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Challenges and opportunities in data collection for sustainable farming: Lessons from EU certification schemes

Antonioli, F., Isbasoiu, A., Ciaian, P., Tur Cardona, J., Fellmann, T.

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Contact information
Name: Federico Antonioli
Email: federico.antonioli@ec.europa.eu

EU Science Hub
https://joint-research-centre.ec.europa.eu

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Contents

Abstract

This report analyses the farm-level data collection practices of selected public and private sustainability-related certification schemes, with the aim of providing insights into synergies and gaps for the upcoming Farm Sustainability Data Network, which will collect data on environmental and social issues. The analysis is based on online surveys, semi-semi-structured interviews and desk research carried out between June and October 2023. Out of 188 common agricultural policy (CAP) interventions associated with certification schemes within the CAP strategic plans of the Member States, 25 relevant certification schemes were pre-selected for consideration in this report. A total of 10 respondents (i.e. certification agencies and, in some cases, responsible public authorities) participated, covering 16 certification schemes, resulting in response rates of 48 % for respondents and 64 % for certification schemes. Key findings relate to the monitoring practices of operators by certification agencies, data collection methods, data sources, data management practices, data exchange and costs incurred. Respondents rated the data collection process as somewhat costly for both certification agencies and farmers. The main challenges and burdens of the data collection process identified by the respondents are also outlined. The analysis indicates that, while data on environmental and social sustainability are available, considerable efforts are required to collect quantitative data and ensure that they are consistent, digitalised and accessible. The voluntary nature of participation in certification schemes limits the representativeness of the data collected and introduces selection bias. Furthermore, increasing farmers' understanding of the purpose and benefits of data collection is crucial for motivating farmers. Providing incentives and collaborating with organisations that have direct contact with farmers can increase farmers' willingness to participate.

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Authors

Federico Antonioli

Ancuta Isbasoiu

Pavel Ciaian

Juan Tur Cardona

Thomas Fellmann

Executive summary

This report analyses the farm-level data collection practices of selected public and private sustainability-related certification schemes, with the aim of providing insights for the forthcoming Farm Sustainability Data Network (FSDN), which aims to incorporate environmental and social information at the farm level. The report's analyses are based on online surveys, interviews and desk research conducted between June and October 2023. The online survey aimed to gather general information about respondents, the certification process, sustainability requirements and data collection costs. Semi-structured interviews collected more in-depth information on data types, sources, collection methods and management practices. Desk research was used to gather additional information from public sources on various aspects of certification schemes related to their sustainability requirements, legal basis, and data collection and sharing practices. Overall, the report provides insights into various aspects of the collection of sustainability-related data carried out as part of the certification process, including the types of data collected, collection methods, data sources, data management practices, data exchange and the costs associated with data collection.

Out of 188 common agricultural policy (CAP) interventions linked to certification schemes in the CAP strategic plans (CSPs) of the Member States, 25 relevant certification schemes were pre-selected for consideration in this report. A total of 10 respondents (i.e. certification agencies and, in some cases, responsible public authorities) participated, covering 16 certification schemes, resulting in response rates of 48 % for respondents and 64 % for the certification schemes. The organic category was the most represented among the certification schemes covered in the interviews', followed by organic plus, animal welfare, multipurpose schemes, good agricultural practices and national quality schemes. Of the 16 certification schemes interviewed, 7 are private while 9 are public. The certification schemes covered come from nine Member States, with the share of the total CAP budget (EU expenditure) corresponding to these certification schemes being 5.2 %. Of the 16 certification schemes interviewed, 14 were linked to Pillar 2 and 15 to Pillar 1, with 12 specifically linked to direct payments.

Key findings include the following.

- **Monitoring and auditing.** Monitoring (auditing) of operators by certification agencies is a crucial aspect of the certification process, all operators that wish to be certified being audited under all the certification schemes considered. Public certification schemes also carry out additional checks of operators, and some public certification schemes allow group certification. Private certification schemes are less likely than public ones to provide additional checks and group certification.

- **Data collection.** Data collection carried out as part of the certification process includes the collection of both qualitative data (checklist) and quantitative data (quantitative data). Private certification schemes tend to rely more on quantitative data, while public schemes rely more on qualitative information. Data collection methods typically include on-farm inspections by the certification agency's inspectors, which may be supplemented by the remote verification of documents or data sharing with relevant public authorities, but these practices are less common.

- **Data sources.** Data sources used to verify operators' compliance with certification scheme requirements include operators' bookkeeping records, on-site visual observations, laboratory tests and data from third parties. All certification schemes use bookkeeping records and on-farm observations, while laboratory tests and data from third parties are used less frequently used.

- **Data management and exchange.** The data collected by private certification schemes are usually migrated to third-party datasets (i.e. to the dataset of the certification body responsible for the certification scheme), while public certification schemes are more likely to store these data in internal databases. Data exchange with third parties depends on whether the certification agency is private or public. All public certification schemes transmit data to relevant public authorities, but not all have access to data from public authorities. All private certification schemes provide data to the certification body responsible for the certification scheme, with only few having access to data from relevant public authorities. This limited data exchange is due to non-harmonised data portals, different data requirements and different data granularity applied by different certification agencies and public authorities. It is important to note that the limited data exchange also results from the primary objective of certification agencies, which is to certify the compliance of farmers on the basis of the information collected. Sharing data with third parties is usually outside their primary scope, unless it is directly relevant for obtaining information for certification purposes.

- **Costs.** Most certification agencies charge a fee for certification services based on unit costs, which vary depending on the size of the operator and the complexity of the production structure. The audit process incurs costs for both operators and certification agencies due to the time required for conducting inspections, which can vary from a few hours to more than a day, and in some cases may involve multiple inspectors. Respondents rated the data collection process as somewhat costly for both certification agencies and farmers. The most expensive activities for both certification agencies and farmers include the data collection itself, equipment, sampling and laboratory testing. Training staff for data collection and monitoring is also relatively costly for certification agencies, while quality control and data collection training are relatively costly for farmers.

According to respondents, the main challenges and burdens of the data collection process are as follows.

- **Differing requirements.** Data collection in public and private certification schemes differs in terms of the requirements for being certified and the nature of the data collected, with private certification often being more stringent and responsive to societal demands. Public certification is often seen as a way for producers to access subsidies, while private certification is more often retailer driven.

- **Heterogeneity of standards.** The same standard, especially if that standard is not regulated at the EU level, may be certified by multiple certification schemes within Member States or the EU, leading to heterogeneity in the data collected, potentially creating confusion for consumers and varying costs for operators, and leading to different competitive advantages.

- **Data management challenges.** Farmers typically manage large amounts of unstructured, paper-based data, which they often find challenging to organise into the structured and consistent format required for certification. Some respondents note that certified farmers, especially organic farmers, increasingly report frustration with the administrative burden and feel more scrutinised than conventional farmers.

- **Administrative burden.** The certification agencies interviewed emphasised the administrative burden of having limited access to data already collected by public institutions, which often leads to duplicated efforts and wastes the time and resources of certification bodies and farmers.

- **Heterogeneity in the adoption of digitalisation.** There is a high degree of heterogeneity in the adoption of digitalisation and in the types of digital tools used by farmers. Similarly, many certification agencies do not necessarily use a fully digital platform to manage the data they collect from farmers. Cultural change and training are needed to facilitate the adoption of digital solutions, and this is expected to be challenging and costly for both farmers and certification agencies.

The report's analyses suggest several implications for the forthcoming expansion of the FSDN to include environmental and social issues. Overall, data on environmental and social sustainability exist (at least with farmers), but significant efforts are required to collect the quantitative data and ensure that they are consistent/harmonised, digitalised and accessible. The main sources of sustainability-related data used by certification agencies are farmers' bookkeeping records and on-site visual observations by certification agency inspectors. However, the wide variety of bookkeeping systems and their low level of digitalisation create barriers to data transfer for future needs. Private certification schemes may face challenges in sharing their data, as they belong to private entities, whereas public schemes have more established cooperation with relevant authorities, making data transfer more feasible.

Among the challenges related to data sharing is the lack of quantitative data being collected by certification agencies, as these agencies often compile checklists indicating farmers' compliance with certification scheme requirements without collecting quantitative data. In addition, the limited interoperability of datasets between public authorities and certification agencies complicates the integration process and increases administrative costs for farmers and relevant institutions involved in data collection.

Increasing farmers' understanding of the purpose and benefits of the data collection is crucial for motivating farmers to provide data. Providing incentives for farmers to participate, such as advisory services and direct rewards (e.g. points for meeting eligibility criteria for EU-funded schemes, data-driven decision-making), and collaboration with organisations that have direct contact with farmers (e.g. producer organisations and associations or cooperatives that can, among other things, act as intermediaries for collecting data from farmers) can increase farmers' willingness to participate.

A limitation of the data collected for certification purposes and their use for policy support is related to the voluntary nature of participation in certification schemes, as this means that data are collected only for farmers who self-select into a particular certification scheme, while data on non-participating farms are not included. Consequently, a dataset constructed solely on the basis of information available from certification schemes – even if the data from the certification schemes could be easily transferred to the FSDN platform – would not provide a representative sample of EU farmers, thus introducing a selection bias.

1. Introduction

Within the farm-to-fork strategy ([1]), the European Commission has announced its plan to convert the Farm Accountancy Data Network (FADN) into the Farm Sustainability Data Network (FSDN), with the proposal for a regulation adopted by the Commission in June 2022. The European Parliament and the Council of the European Union reached an agreement on the regulation in June 2023, and it was subsequently published in November 2023 ([2]).

The FADN annually compiles detailed microeconomic and accountancy data for over 80 000 EU farms. The European Commission facilitates this process by providing a harmonised methodology and a common questionnaire that is used by all Member States (MSs), as well as periodically updated guidance documents. MSs are responsible for collecting, verifying and submitting the data for their respective territories. Currently, the FADN mainly supports the assessment of economic and financial situations of EU farms, but FADN data have been increasingly used over the last decade to carry out environmental and social analyses as well. The regulation for the conversion of the FADN into the FSDN has expanded the scope of this survey to include additional environmental and social topics. This aligns with the framework of the United Nations sustainable development goals, enabling a more comprehensive evaluation of the sustainability of EU farms across economic, environmental and social aspects.

The regulation aims not only to broaden the scope of data collection to include environmental and social dimensions, but also to simplify and modernise the current dataset, incentivise farmers' participation in the data network, and assist MSs with the data collection process by promoting the interoperability of various datasets at the EU level (e.g. the common agricultural policy (CAP) database for monitoring and evaluation and the integrated administration and control system). The proposal also encourages the use of modern, remote and digital tools for data collection, such as satellite and sensor measurements. This approach aims to reduce data collection costs for MSs and alleviate the burden on farmers by enabling the collection of farm data once for multiple uses.

The availability of sustainability-related data will be crucial for monitoring key EU policies, such as the farm-to-fork and biodiversity strategies' objectives, as well as the CAP. These data will also facilitate benchmarking of farm performance against regional, national or sectoral averages and support the improvement of sustainability among participating farmers through tailored advisory services. Therefore, it is essential to have consistent, comparable, harmonised and high-quality farm-level data at the EU level. To achieve this, relevant EU legislation must establish common definitions, reporting formats and quality requirements.

The approved CAP strategic plans (CSPs) ([3]) for each MS establish how the CAP will be implemented in 2023–2027. Several CSPs incorporate voluntary certification schemes (CSs), granting participating farms access to certain types of CAP subsidies ([4]) (e.g. Pillar 1 eco-schemes and/or sectoral interventions, and Pillar 2 subsidies related to cooperation and/or the environment and climate). These CSs target various aspects of the sustainability of farms' activities, such as organic farming, animal welfare and social sustainability. Certification agencies (CAs) and public authorities (PAs) ([5]) play a crucial role in collecting and verifying the data necessary to certify farms ([6]) under these schemes. Importantly, the data collected for sustainability-related CSs can also serve as valuable input for the necessary data collection on environmental and social practices envisaged to be incorporated in the future FSDN.

([1]) https://eur-lex.europa.eu/resource.html?uri=cellar:ea0f9f73-9ab2-11ea-9d2d-01aa75ed71a1.0001.02/DOC_1&format=PDF.

([2]) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R2674.

([3]) https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en.

([4]) The terms 'payment' and 'subsidy' are used interchangeably throughout the text.

([5]) We will refer to both CAs and PAs as respondents or interviewees throughout the text, although CAs were primarily considered in the study.

