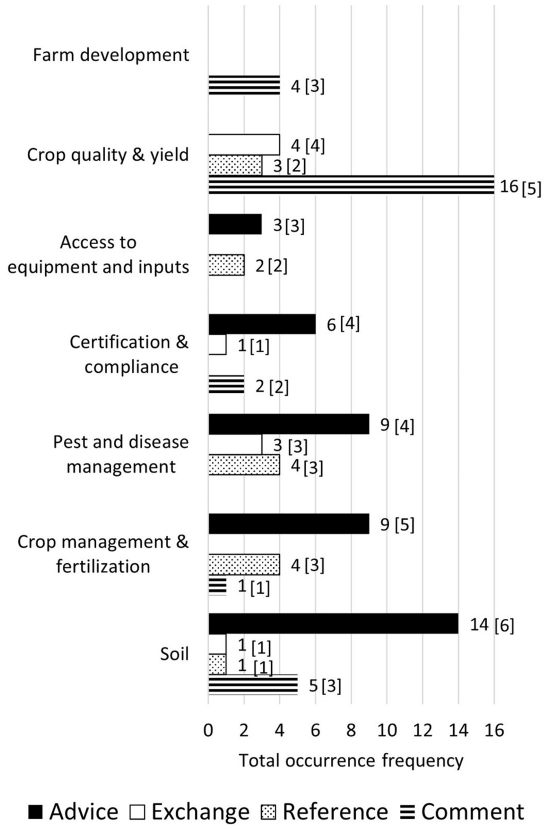

FIGURE 2
Topics observed most frequently during PO1-PO11: total occurrence frequency across PO1-PO11 (n=11) [number of visits in which the topics arose in brackets]. Topics observed on more than two visits in at least one category displayed.

5. Discussion

5.1. Explicit and implicit costs of PGS certification

The PGS certification process implemented by *Las Brumas*, and consequently the tasks and activities that influence PGS certification costs, was largely determined by the regulatory framework for PGS. Activities not mandatory by law included internal inspections of PGS member farms in conversion to organic farming, and bi-monthly PGS meetings. Although some PGS initiatives, e.g., in Brazil, have been found to adapt successfully to changing legal requirements for PGS (Lemeilleur et al., 2022), prior research identified the legal formalization of PGS as boosting administrative, documentary, time and cost requirements (Bara et al., 2018; Hruschka et al., 2021; Jacobi et al., 2022). The present data indicated that about one third of the total time invested for internal inspections of PGS member farms and PGS registration and external inspection by ARAO at *Las Brumas* was related to the PGS registration process and external inspection by ARAO. Moreover, about 50 percent of the total time investment for the PGS certification process was related to the legal form of the PGS, a legal minimum requirement for PGS initiatives (Decree N°35242-MAG-H-MEIC, 2009) that has been reported to be a barrier to PGS certification in other countries (Bara et al., 2018).

The annual registration fee charged to PGS initiatives by ARAO is the same as that charged to individually certified and registered farmers and third-party certified organized producer groups (SFE, 2022c,d). Consequently, the economic burden of organic certification is reduced when choosing PGS certification or group TPC over individual TPC. In the case of *Las Brumas*, the registration fee per PGS member farm was 6 USD, rather than 105 USD for individual registration. Views that PGS registration fees are a barrier to PGS certification and that government-regulated PGS is comparable to TPC in terms of costs for farmers (Jacobi et al., 2022) thus cannot be confirmed. At the same time costs for legal and accounting matters of the association accounted for 36 percent of the total explicit costs for PGS certification in 2022. Exempting PGS initiatives from registration fees could reduce the economic burden of PGS initiatives, in this case study by 7 % of the total explicit PGS certification costs in 2022.

A thorough comparison of certification costs between PGS and TPC is not an easy task. Transparency (Cuéllar-Padilla et al., 2022) and different approaches to fee structures (Dabbert et al., 2012) of TPC bodies present a major obstacle to this. For TPC bodies accredited for organic certification in Costa Rica (SFE, 2022a), information about inspection and certification fees is not publicly available. The fee schedule of another TPC body operating in the region (El Salvador, Guatemala, Nicaragua, Panamá, Mexico, Honduras) available online displays charges of 300 USD for the audit report review and certification only. Additional fees are charged for revision of the application (120 USD/day), inspection (between 8 and 30 USD/day depending on farm size and year of certification), inspection report writing (100 USD/day), travel (150 USD/day), transportation, and *per diem* charges of the inspector (from 35 USD depending on the location; Bio Latina, 2022).

A full comparison of certification costs between PGS and TPC would have to consider the differences between individual TPC and group TPC. According to our interview partners and the legal requirements in Costa Rica for PGS and TPC, explicit and implicit costs for inspection and certification by the TPC body are the cost components that differentiate PGS from group TPC. Consequently in our case study, choosing PGS over group TPC resulted in a reduction of total certification costs, because a TPC body did not have to be contracted. A comparison of the explicit costs paid by the majority of PGS members (96 USD membership fee) and the data for certification costs consulted from Bio Latina (2022) suggests that the explicit certification costs for individual PGS members were below the explicit costs for individual TPC. However, for a more indepth comparison of total certification costs (explicit and implicit) between PGS and individual TPC, primary data for both cases would be required and farm-level transaction costs, e.g., for compliance and search and information (Zorn, 2008), would have to be included. However, farm-level transaction costs did not fall within the scope of this study.

As suggested by Cuéllar-Padilla et al. (2022), explicit costs were accompanied by substantial implicit costs in terms of time investment undertaken by PGS members. Participation in internal and external inspections of PGS member farms was monetarily remunerated – an approach challenged by other PGS initiatives due to it transforming PGS members into TPC-like inspection personnel (Home et al., 2017; Kaufmann and Vogl, 2018), but discussed as an important incentive mechanism to foster participation in volunteer organizations

(Chinman and Wandersman, 1999 cit. Olson, 1965; Kanter, 1968; Knoke and Wood, 1981). However, implicit costs in terms of non-remunerated voluntarily donated time still accounted for the largest part of total PGS certification costs of *Las Brumas* in 2022. These data reaffirm the dependency on PGS members' time reported by other scholars and particularly reflect the reliance on a few PGS members and the unequal workload distribution found in prior studies (Hruschka et al., 2021; Anselmi and Vignola, 2022; Romagny et al., 2023), as the time required for PGS certification of *Las Brumas* in 2022 was provided by four PGS members, and the work for farm inspections by two members.

In this regard, our data reflect other studies that have found small audit teams and the absence of broader peer participation in internal farm inspections due to a lack of participation or to reduce costs (Hruschka et al., 2021). Rotation principles for internal inspections to PGS member farms, as found for PGS initiatives in Spain (Cuéllar-Padilla et al., 2022) for example, were not implemented. Against this backdrop, mandatory participation in PGS meetings, an approach also reported for PGS in Spain (Cuéllar-Padilla et al., 2022), was considered central to the participatory character of the PGS. Mandatory participation can also serve as a strategy to combat free-riding (Chinman and Wandersman, 1999) and avoid a weakening of collective action (Cuéllar Padilla and Ganuza-Fernandez, 2018). PGS often need to account for limited time resources (Cuéllar Padilla and Ganuza-Fernandez, 2018), which is why strategies for increasing the cost-effectiveness of the PGS are important (Moura e Castro et al., 2019). The limitation of tasks to legal minimum requirements and the simplification of procedures practiced by *Las Brumas*, such as merging PGS inspection visits with certification decisions, transferring certain tasks to group activities, and combining several internal farm inspections on a single audit day, can be considered such strategies. This approach also reflects the difficult balancing act between keeping the PGS functional while making it horizontal and inclusive, as reported by other scholars (Cuéllar Padilla and Ganuza-Fernandez, 2018).