([6]) The terms 'farms'/'farmers', 'operators' and 'members' are used interchangeably throughout the report. The terms 'farms' and 'farmers' refer specifically to firms in the agricultural sector, while the terms 'operators' and 'members' may include firms at other stages of the supply chain (e.g. food-processing companies).

The objective of this report is to assess the synergies between the data collected by public and private CAs for selected CSs and the FSDN. Given the current economic and financial focus of the FADN and the aims of the FSDN to expand the dataset to include environmental and social data, priority is given to CSs included in the CSPs that focus on these two dimensions of sustainability. Specifically, the report aims to deepen the understanding of the type of data collected from farms for the selected CSs, the sources of these data, the methods used for data collection and how the data are managed by the CAs (i.e. if and how it is stored). This report assesses whether insights from the data collection systems and processes used by various CSs as part of the certification process can be used for the upcoming transition to the FSDN, potentially reducing the costs and burdens associated with the upcoming data network. The analyses in this report are based on the online survey and face-to-face semi-structured interviews conducted with CAs and, in some cases, the responsible PA accredited to certify the selected CSs, as well as information gathered through desk research performed for each selected CS. The online survey and semi-structured interviews were conducted between June and October 2023.

2. Methodology

The analyses of this report are based on information collected through an online survey (via the EU Survey Tool) and face-to-face semi-structured interviews with representatives of accredited CAs and in some cases PAs. In addition, desk research on each CS was conducted. The online survey aimed to collect general data about the respondents, the certification process, the CSs' sustainability requirements and the costs of data collection. Semi-structured interviews were designed to gather more in-depth information about the type of data collected for the selected CSs, data sources, data collection methods and data management practices applied by the respondents, including data storage and accessibility. Desk research involved the collection of information about CSs from public sources (see Section 2.3 for more details).

The methodology is summarised by the following three steps.

1. The most relevant CSs included in the CSPs, based on their significance to sustainability and the data requirements for the certification process, were selected (see Section 2.1).
2. The selected CSs were contacted, through either the accredited CA or the competent PA's representatives, to conduct the structured interview. They were also invited to complete the online survey, prior to the scheduled date of the structured interview (see Section 2.2).
3. Face-to-face semi-structured interviews were conducted. In addition, in cases where the online survey was not completed before the interview, or responses required clarification, the questions of the online survey were asked during the face-to-face interview (see Section 2.3).

2.1. Selection of certification schemes from common agricultural policy strategic plans of the Member States

The selection of the CSs from CSPs in this study involved two phases: (i) mapping mentions of the CSs, in each MS's CSP, that relate to CAP interventions and (ii) pre-selecting the most relevant CSs.

Mapping the certification schemes from the common agricultural policy strategic plans of the Member States

Thorough desk research was conducted on the adopted CSPs for all MSs ([7]), resulting in the compilation of a comprehensive list of CAP interventions to which CSs are linked and that relate to sustainability aspects. When a CS is mentioned for a specific CAP intervention, it serves as an eligibility criterion for farms/operators to qualify for receiving the related subsidies. For some CAP interventions, especially sectoral interventions under Pillar 1, the recipient is a recognised collective of farmers (e.g. a producers' organisation), particularly for the development, implementation and/or maintenance of CSs (e.g. a national quality scheme (NQS)).

The mapping involved reviewing the descriptions of CAP interventions in each CSP to determine if any and if so which CSs were included as eligibility criteria. Two categories were used to group the CAP interventions set out in CSPs depending on the extent to which they mention a CS as an eligibility criterion ([8]): (i) generic, that is, when CAP interventions mention a general category of CS, without any further specification (e.g. for the Flemish Region of Belgium, the intervention 'Animal Welfare Label' requires, inter alia, that 'The livestock farmer joins a quality mark recognized by the Department of Animal Welfare. The eligible quality schemes are determined by the Department

([7]) Details on CSPs can be found at https://agriculture.ec.europa.eu/cap-my-country/cap-strategic-plans_en and in the CSP master file (Isbasoiu and Fellmann, 2023).

([8]) Note that CSPs also contain CAP interventions for which eligibility criteria refer to certified seeds or certified animal breeds, particularly coupled income support interventions. These CAP interventions were not considered in this report, as they do not necessarily require farmers to be subject to any certification process related to sustainability; in fact, they only need to ensure the use of certified seeds and/or certified animal breeds.

of Animal Welfare of the Department of Environment'); and (ii) specific, that is, when CAP interventions mention a specific CS (e.g. in the CSP of Italy, 'Sistema di Qualità Nazionale per il Benessere Animale (SQNBA)' is mentioned).

The following types of information were collected for all CAP interventions linked to the CSs from the adopted CSPs and used as criteria to pre-select the most relevant CSs in the next steps:

- information on whether or not the CAP intervention linked to the CS is supported under Pillar 1 or Pillar 2 of the CAP, defining the type of intervention (i.e. schemes for the climate, the environment and animal welfare (eco-scheme); coupled income support; investments, including investments in irrigation (invest); cooperation; sectoral intervention; setting up of young farmers and new farmers and rural business start-ups (instal); and environmental, climate-related and other management commitments (envclim));
- information on the sectoral coverage of the interventions linked to CSs (e.g. crops, livestock, fruits and vegetables, wine) and the objectives of the interventions (e.g. providing incentives to farmers to achieve a higher level of animal welfare through adhering to an animal welfare scheme);
- a brief description of the eligibility conditions of the interventions linked to sustainability-related CSs, as well as a description of what the relevant good agricultural and environmental conditions and statutory management requirements are, when such conditions apply;
- financial information on the total EU contribution and total public expenditure for direct payments ([9]) and sectoral and rural development interventions.

The mapping process led to the identification of a total of 188 interventions linked to CSs mentioned in the CSPs.

Pre-selecting the most relevant certification schemes

Out of the 188 mapped interventions linked to CSs in the first phase, 25 relevant CSs were pre-selected for consideration in this report. As mentioned above, priority was given to CSs focusing on the environmental and social dimensions of sustainability, with the aim of ensuring diverse coverage of these aspects. The pre-selected CSs primarily constitute eligibility conditions for receiving decoupled direct payments under Pillar 1 of the CAP. Specifically, within decoupled direct payments, a particular emphasis was placed on CSs related to eco-schemes. However, some of the pre-selected CSs are also included in the eligibility requirements for sectoral interventions under Pillar 1 or serve as eligibility criteria for different types of rural development interventions under Pillar 2 (e.g. Envclim, Cooperation). Other criteria used for the pre-selection of CSs aimed, as much as possible, to ensure diverse coverage of agricultural sectors and representation across MSs, and their relevance according to Chever et al. (2022), who provide an overview of CSs in the EU.

Building on the broad sustainability categories of CSs identified from the CSPs, desk research was conducted using public sources (e.g. websites of CAs and CSs, official documentation) to pinpoint more specific sustainability objectives and the types of data collected by each pre-selected CS. According to the typologies defined in Chever et al. (2022) and the thematic focus of each CS, six main categories of CSs used in CSPs were defined.

1. **Organic farming.** This category includes the EU organic CS established by Regulation (EU) 2018/848 ([10]). By definition, this CS is public and primarily related to the environmental dimensions of sustainability (e.g. application of chemical inputs, crop rotation) and animal welfare.

([9]) Direct payments include decoupled direct payments (basic income support for sustainability, complementary redistributive income support for sustainability, complementary income support for young farmers and schemes for the climate, the environment and animal welfare (eco-schemes)) and coupled income support.

([10]) https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018R0848.

2. **Organic plus.** These CSs are based on the EU organic regulation but with additional requirements. These CSs often integrate additional social-related sustainability requirements, such as labour-related (e.g. worker protection, value distribution) and/or additional environmental-related (e.g. greenhouse gas (GHG) emissions) requirements.

3. **Good agricultural practices (GAPs).** This category encompasses CSs that primarily address environmental issues (e.g. soil fertility, water quality, biodiversity). These CSs are often less restrictive, making them more accessible than organic farming CSs (Chever et al., 2022).

4. **Animal welfare.** This category includes CSs that address animal welfare across the whole animal production supply chain, including birth, care, breeding, transport and/or slaughtering of animals. These CSs focus on the social dimension of sustainability.

5. **NQSs.** These CSs are defined by national legislative frameworks, and they aim to ensure a high quality of specific final products and verify the origin of inputs. All CSs in this category are public and cover both environmental and social aspects of sustainability, such as the use of local inputs, labour conditions and environmentally friendly practices.

6. **Multipurpose schemes.** This category includes CSs that address several dimensions/aspects of sustainability along the supply chain. These schemes may encompass environmentally friendly practices, such as the use of chemical inputs or the reduction in GHG emissions, as well as social and ethical commitments, such as the fair remuneration of workers. They cover both environmental and social dimensions, albeit with different nuances and specificities.

2.2. Contacting the accredited certification agencies and competent public authorities for each pre-selected certification scheme

At least one accredited CA and/or PA for each pre-selected CS was invited (via email) to participate in the study. Overall, 21 CAs and/or PAs were contacted ([11]). Simultaneously, the representatives contacted were informed about the study's objectives, the CS to be covered and the nature of both the online survey and the structured interview questions. On confirmation of participation, a link to the online survey was provided, and the structured interview was scheduled.

2.3. Approaches to data and information collection: the online survey, semi-structured interviews and desk research

As mentioned above, the analyses in this report are based on data and information collected via three different methods: an online survey, semi-structured interviews and desk research.

Online survey

The online survey, designed using the EU Survey Tool, was shared via a hyperlink with respondents before the scheduled face-to-face interviews. In cases where the online survey remained incomplete or further clarifications were necessary, respondents were asked during the semi-structured interviews to ensure the completion of the survey.

([11]) Some of the respondents contacted covered more than one CS, which is why the number is less than 25, i.e. less than the number of pre-selected CSs.

The online survey was conducted in English, Italian or Spanish, depending on the respondents' language preferences, and covered a maximum of two CSs per respondent. The survey, outlined in Annex I, comprised four sections as follows.

1. **Profile, policy awareness and membership fee structure of the respondent.** This section aimed to gather information on (i) the type of respondent (private or public CA, or a PA); (ii) the core activity of the respondent (whether the respondent was involved in conducting official controls ([12]) to verify farmers' compliance with CS requirements and/or in designing and managing CSs); (iii) the respondent's engagement with official national/international bodies; (iv) the respondent's awareness about the CAP and the CSP; and (v) the membership fee structure of the CS for members.

2. **Profile of the CS and the nature of CS sustainability requirements.** This section was designed to gather information on (i) the type of CS (private or public, i.e. whether the sustainability requirements are established by a private or public entity); (ii) the geographical coverage of the CS (whether recognised at the MS level only, in more than one MS, in the whole EU and/or outside the EU); (iii) the production stages covered by the CS (whether the scheme applies to a specific phase of the production process, i.e. raw agricultural products / live animals and/or processed food product); (iv) the agricultural sectors covered; (v) the target of the CS, identifying whether final consumers (business-to-consumer (B2C)) or intermediate agents of the supply chain (business-to-business (B2B)), or both, are the final target of the CS; and (vi) the nature of CS sustainability requirements, indicating whether requirements differ between agricultural sectors and/or between countries, specifying to which policy framework(s) they belong to (e.g. the CAP, the European Green Deal, national frameworks) and exploring if and to what extent strictness of requirements changed in the last 5 years and the main reasons for such changes (i.e. regulations and/or market demand).

3. **Respondents' cost assessment of data collection activities from the perspectives of both the respondents and farmers.** This section covered respondents' cost assessment of data collection activities, particularly costs concerning bookkeeping activities, monitoring activities, sampling and laboratory tests, quality checking, training for data collection, data collection per se and equipment for data collection, other costs and an overall cost assessment.

4. **General opinion of the respondent on the topics covered in the survey.** This section allows respondents to freely express their opinion and/or comments, if any, on the survey and the topics covered therein.

Semi-structured interviews

After gathering general information through the online survey, face-to-face semi-structured interviews were conducted with representatives of CAs and PAs to obtain a deeper understanding of the data collection process and data management. Specifically, the semi-structured interviews focused on:

- the type of data collected (i.e. whether the compliance assessment investigated specific requirements (qualitative data) and/or collected actual data values (quantitative data));
- the methods of data collection (i.e. how data and information are collected, e.g. on-farm ([13]) data collection, observation/measurement, remote document review or verification of compliance with the checklist of requirements);

([12]) The terms 'audit', 'checks', 'control' and 'inspection' are used interchangeably throughout the text..

([13]) The terms 'on-farm' and 'on-site' are used interchangeably to refer to instances in which the official control is performed through a physical inspection of the operator's premises.

- the sources of the data collected (i.e. where the data originate, e.g. bookkeeping records of the farm and other documents, on-farm visual observations, laboratory tests or existing third-party data);
- additional data collection (i.e. whether or not, in addition to the data and information required by the CS, supplementary data and information are collected);
- database creation (i.e. if and how data are stored and managed, e.g. in a certification report outlining the outcome of the certification process (the checklist of requirements), in a third party's dataset, in an internal database or in an ad hoc format (unstructured database), or if no data are stored and managed);
- data exchange with third parties and/or PAs (i.e. whether data are transmitted to the competent PAs and/or to private third parties, and/or if the respondents have access to third-party data, including PAs);
- methods for monitoring operators, with the aim of understanding how operators are monitored during the certification process (including whether group certifications are allowed, the approach of operators' selections for audits (whether all operators and/or only samples of operators are audited) and whether additional audits are conducted (e.g. based on risk assessment)).

Desk research on the certification schemes

Comprehensive desk research was conducted on CSs to complement the data collected through the online survey and semi-structured interviews. This involved reviewing publicly available information about the CSs, including official websites of CAs, PAs and CSs, to gather information on their sustainability requirements, legal basis, practices for data collection and exchange, and other pertinent details.

3. Mapping of certification schemes from the common agricultural policy strategic plans of the Member States

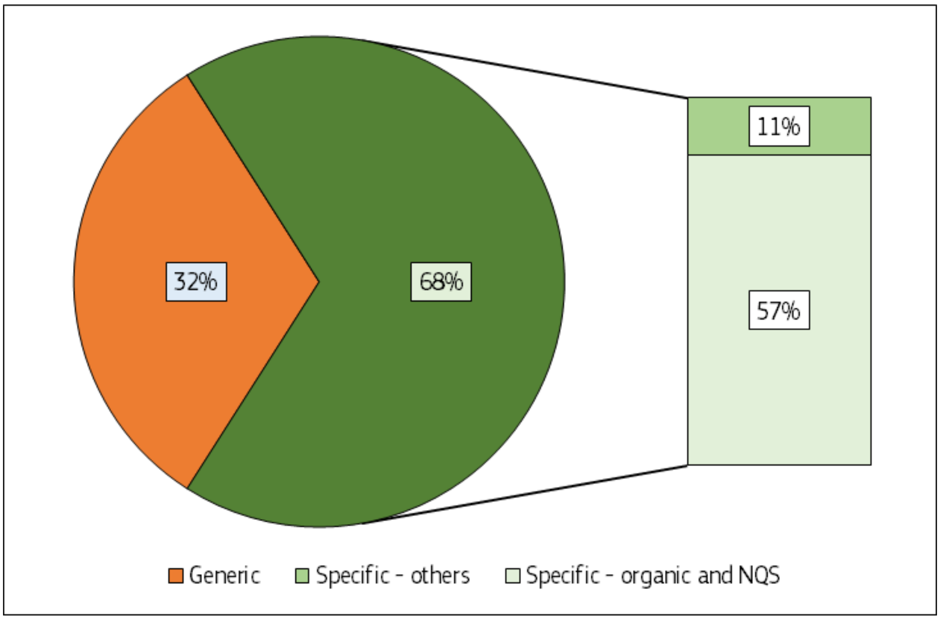
Figure 1 shows the distribution of mapped interventions linked to CSs by CS category (Figure 1a), their shares of total EU CAP expenditure ([14]) on mapped interventions linked to CSs (Figure 1b), as well as the distribution of the number of interventions and the total EU CAP expenditure on mapped CAP interventions linked to CSs by CS category (Figure 1c). As described earlier, when mentioned in a CSP, a CS linked to a CAP intervention can be 'specific' (i.e. the CS and/or a list of accredited CSs is clearly specified) or 'generic' (i.e. the CS is not clearly specified and only the main nature of the CS is defined).

Out of the total 188 mapped CAP interventions linked to CSs in the CSPs, 32 % were generic and 68 % were specific. The latter category includes mainly the EU organic farming scheme and NQSs (e.g. geographical indications, national schemes for integrated production), representing 57 % (108 mentions) of all specific CSs, while the remaining 11 % (20 mentions) are other specific CSs (e.g. animal welfare, traceability CSs) (Figure 1a). Note that different CAP interventions linked to CSs may relate to the same (specific or generic) CS across and within MSs (e.g. EU organic farming certification can serve as an eligibility criterion for more than one CAP intervention). In addition, in some cases, more than one CS may correspond to one CAP intervention. Therefore, the number of CAP interventions linked to CSs does not match the number of distinct CSs.

In terms of EU CAP expenditure for the whole programming period, the mapped CAP interventions linked to CSs account for 8.4 % of total EU CAP expenditure. Expenditure for CAP interventions linked to 'generic' and 'specific' CSs amounts to 7.6 % (EUR 1.7 billion) and 92.4 % (EUR 20.4 billion), respectively, of total EU CAP expenditure on all interventions linked to CSs (Figure 1b and c).

Figure 1. The distribution of mapped CAP interventions linked to CSs

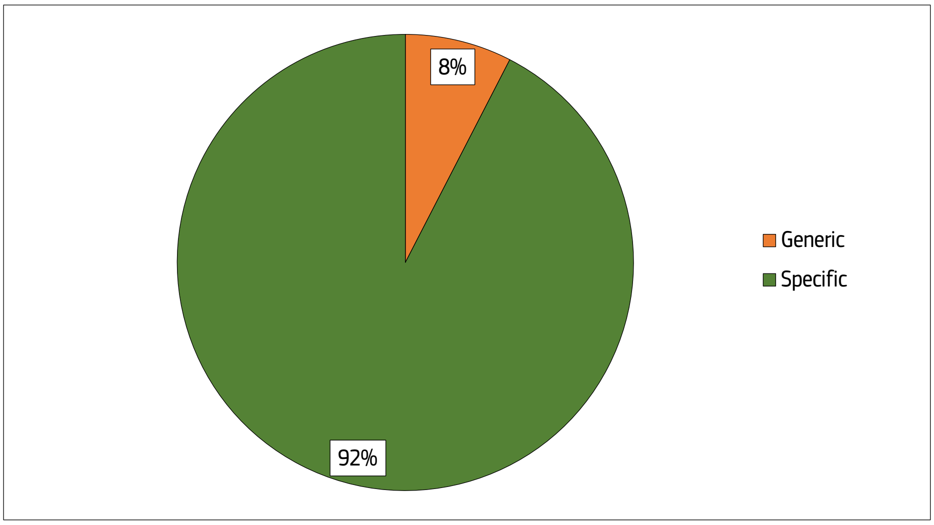
(a) The distribution of mapped CAP interventions linked to CSs by CS category



Source: Authors' calculations based on information extracted from CSPs.

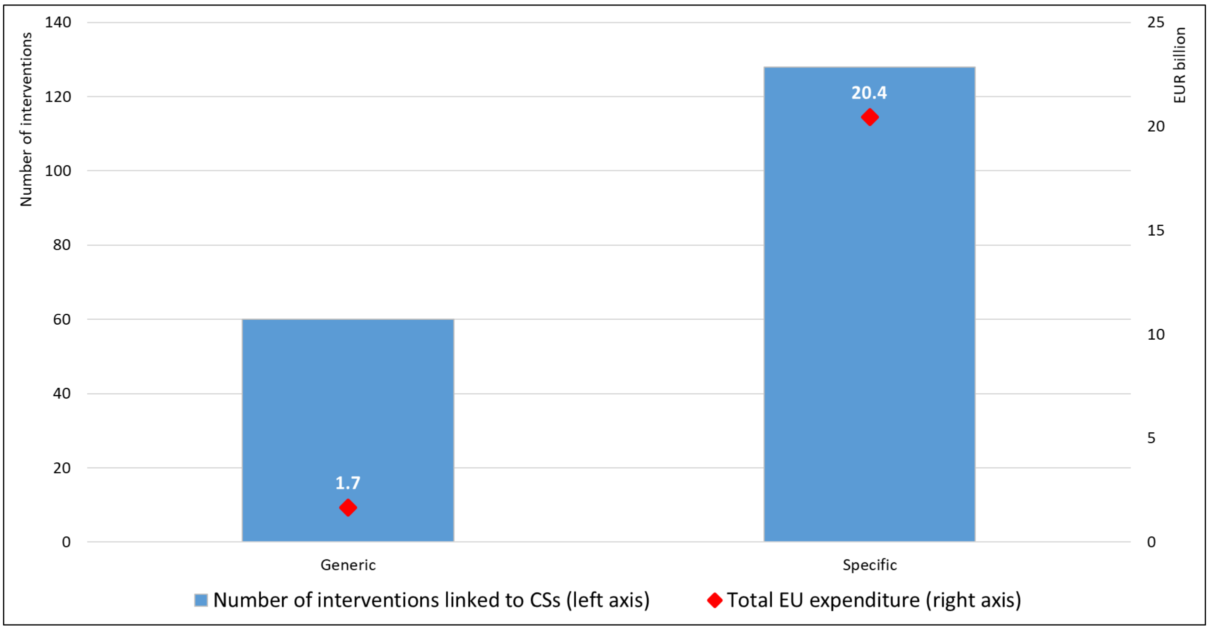
([14]) EU CAP expenditure (2023–2029) refers to the EU's contribution to an intervention's budget through the relevant fund (European Agricultural Guarantee Fund or European Agricultural Fund for Rural Development) for the whole programming period. Note that MSs planned European Agricultural Guarantee Fund until financial year 2028 and European Agricultural Fund for Rural Development until financial year 2029.

(b) The distribution of total EU CAP expenditure on mapped CAP interventions linked to CSs by CS category



NB: The budget for sectoral CAP interventions linked to CSs for certain sectors (e.g. fruits and vegetables, milk and milk products, olive oil and tables olive) is not considered in this figure, as this information is provided in CSPs per operational programme and not per level of intervention.
Source: Authors' calculations based on information extracted from CSPs.

(c) The distribution of the number of interventions and the total EU CAP expenditure on mapped CAP interventions linked to CSs by CS category

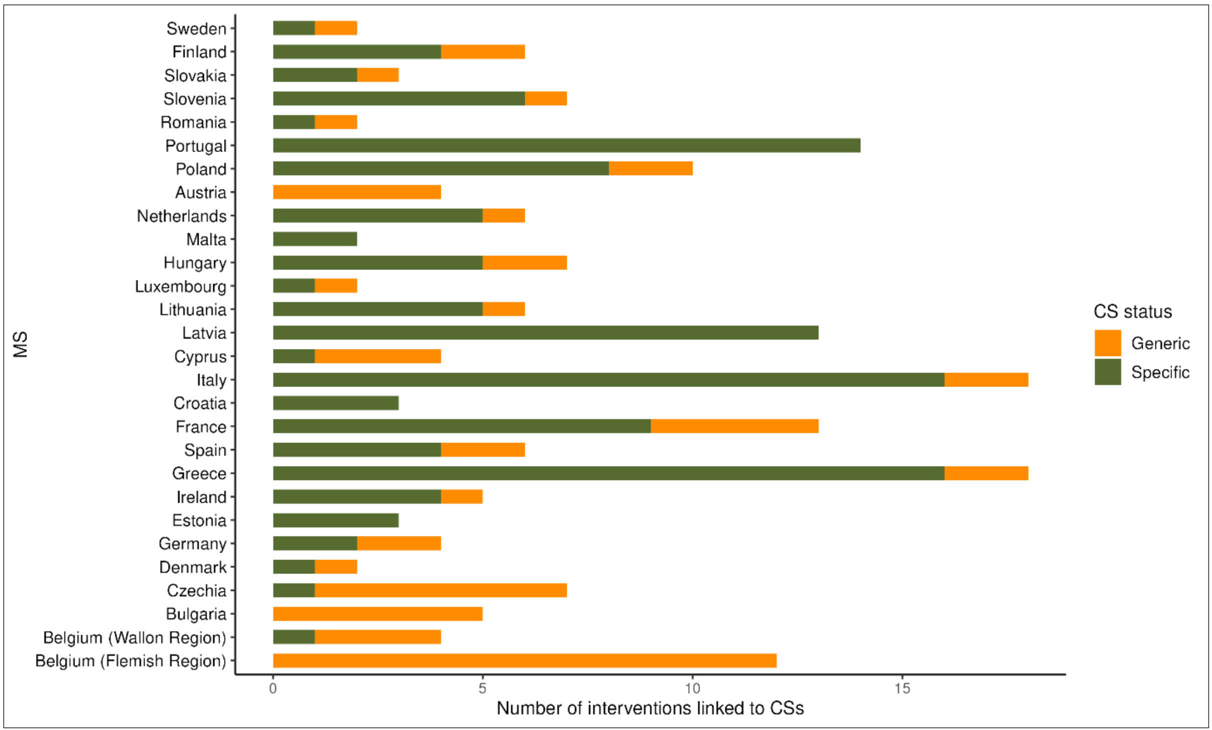


NB: The budget of sectoral CAP interventions linked to CSs for certain sectors (e.g. fruits and vegetables, milk and milk products, olive oil and table olives) is not considered in this figure, as this information is provided in the CSPs per operational programme and not per level of intervention.
Source: Authors' calculations based on information extracted from CSPs.