Apart from the time resources contributed by PGS members, monetary resources to cover the remaining explicit monetary costs are crucial to PGS implementation and essential for PGS sustainability (Moura e Castro et al., 2019). In many PGS initiatives, NGO funds (Binder and Vogl, 2018; Lemeilleur and Allaire, 2019) or other external support (Nelson et al., 2010; Moura e Castro et al., 2019) are essential. In the absence of such support, the PGS activities of *Las Brumas* were self-sustained by PGS members through monthly membership fees. This strategy has been suggested as valuable for long-term PGS implementation and sustainability (Moura e Castro et al., 2019).

PGS certification costs for individual PGS members of *Las Brumas* reflect the inclusivity of the PGS, and – when considering implicit costs – mirror the unequal workload distribution among PGS members. While in other PGS initiatives, membership fees depend on farm size or location (Lemeilleur and Allaire, 2019), in *Las Brumas* the annual membership fee was the same for all PGS members, and reflected "the concept of belonging" to the PGS (Cuéllar-Padilla et al., 2022, p. 10) rather than paying for inspection and certification services. However, small farms managed by part-time farmers were treated in the same way as full-time farmers of larger farms. Membership fees were not used solely to cover inspection costs, thus allowing farmers to obtain further benefits from participating in *Las Brumas* that are not accessible from individual TPC. For most members of *Las Brumas*, costs supplementary to the membership fee included time for participating in bi-monthly meetings, the General Assembly and training courses, plus transport costs. These costs were below the marginal willingness to pay for an ecolabel certification reported for smallholder farmers in Thailand (Praneetvatakul et al., 2022). For the four more engaged PGS members, however, the total costs for PGS certification were between 13 and 216% higher than for other PGS members, and in some cases were further supplemented by the contribution of material resources needed to implement the certification process (e.g., car).

Even if the PGS initiative studied did achieve reductions in explicit monetary costs, as suggested by our results but not established conclusively for individual TPC, our case study shows that monetary resources are not the only factor defining PGS accessibility. PGS members need to have the time and material resources (e.g., transport) necessary for the minimum extent of participation required by the PGS – in our case study, resources needed for bi-monthly meetings, General Assemblies and training courses. Moreover, as has also been suggested by Cuéllar-Padilla et al. (2022), a critical number of PGS members able and willing to undertake PGS certification responsibilities and invest the time, and sometimes also monetary and material resources necessary to keep the certification system running, is needed. Dependency on a few members – as in our case study – makes PGS initiatives fragile. However, an increase in PGS certification costs – in terms of both explicit costs, e.g., for transport, and implicit costs of participation, administration and coordination – needs to be considered when engaging more members, adopting rotation principles and broadening levels of participation. According to transaction cost theory, different types of transaction costs can be positively or negatively correlated with each other, and transaction costs invested in earlier process stages can reduce costs later on (McCann et al., 2005; Musole, 2009). Engaging more PGS members in the certification process to foster transparency and peer learning increases costs for transport and time investment, yet could pay off by reducing enforcement and monitoring costs if participation in farm inspections encourages learning and supports compliance with standards, thus decreasing the costs of following up non-conformities. Similarly, costs of training at the time of data collection could be reduced not only because the MAG's regional extension office assumed an important role in providing training free of charge, but also because PGS members implementing the process were already experienced and well-trained. Experience and learning are important factors in reducing transaction costs over time (McCann et al., 2005, cit. Falconer et al., 2001).