Figure 2 illustrates the distribution of CAP interventions linked to CSs across MSs and category of CS. Clearly, both the number (Figure 2a) and budgetary amounts and shares (Figure 2b and c) of CAP interventions linked to CSs are not equally distributed across MSs. Italy, Greece and Portugal have the largest number of mapped CAP interventions linked to CSs, while Denmark, Luxembourg, Romania, Sweden and Malta have the lowest. The distribution of EU CAP expenditure on interventions linked to CSs across MSs is even more unequal, influenced by, inter alia, the size of each MS. France, Germany, Greece and Italy have the largest budgets (EU contributions) for CAP interventions linked to CSs, whereas Luxembourg, Malta and Cyprus have the lowest. In terms of shares of total EU CAP expenditure, France, the Netherlands and Greece have the largest shares of EU expenditure for mapped CAP interventions linked to CSs, while Belgium (Flemish Region), Romania and Hungary have the smallest.

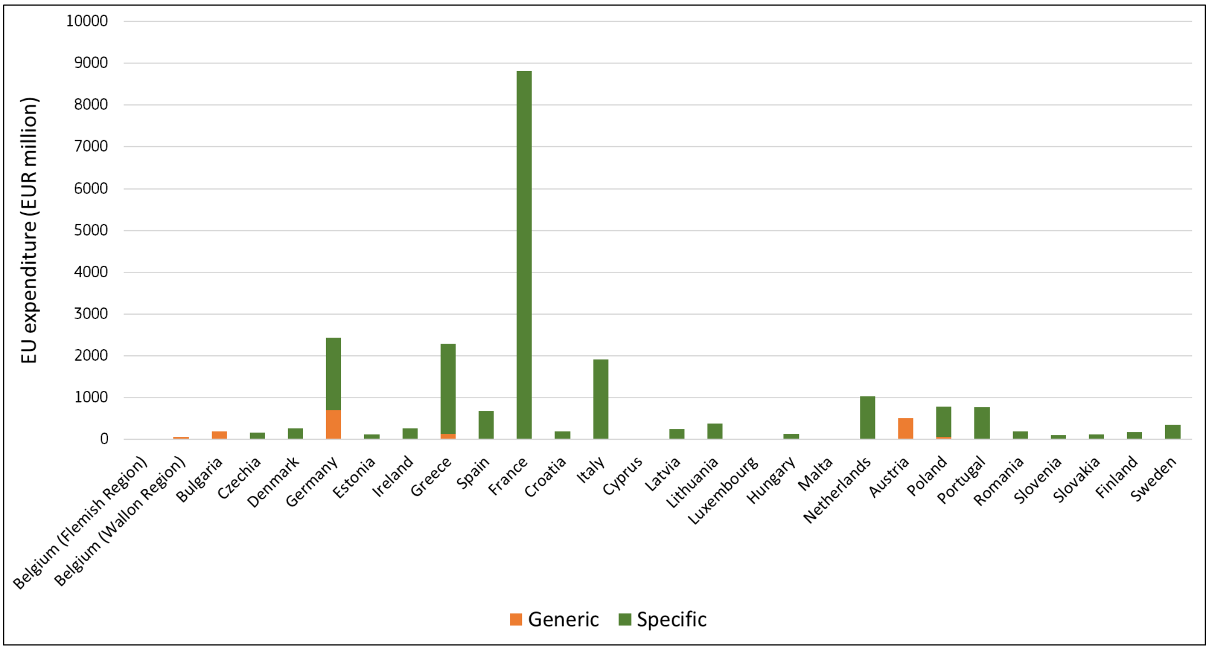
Figure 2. The distribution of mapped CAP interventions linked to CSs by MS and CS category

(a) The number of mapped CAP interventions linked to CSs



Source: Authors' calculations based on information extracted from CSPs.

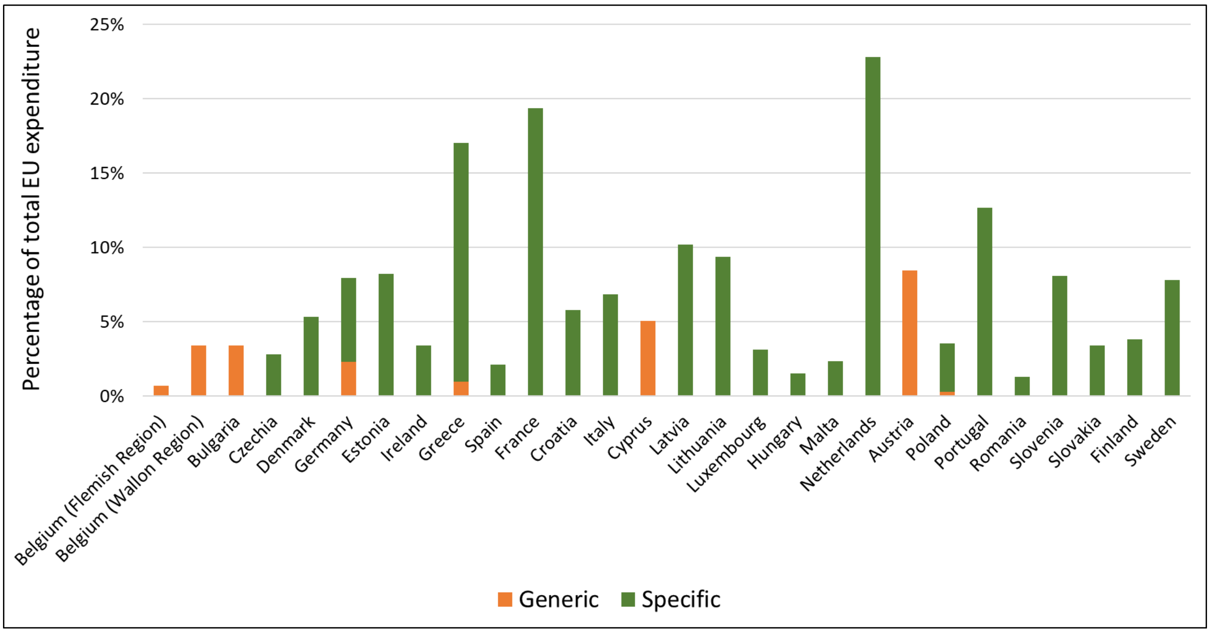
(b) EU expenditure on mapped CAP interventions linked to CSs (EUR million)



NB: The budget of sectoral CAP interventions linked to CSs for certain sectors (e.g. fruits and vegetables, milk and milk products, olive oil and tables olive) is not considered in this figure, as this information is provided in the CSPs per operational programme and not per level of intervention.

Source: Authors' calculations based on information extracted from CSPs.

(c) EU expenditure of mapped CAP interventions linked to CSs (percentage of total EU expenditure of CAP interventions at the MS level)



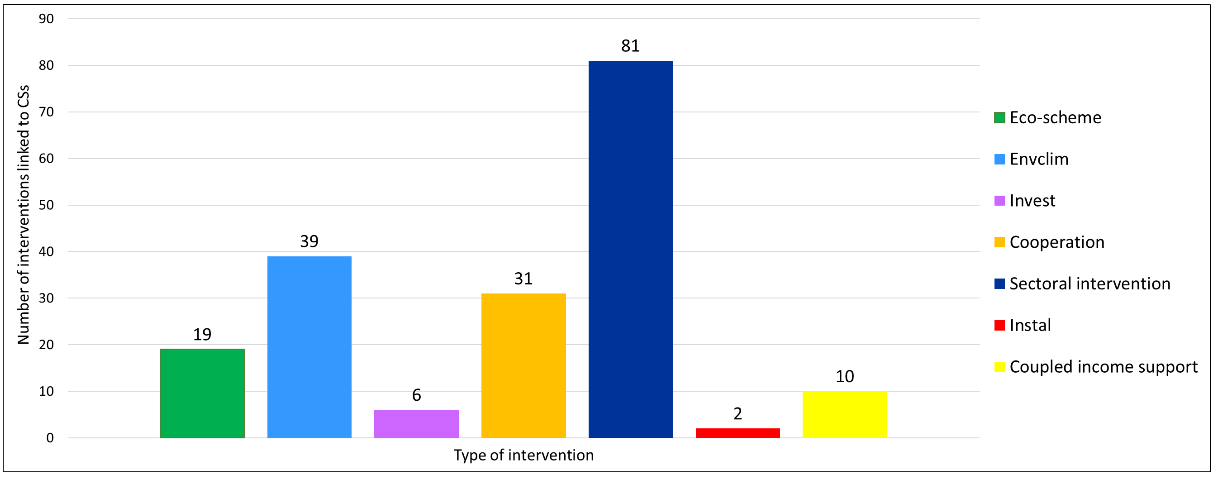
NB: The budget of sectoral CAP interventions linked to CSs for certain sectors (e.g. fruits and vegetables, milk and milk products, olive oil and tables olive) is not considered in this figure, as this information is provided in the CSPs per operational programme and not per level of intervention.

Source: Authors' calculations based on information extracted from CSPs.

Figure 3a illustrates the number of mapped CAP interventions linked to CSs by type of intervention (e.g. eco-scheme, envclim). Most of the interventions linked to the CSs detected in the CSPs are sectoral interventions, followed by envclim, cooperation and eco-scheme interventions. Figure 3b shows the distribution of CAP interventions linked to CSs by MS and type of intervention. The distribution of different types of CAP interventions linked to CSs is heterogeneous across MSs, with sectoral interventions being present in most MSs, followed by envclim, cooperation and eco-scheme interventions. The other types of interventions linked to CSs are present in only some MSs. Figure 3c shows that the eco-scheme and envclim interventions have the largest shares of total EU expenditure for the mapped CAP interventions linked to CSs, with 60.9 % and 25.8 %, respectively. The corresponding shares for each of the other types of CAP intervention are lower than 7 %.

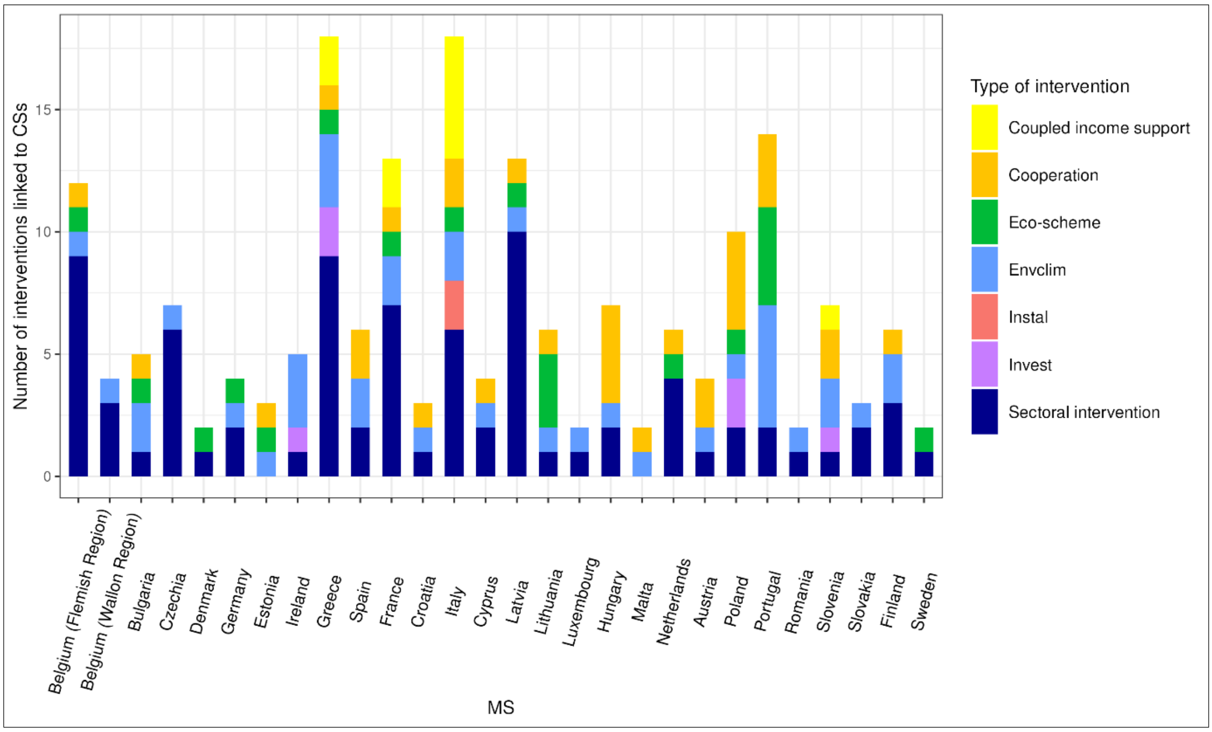
Figure 3. The distribution of CAP interventions linked to CSs by type of CAP intervention

(a) The number of CAP interventions linked to CSs by type of CAP intervention



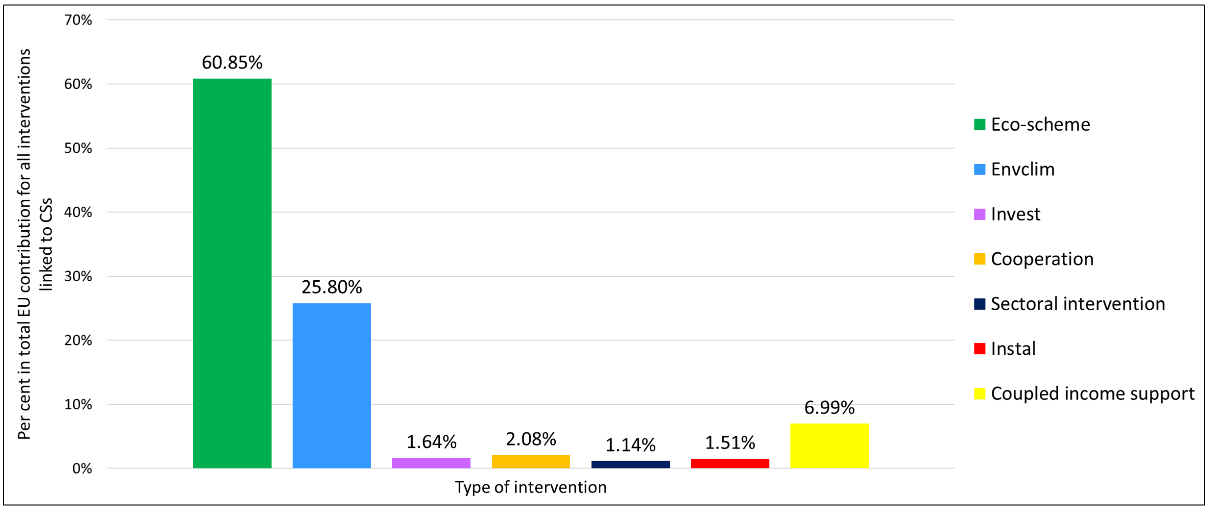
Source: Authors' calculations based on information extracted from CSPs.

(b) The number of CAP interventions linked to CSs by type of CAP intervention and by MS



Source: Authors' calculations based on information extracted from CSPs.

(c) EU expenditure of CAP interventions linked to certification by type of CAP intervention (percentage of total EU expenditure of CAP interventions linked to certification)



NB: The budget of sectoral CAP interventions linked to CSs for certain sectors (e.g. fruits and vegetables, milk and milk products, olive oil and tables olive) is not considered in this figure, as this information is provided in the CSPs per operational programme and not per level of intervention.

Source: Authors' calculations based on information extracted from CSPs.

4. Profiles of respondents and certification schemes analysed ([15])

4.1. Overall statistics of respondents and certification schemes

Table 1 provides statistics on the analysed CSs ([16]), along with the number of respondents. In total, 10 respondents, including 8 CAs and 2 PAs, were interviewed, covering a total of 16 CSs ([17]). This resulted in response rates of 48 % for respondents (10 out of the 21 CAs and PAs contacted) ([18]) and 64 % for CS (16 out of the 25 pre-selected CSs) ([19]). In terms of CS categories, at least two CSs per category were considered in the study. The organic category is the most represented, with four out of six pre-selected CSs interviewed. All the pre-selected CSs belonging to the organic plus (n = 3) and multipurpose (n = 2) categories were eventually interviewed, while the GAP category is represented by two out of four pre-selected CSs and the animal welfare category by three out of four pre-selected CSs. Finally, of the six CSs related to the NQS category, two were interviewed. In terms of the number of respondents per category, the breakdown is as follows: the organic category included four respondents, the organic plus, GAP, NQS and multipurpose categories had two respondents each, and the animal welfare category had three respondents.

([15]) We refer to analysed CSs for both pre-selected and covered CSs: the covered CSs include schemes for which respondents were interviewed and for which the online survey was completed, and the pre-selected CSs are the 25 pre-selected CSs, as explained above.

([16]) Note that it was not possible to complete the online survey or to perform the structured interview with representatives of the French Haute Valeur Environnementale (HVE) CS. Therefore, only the information that could be retrieved through desk research is considered in the analysis.

([17]) Note that, out of the EU sustainability CSs reported in Chever et al. (2022), 30 are mentioned in the CSPs, of which 10 are analysed in the current study (see Table 1 and Annex II).

([18]) For some CSs, more than one CA or PA was contacted and interviewed.

([19]) The CS Biogarantie of Belgium was included as per its relevance in Chever et al. (2022), although it was not mentioned in the two Belgian CSPs (for the Flemish and Walloon Regions).

Table 1. List of pre-selected and covered CSs and the numbers of respondents

ID	CS	MS	Interviewed	Total No of pre-selected CSs	Total No of CSs interviewed	Total No of respondents (CAs and PAs)*	Chever et al. (2022)
		Organic farming		**6**	**4**	**4**	
1	Organic farming	Belgium (Flemish Region)	✓				✓
2	Organic farming	Lithuania	✓				✓
3	Organic farming	Netherlands	✓				✓
4	Organic farming	Spain	✓				✓
5	Organic farming	Czechia	×				✓
6	Organic farming	Slovenia	×				✓
		Organic plus		**3**	**3**	**2**	
7	Bioland	Germany	✓				✓
8	Naturland	Germany	✓				✓
9	Biogarantie	Belgium	✓				✓
		GAP		**4**	**2**	**2**	
10	Produção Integrada	Portugal	✓				✓
11	HVE	France	✓				✓
12	Integrowana Produkcja Roślin	Poland	×				✓
13	Sistema di Qualità Nazionale di Produzione Integrata	Italy	×				✓
		Animal welfare		**4**	**3**	**3**	
14	Beter Leven	Belgium (Flemish Region)	✓				✓
15	SQNBA	Italy	✓				×
16	Welfair	Portugal	✓				✓
17	Sikava	Finland	×				×
		NQS		**6**	**2**	**2**	
18	Kokybe	Lithuania	✓				×
19	Dokazana kvaliteta	Hungary	✓				×
20	Sustainable beef and lamb assurance scheme	Ireland	×				✓
21	Selected quality	Slovenia	×				✓
22	Label Rouge	France	×				✓
23	System Gwarantowanej Jakości Żywności	Poland	×				✓
		Multipurpose scheme		**2**	**2**	**2**	
24	Equalitas	Italy	✓				✓
25	GlobalG.A.P.	Germany	✓				×
		Total		**25**	**16**	**10**	

**NB: The same respondent may cover more than one CS.*

Source: Compiled by the authors based on information extracted from CSPs.

Overall, the share of the total CAP budget (EU expenditure) corresponding to the pre-selected CSs is 5.5 %, whereas for the covered CSs it is 5.2 % (Table 2). This represents a coverage rate of 66 % for the pre-selected CSs and 62 % for the covered CSs of the total EU CAP budget linked to CSs in the CSPs. Out of the 25 pre-selected CSs, 14 were linked to both CAP pillars, 22 to CAP Pillar 2 and 16 to CAP Pillar 1, with 14 of them specifically linked to direct payments (see Figure 4a). In the subset of the selected 16 CSs interviewed, 9 were linked to both pillars, 13 were related to Pillar 2 and 11 to Pillar 1, of which 11 were specifically associated with direct payments (see Figure 4b). It is important to note that the same CS may cover both Pillar 1 and Pillar 2, as well as various CAP payments.

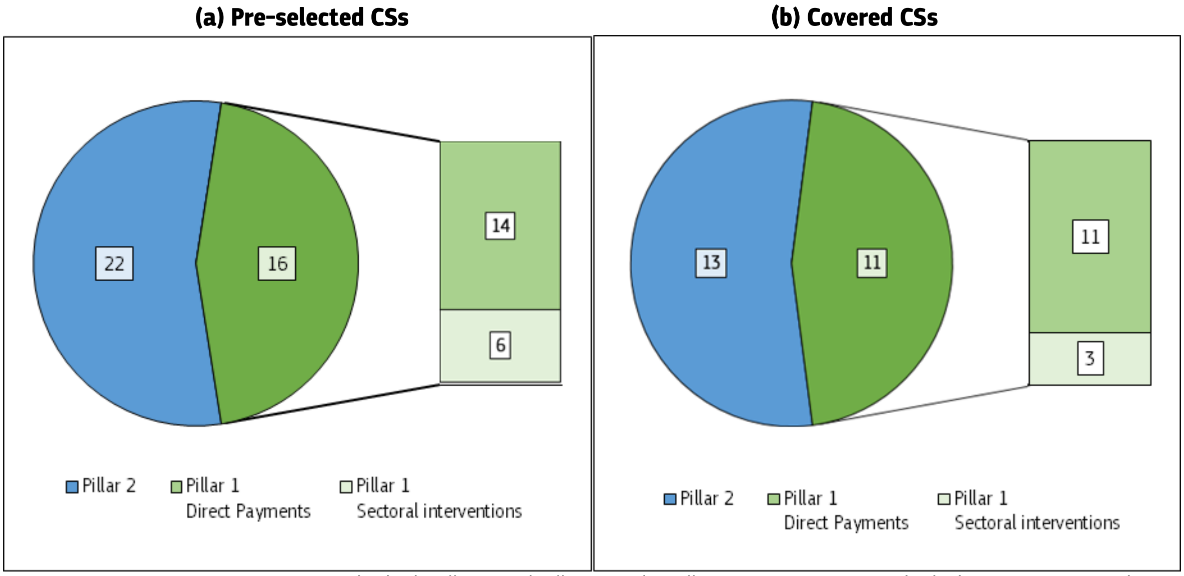
Table 2. List of analysed CSs and the related EU CAP expenditure (EUR Million) and shares of total EU CAP expenditure