In this context, our data further indicates a relation between how long PGS members have been members and their experience in organic farming, and PGS certification costs. Internal farm inspections of new PGS members require more time, and newly converted farms may increase the time required for the provision of advice and correction of non-conformities detected during internal and external farm inspections. Closing non-conformities was shown to amount to the largest share of the time invested in PGS registration and external inspection. Consequently, in settings where a larger share of PGS members are in the conversion process and where engaged PGS members have lower levels of experience and training in the PGS certification process, higher PGS certification costs may be incurred. As for other volunteer organizations (Chinman and Wandersman,

1999), ensuring sufficient resources in terms of time and competencies on a long-term basis will be crucial for the sustainability of the PGS initiative studied. Tangible benefits are important in this regard (Chinman and Wandersman, 1999; Enengel et al., 2011; Cuéllar Padilla and Ganuza-Fernandez, 2018), such as social networking and information exchange (Romagny et al., 2023) during internal inspections of PGS member farms.

5.2. PGS farm inspections

Internal inspections of PGS member farms in part reflected the structure of PGS visits in Brazil reported by Hirata et al. (2021), but extensive opening and closing meetings were not observed. Reduced formality was evident, although *Las Brumas* was operating in a legally formalized environment. Close personal ties between inspected PGS members and audit team members, as reported by Hirata et al. (2021), were frequently manifested, and on some occasions joint meals and informal chats during the meals seemed to be an important part of the internal farm inspection. Farm-level documentation was less important than the farm tour and exchange with the inspected PGS member, and farm inspections rather resembled "meetings among peers" (Hirata et al., 2021) and proved to be important occasions for information and knowledge exchange (Cuéllar-Padilla et al., 2022). Our data show that information exchange, beyond completing the inspection checklist and establishing compliance with the organic regulation, was a key aspect of the internal farm inspections. As promoted for PGS farm inspections by other scholars, spaces of shared learning (Moura e Castro et al., 2019) were created, and the improvement of production techniques beyond compliance (IFOAM-Organics International, 2019; Cuéllar-Padilla et al., 2022) was encouraged. In doing so, conditions for overcoming the pass or fail logic characterizing TPC (Cuéllar Padilla and Ganuza-Fernandez, 2018) and for fostering diverse organic production systems (Home and Nelson, 2015) were established. Topics covered by the recommendations also reflected the continuous improvement approach suggested in the literature (Cuéllar Padilla and Ganuza-Fernandez, 2018; Hirata et al., 2021; Cuéllar-Padilla et al., 2022), and addressed the current farming realities of PGS members during the rainy season. In the study by Seppänen and Helenius (2004) on farm inspections in Finland, joint negotiation of identified problems emerged as an important part of the advice given in farm inspections, in their case a remnant from times prior to the ISO-based separation of control and advice. Similarly, the advice during observed farm inspections was not limited to instructions by audit team members, but was accompanied by mutual exchange, references to other internal farm inspections, and recommendations given by the inspected PGS member, creating a process in which the challenges identified were collectively analyzed and discussed. According to prior research on other sustainability standards regulated by TPC, the discourse and social interactions thereby created (Ahmad Rizal et al., 2021) and the technical assistance provided (Lemeilleur et al., 2020; Praneetvatakul et al., 2022) can act as important incentives supporting farmers' adoption of certification. Moreover, in line with Loconto and Hatanaka (2018) and Hatanaka (2020), this practice of mutually sharing and integrating different forms of knowledge represents an appreciation of farmers' practical knowledge (Loconto and Hatanaka, 2018) and a form of deliberative governance that is crucial for improving food system sustainability (Hatanaka, 2020). The PGS approach to inspection and certification has been said to promote farmers' self-awareness and self-confidence (Cuéllar Padilla and Ganuza-Fernandez, 2018), practices that could also be observed in the form of positive, encouraging comments made by audit team members. Peer learning – as identified in our case study – has been reported to be an important benefit of participation in PGS farm inspections (Hruschka et al., 2021), and can represent an important return for PGS members participating as an audit team member in internal farm inspections.