CS (*)	**MS**	**Type of intervention to which the CS is linked**	**EU expenditure (EUR Million)**	**Share of total CAP budget (EU expenditure)**
		Pre-selected – interviewed		
HVE	France	Eco-scheme (Pillar 1), Envclim, Cooperation (Pillar 2)	8 608	3.26 %
Bioland	Germany	Eco-scheme (Pillar 1), Envclim (Pillar 2)	2 421	0.92 %
Naturland	Germany	Eco-scheme (Pillar 1), Envclim (Pillar 2)	2 421	0.92 %
Organic farming	Netherlands	Eco-scheme, Sectoral intervention (Pillar 1)	964	0.37 %
Organic farming	Spain	Envclim (Pillar 2)	565	0.21 %
SQNBA	Italy	Eco-scheme (Pillar 1), Cooperation (Pillar 2)	386	0.15 %
Organic farming	Lithuania	Eco-scheme (Pillar 1), Envclim (Pillar 2)	356	0.13 %
Produção Integrada	Portugal	Eco-scheme (Pillar 1), Envclim (Pillar 2)	273	0.10 %
Equalitas	Italy	Cooperation (Pillar 2)	55	0.02 %
Biogarantie	Belgium (Walloon Region)	Envclim (Pillar 2)	52	0.02 %
Welfair	Portugal	Eco-scheme (Pillar 1)	19.5	0.01 %
Kokybe	Lithuania	Eco-scheme (Pillar 1), Cooperation (Pillar 2)	14	0.01 %
Biogarantie	Belgium (Flemish Region)	Eco-scheme, Sectoral intervention (Pillar 1), Envclim (Pillar 2)	12	0.005 %
Organic farming	Belgium (Flemish Region)	Eco-scheme, Sectoral intervention (Pillar 1), Envclim (Pillar 2)	12	0.005 %
Dokazana kvaliteta	Croatia	Cooperation (Pillar 2)	3	0.001 %
Beter Leven	Belgium (Flemish Region)	Cooperation (Pillar 2)	0.3	0.0001 %
GlobalG.A.P.	Germany	Not mentioned in the German CSP	—	—
		Total interviewed	**13 675**	**5.18 %**
		Pre-selected – not interviewed		
Sistema di Qualità Nazionale di Produzione Integrata	Italy	Sectoral intervention (Pillar 1), Envclim (Pillar 2)	233	0.09 %
Integrowana Produkcja Roślin	Poland	Eco-scheme (Pillar 1), Invest, Cooperation (Pillar 2)	213	0.08 %
Organic farming	Czechia	Envclim (Pillar 2)	158	0.06 %
Sustainable beef and lamb assurance scheme	Ireland	Envclim (Pillar 2)	103	0.04 %
Organic farming	Slovenia	Envclim, Invest (Pillar 2)	67	0.03 %
System Gwarantowanej Jakości Żywności	Poland	Sectoral intervention (Pillar 1), Cooperation (Pillar 2)	60	0.02 %
Label Rouge	France	Coupled income support, Sectoral intervention (Pillar 1), Cooperation (Pillar 2)	59	0.02 %
Selected quality	Slovenia	Coupled income support (Pillar 1), Cooperation (Pillar 2)	30	0.01 %
Sikava	Finland	Cooperation (Pillar 2)	2	0.001 %
		Total not interviewed	**925**	**0.35 %**
		Total pre-selected	**14 600**	**5.53 %**

(*) Not all the CSs listed here are specifically mentioned in the CSPs. The grey shading indicates amounts already included in the amounts of other rows, and, therefore, to avoid double-counting, they were not included in the totals. Some CSs (e.g. Biogarantie and Bioland) were included due to their relevance in Chever et al. (2022) even though they were not specifically mentioned in the CSPs; the amounts reported

refer to the financial allocations for the organic farming interventions in those MSs. Invest, investments, including investments in irrigation.
Source: Compiled by the authors based on information extracted from CSPs.

Figure 4. Number of analysed CSs by CAP pillar

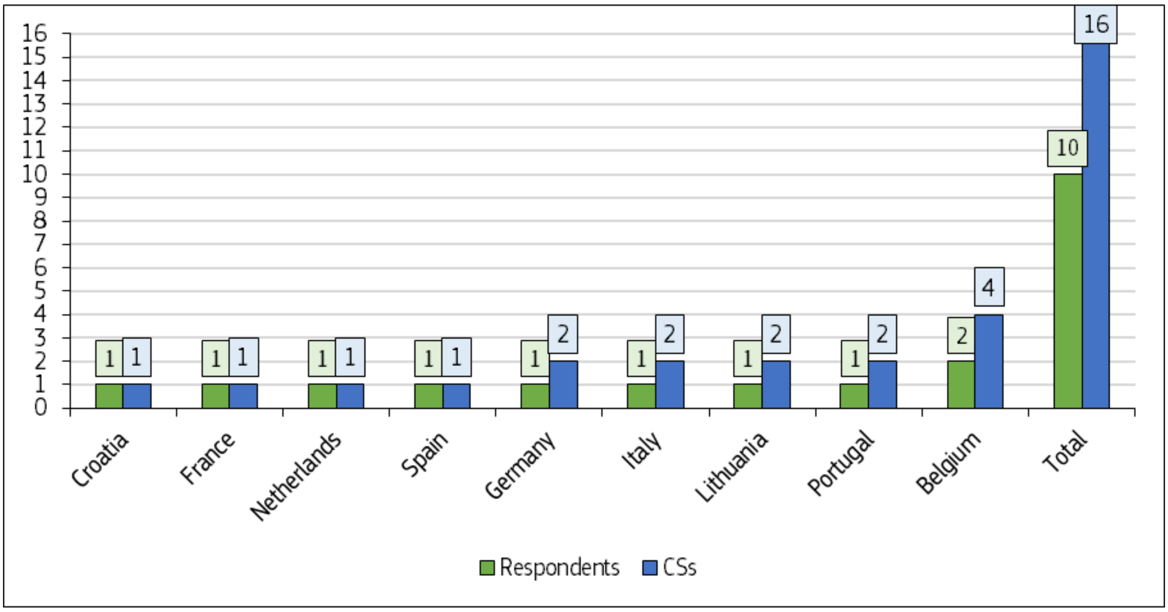


NB: One CS may cover interventions under both Pillar 1 and Pillar 2. Under Pillar 1, one CS can cover both direct payments and sectoral interventions. Direct payments include basic income support for sustainability; complementary redistributive income support for sustainability; complementary income support for young farmers; schemes for the climate, the environment and animal welfare (eco-schemes); and coupled income support.
Source: Authors' calculations based on information extracted from CSPs.

4.2. Respondents' coverage across Member States and nature

Figure 5 depicts the distribution of respondents by country, specifically the location of the head office of the interviewee. It is important to note that the sample is not representative across different MSs or CSs, as the main objective was to collect data and information from various CSs covering different aspects of sustainability. Nonetheless, efforts were made to cover as many MSs as possible. In total, the study covered nine MSs, with the number of respondents varying between one and two and the number of CSs varying between one and four per MS. For Belgium, one CA and one PA were included, representing four different CSs (i.e. two for each respondent). In France, one PA was interviewed, representing one CS. In other MSs covered, at least one CA was interviewed, with two CSs represented for Germany, Italy, Lithuania and Portugal, and one CS for Spain, Croatia and the Netherlands.

Figure 5. Number of CAs and PAs interviewed and CSs per MS (numbers of respondents and CSs)



Source: Authors' calculations based on semi-structured interviews and online survey.

Out of the eight interviewed CAs, five were exclusively involved in the certification process, performing official controls ([20]) to verify operators' compliance with the specific requirements of the CSs. The remaining three CAs were also engaged in the design and management of CSs, contributing to developing, defining and managing (private) CSs, in addition to their involvement in the certification process. Two respondents were PAs, thus receiving the information and data collected by CAs for the covered CSs (Table 3).

Table 3. Number of interviewed CAs by core activity

CA or PA	Number of respondents	Private	Public
CA	**8**		
Certification process exclusively (e.g. data collection)	5	6	2
Certifying process and design/management of the CS(s)	3		
PA	**2**		**2**
Total	**10**	**6**	**4**

Source: Compiled by the authors based on semi-structured interviews and online survey.

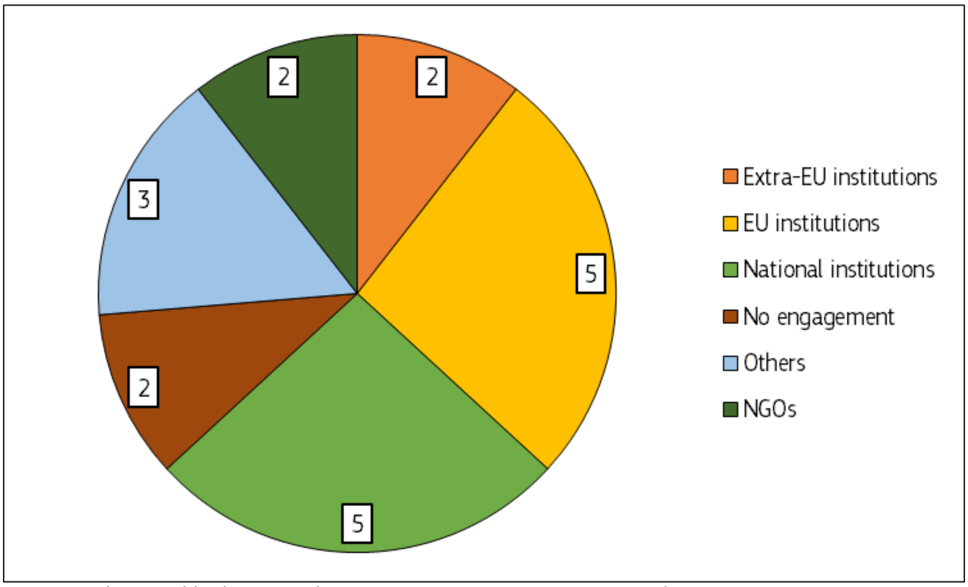
In terms of the legal nature of the CAs, six were private entities, while the remaining two were public. The public CAs are established by the public competent authority (e.g. the ministry of agriculture) and exclusively certify operators for the recognised CSs (including CSs for which operators can receive public support). The remaining two respondents were PAs and hence not directly involved in data collection, but received and managed the information collected by a different CA.

In the online survey, and during the semi-structured interviews if information was missing or incomplete in the survey, respondents were asked to specify if and if so with which other official national and/or international bodies they engage to align and/or discuss the requirements of the CSs. Five respondents engaged with EU institutions (e.g. the European Commission), five engaged with national institutions (e.g. various ministries, the national paying agencies), two engaged with extra-EU institutions (e.g. the United States Department of Agriculture), two with non-

([20]) The terms 'audit', 'checks', 'control' and 'inspection' are used interchangeably throughout the text.

governmental organisations, two had no engagement with official institutions and three selected other institutions (e.g. associations regulating the CSs, particularly for the private CSs) (Figure 6).

Figure 6. Number of respondents by their engagement with official national and/or international bodies



NB: Respondents could select more than one answer. NGO, non-governmental organisation.
Source: Authors' calculations based on semi-structured interviews and online survey.

4.3. Covered certification schemes: profiles and the nature of sustainability requirements

Overall, out of the 16 covered CSs, 7 CSs were private and 9 were public. Public CSs are defined by specific policy regulations at the national or EU level that set requirements. On the other hand, private CSs are owned and managed by private entities (e.g. certification bodies, stakeholder associations), which define the requirements of the scheme. Nevertheless, private CSs may also rely on public regulations to define their requirements. For example, Biogarantie, Naturland and Bioland require certified farmers to adhere to the EU organic farming regulation, as well as requiring them to adhere to additional and usually more stringent requirements. In terms of CS categories, the interviewed EU organic farming schemes are defined by Regulation (EU) 2018/848, while NQSs follow dedicated national legal frameworks. Both multipurpose and organic plus CS categories are entirely private, while the organic, GAP and NQS categories are entirely public. Within the animal welfare category, two CSs are private and one is public (see Table 4).

Table 4. Number of covered CSs by category and legal nature

CS	Number of CSs	Legal nature	
		Private	**Public**
Organic farming	**4**		
Organic farming (Belgium, Spain, Lithuania, Netherlands)	4		✓
Organic plus	**3**		
Bioland	1	✓	
Naturland	1	✓	
Biogarantie	1	✓	
NQS	**2**		
Kokybe	1		✓
Dokazana kvaliteta	1		✓
Animal welfare	**3**		
SQNBA	1		✓
Beter Leven	1	✓	
Welfair	1	✓	
GAP	**2**		
Produção integrada	1		✓
HVE	1		✓
Multipurpose	**2**		
GlobalG.A.P.	1	✓	
Equalitas	1	✓	
Total	**16**	**7**	**9**

Source: Compiled by the authors based on online survey, semi-structured interviews and desk research.

Table 5 defines the geographical coverage of each CS as per the definition given by the respondent, distinguishing whether it applies within a given MS's boundaries only, in more than one MS but not the whole EU, the whole EU or also outside the EU. All CSs are recognised at the MS level, one is recognised in more than one MS but not throughout the entire EU, and eight are used at the EU level and beyond the EU (e.g. the EU organic farming CS is recognised throughout the EU as well as by countries outside the EU). Within the organic plus category, Naturland is recognised at the EU level and beyond EU boundaries, while the remaining two schemes (i.e. Biogarantie and Bioland) are recognised in their respective MSs only. In the animal welfare category, one CS is recognised beyond its respective MSs but does not cover the whole EU (i.e. Beter Leven in the Netherlands and Belgium) and one is recognised within the EU and beyond the EU (i.e. Welfair). SQNBA is specific to one MS only. CSs belonging to the NQS and GAP categories are exclusively applied within the boundaries of the MS to which they belong. The multipurpose category encompasses all levels of geographical coverage, applying to the whole EU and also outside its borders.

Table 5. Geographical coverage of covered CSs as indicated by respondents

CS	Extra-EU level	EU level	Multi-MS level	MS level
Organic farming				
Organic farming (Belgium, Spain, Lithuania, Netherlands)	✓	✓		✓
Organic plus				
Bioland				✓
Naturland	✓	✓		✓
Biogarantie				✓
NQS				
Kokybe				✓
Dokazana kvaliteta				✓
Animal welfare				
SQNBA				✓
Beter Leven			✓	✓
Welfair	✓	✓		✓
GAP				
Produção integrada				✓
HVE				✓
Multipurpose				
GlobalG.A.P.	✓	✓		✓
Equalitas	✓	✓		✓
Total	**8**	**8**	**1**	**16**

NB: Respondents could select more than one answer.
Source: Compiled by the authors based on semi-structured interviews, online survey and desk research.

Concerning the three production phases that can be covered by the CSs' requirements – the raw agricultural product or animal, the production process and the processed food product phases – all CSs apply to the first phase, 11 also consider the production process phase and 14 consider the final processed food product phase (see Table 6).

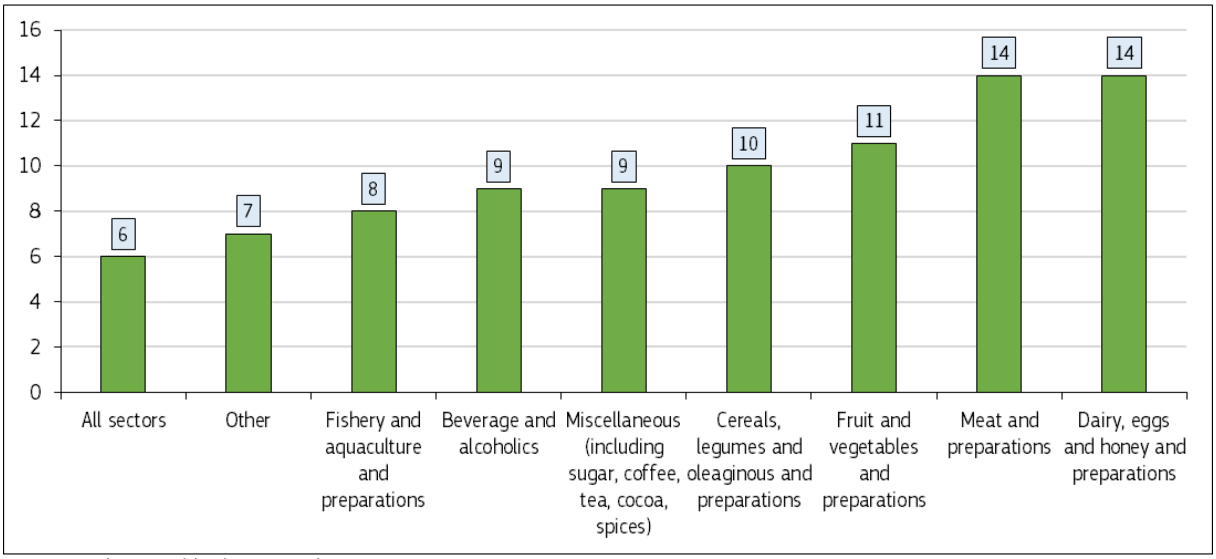
Figure 7 displays the number of CSs per agricultural sector. Six CSs cover all agricultural sectors (i.e. organic farming, Biogarantie, Bioland, GlobalG.A.P., Naturland and HVE). This is followed by the category 'other', with seven CSs, and the fishery and aquaculture sector, with eight CSs. Beverages and alcoholic products, mainly relating to wine, are covered by 9 out of the 16 CSs, along with the miscellaneous sector, while cereals, legumes and oleaginous crops are covered by 10 CSs and fruits and vegetables by 11 CSs. Finally, the dairy, eggs and honey and preparations and the meat and preparations sectors are the two most highly represented sectors, with 14 CSs.

Table 6. Production phases covered by the covered CSs

CS	Raw product / animal	Production process	Processed food product
Organic farming			
Organic farming (Belgium, Spain, Lithuania, Netherlands)	✓	✓	✓
Organic plus			
Bioland	✓	✓	✓
Naturland	✓	✓	✓
Biogarantie	✓	✓	✓
NQS			
Kokybe	✓		✓
Dokazana kvaliteta	✓		✓
Animal welfare			
SQNBA	✓	✓	✓
Beter Leven	✓	✓	✓
Welfair	✓	✓	✓
GAP			
Produção integrada	✓		
HVE	✓		
Sustainability			
GlobalG.A.P.	✓		✓
Equalitas	✓	✓	✓
Total	**16**	**11**	**14**

NB: Respondents could select more than one answer.
Source: Compiled by the authors based on semi-structured interviews, online survey and desk research.

Figure 7. Number of covered CSs by agricultural sectors covered



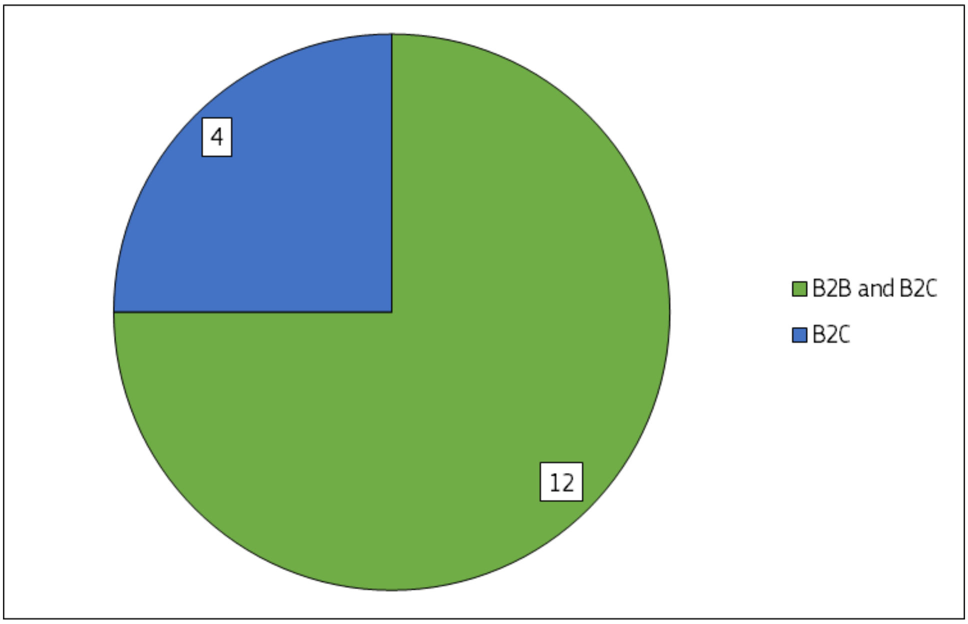
NB: Respondents could select more than one answer.
Source: Authors' calculations based on semi-structured interviews, online survey and desk research.

CSs can operate at a B2B level, where the final recipients of the information are, for instance, supermarkets and processing businesses, or at a B2C level, where consumers are the final recipients. Figure 8 shows that four covered

CSs are B2C CSs, while 12 serve both consumers and other intermediary buyers (i.e. they are B2B and B2C CSs). For some CSs (e.g. Biogarantie, HVE and all animal welfare schemes), when the certification is applied to primary agricultural producers, and the product is later processed and sold on the final consumer market, the CS requirements must be adhered to throughout the supply chain for the processed product to be labelled with the certification logo. In particular, when animals are involved and the animal is eventually slaughtered and put on the consumer market, the chain of custody ensures that the requirements of the CS are transmitted throughout the production process.

Respondents were asked if CS requirements differ between sectors, products and MSs, as depicted in Figure 9. For the majority of CSs, requirements vary between sectors and/or products, as shown in Figure 9a. For instance, organic farming requirements differ for animals and crops. However, requirements do not differ between MSs for most covered CSs, as indicated in Figure 9b. When CS requirements vary between MSs, the differences primarily relate to social requirements, particularly those concerning workers' conditions, which are influenced by different national legal frameworks.

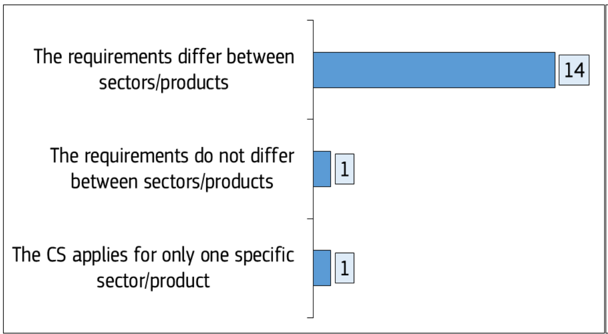
Figure 8. Number of covered CSs by final target recipients



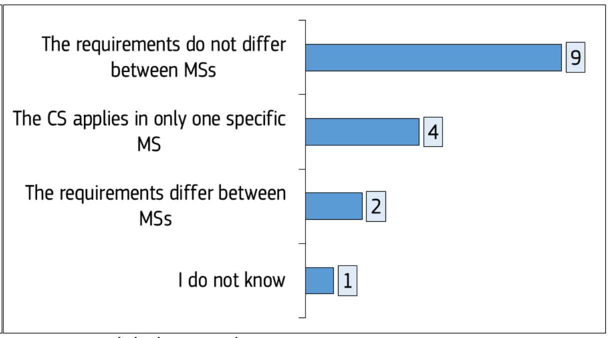
Source: Authors' calculations based on semi-structured interviews, online survey and desk research.

Figure 9. Number of covered CSs by requirement specifications

(a) Requirement specifications by sector/product



(b) Requirement specifications by regional coverage



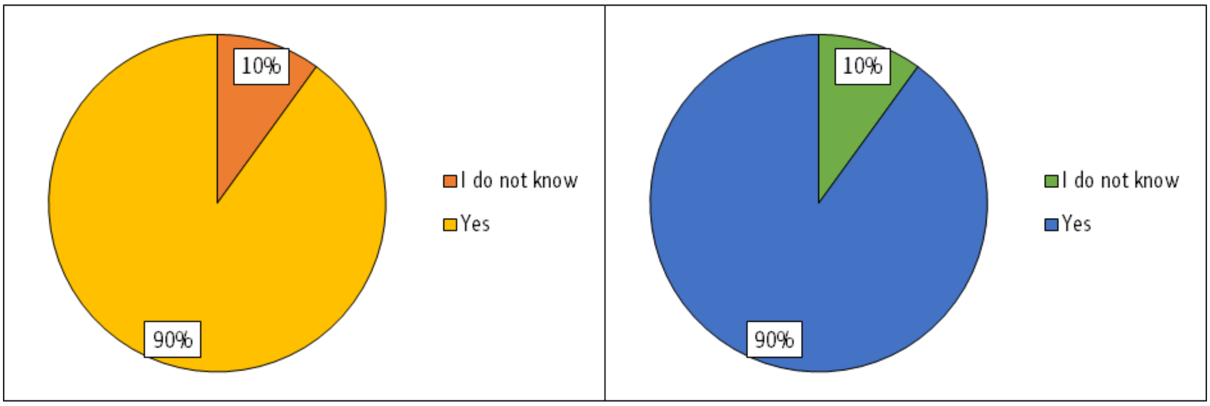
Source: Authors' calculations based on semi-structured interviews, online survey and desk research.

5. Policy awareness, policy framework and change in strictness of requirements

Respondents were asked if they were aware of the CAP and the inclusion of the corresponding CSs in the CSP. Figure 10 shows that almost all respondents were aware of both the CAP and the inclusion of the CSs into the CSP. Only one representative responded ‘I do not know’.