References to other internal farm inspections constitute important experience-sharing practices adopted by audit team members. Participation in the PGS certification process is thought to ensure transparency that is important for learning, and building trust and a community (IFOAM-Organics International, 2019). Small audit teams with little or no rotation – as identified in our case study – prevent a larger number of PGS members from engaging in peer-to-peer exchange and learning as an essential benefit of PGS farm inspections. However, in the absence of broader PGS member participation, rotation principles (Cuéllar-Padilla et al., 2022), and confidentiality requirements prominent in TPC (Austrian Standards Institute, 2013), audit team members were revealed to assume an important role in creating transparency among PGS members with regard to inspection results and production practices.

6. Conclusion

This study sheds light on PGS certification costs and farm inspections by applying a mixed-methods case study approach in a Costa Rican PGS initiative. By determining PGS certification costs, considering both explicit and implicit cost components, and exploring PGS farm inspections through participant observation, our results provide novel insight into PGS.

PGS certification costs were shown to be largely influenced by legal PGS requirements, with explicit monetary costs for PGS certification accompanied by substantial implicit costs in terms of time. These implicit costs were borne by only a few PGS members, and implementation of PGS farm inspections was monetarily incentivized. Unequal workload distribution resulted in considerable differences between PGS members regarding the total individual costs of PGS certification. Thus, answers to the question of whether PGS is a cheaper, more inclusive certification alternative to TPC may vary for different members of the same PGS initiative. Moreover, comparable primary data on the implicit and explicit costs of TPC certification and data on farm-level transaction costs in PGS and TPC, e.g., for compliance or for search and information (Zorn, 2008), would be needed in order to provide a conclusive answer to this question. Further research could place an emphasis on a comparison of this kind.

Our results showed that despite legal formalization, farm inspections in PGS can be events for knowledge sharing and exchanging experiences. Even with low levels of PGS member participation in farm inspections, exchange and transparency can be fostered by the PGS members carrying out farm inspections.

Our research partly confirmed the respondents' difficulties in recalling how much time they invested, which has also been found by other scholars (Quiñones-Ruiz et al., 2016). In this context, the use of instant messaging services for coordination tasks seemed to play an

important role. Consequently, implicit costs of PGS coordination and administration might be slightly underestimated. Future research could adopt an explicit focus on these transaction costs, as well as on other types of transaction costs not considered in this study, such as the costs of negotiating conflicts and reconstructing the PGS identity (Montefrio and Johnson, 2019).

The number and diversity of agents, the size and structure of the transaction, and the design of applicable policies are important sources of transaction costs (Musole, 2009). Transferring the results of our case study to other PGS initiatives may therefore only be possible with comparable cases. Nevertheless, the cost components identified within our study may also be relevant to other PGS initiatives and similar grassroots organizations that are based on collective action. Contextualizing our results within transaction cost literature allowed us to identify additional PGS characteristics affecting PGS certification costs. These comprise: legal requirements for upholding a PGS, the number of PGS members, the activities and tasks comprised within the PGS certification process, the cost-effective design and implementation of PGS tasks and activities, PGS members' time of membership in the PGS, PGS members' experience of organic farming, the level of member engagement and investment in training in the earlier stages of PGS development, the level of experience, knowledge and training of PGS members in charge of the PGS certification process, the number of PGS members participating in the PGS certification process, and the geographical distribution of PGS member farms. Taking these factors into account and carefully considering correlations between different cost components may help support PGS design and implementation in such a way as to ensure the long-term availability of adequate time and monetary resources. It is only when these resources are ensured for the long term that PGS initiatives will be able to function effectively on a sustainable basis in order to generate associated benefits and contribute to food security and food system sustainability.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material S1, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements. Oral informed consent to participate in this study was provided by the participants.

Author contributions

SK: conceptualization, methodology, investigation, data curation, formal analysis, visualization, writing-original draft, and funding acquisition. NH: conceptualization, validation, and writing – review and editing. CV: conceptualization, validation, funding acquisition, project administration, resources, supervision, and writing – review and editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2023.1176057/full#supplementary-material

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