Figure 10. Shares of respondents aware of the CAP and the inclusion of CSs in the CSP (percentage of all respondents)

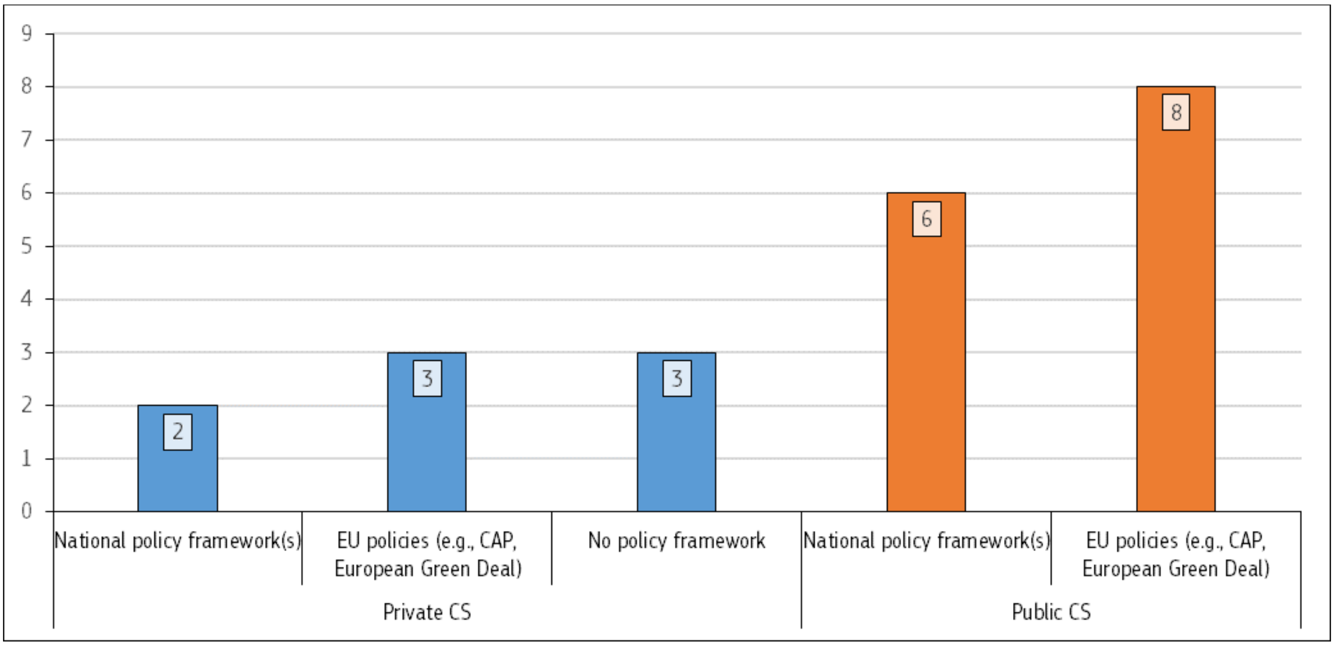
(a) Awareness of the CAP and its general functioning **(b) Awareness of the inclusion of CSs in the CSP**



Source: Authors’ calculations based on semi-structured interviews and online survey.

Respondents were also questioned about the policy frameworks that define CS requirements, as illustrated in Figure 11. It is important to distinguish between private and public CSs, with the former following a set of requirements established by a private entity and the latter inherently adhering to certain policy regulations. Most covered CSs follow a national policy framework, an EU policy framework or both. Three private CSs follow EU policies (i.e. the CAP, the European Green Deal and EU regulations, such as Regulation (EU) 848/2018 on organic farming) and two (i.e. those belonging to the organic plus category) adhere to national policy frameworks. Three private CSs (i.e. GlobalG.A.P., Welfair and Equalitas) do not follow any specific policy framework. All public CSs, by definition, rely on, at least, a national policy framework: six follow national policies (particularly the animal welfare, NQS and the GAP categories) and eight follow EU policy frameworks (particularly those within the organic category).

Figure 11. Number of covered CSs that follow certain policy framework(s) by legal nature of the CSs

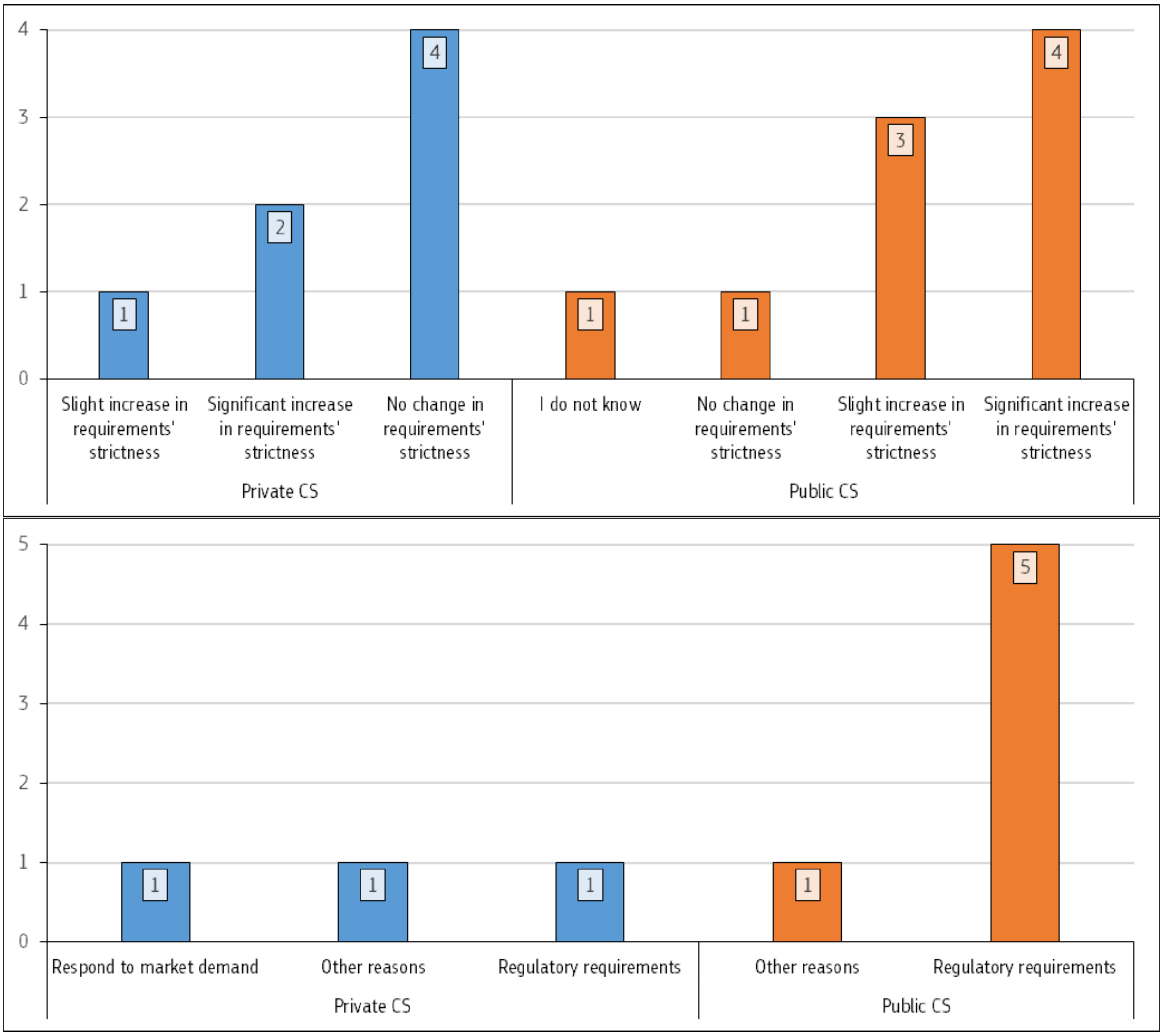


NB: Respondents could select more than one answer.

Source: Authors' calculations based on semi-structured interviews and online survey.

Figure 12 reports the changes in CAs' requirements in the last 5 years, as evaluated by CA representatives, according to the legal nature of the CSs (public or private). Figure 12a shows the extent of changes, while Figure 12b illustrates the primary underlying reasons for such changes. Most private CSs did not experience significant changes in the strictness of their requirements, with two CSs showing a significant increase and one a slight increase. Among the public CSs, seven saw either a significant or a slight increase in the strictness of requirements – with four experiencing a significant increase in strictness – while one saw no change in strictness and one had an unknown status. The main reasons for these changes, as indicated by CA representatives, include changes in regulatory requirements (for five public CSs) and other reasons (for one public CS). For the private CSs, changes were driven by market demand, regulatory changes and other reasons.

Figure 12. The extent of changes in sustainability requirements in the last 5 years (a) and the underlying reasons (b) by legal nature of the covered CSs (number of CSs)



NB: The HVE respondent is not included panel b.

Source: Authors' calculations based on semi-structured interviews and online survey.

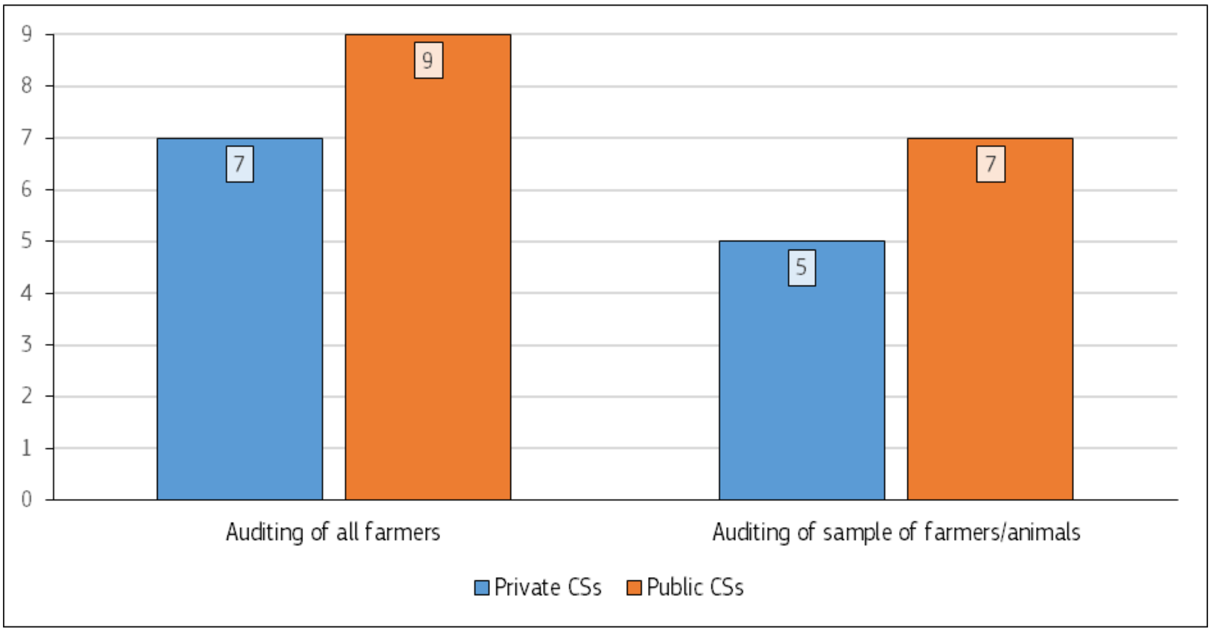
6. Data types, collection process, data management and exchange

This section presents the data collected for each CS covered through the structured surveys, with respondents from both CAs and PAs, and further information collected through desk research for each CS. The analysis focuses on describing the monitoring system of the certification process, the type of data collected, the methods of collection and the sources of data, as well as how the collected data are managed and if and how they are transmitted to the PAs and/or to private third parties.

6.1. Monitoring of operators

Monitoring is a crucial aspect of the certification process, as it involves auditing operators to verify their compliance with the CS's requirements. In addition, this step is fundamental to data collection, as it gathers all the information needed to verify operators' compliance. An important element of auditing is data collection on the operators' premises. This monitoring could include auditing all operators that wish to be certified and/or samples of operators, such as through random sampling or based on risk assessment. According to results reported in Figure 13, all covered CSs will audit all operators that wish to be certified. In addition, random sampling or risk-based checks of operators are undertaken. Four public CSs also allow for group certification, that is, they audit a sample of farmers belonging to a group of operators that is certified. Additional checks and group certification are common within the private CSs, with five out of seven private CSs providing for additional checks and/or allowing for group certification. Likewise, seven out of nine public CSs and five out of seven private CSs apply a risk assessment, hence applying additional checks to those operators with a higher risk of non-compliance.

Figure 13. Number of covered CSs by type of data monitoring and legal nature of the CSs



NB: The same CS could be represented in more than one option.

Source: Authors' calculations based on semi-structured interviews, online survey and desk research.

6.2. Type of data collected

The type of data collected refers to the type of data eventually recorded and managed by the respondent as required by the CS. In practice, two main types of data can be distinguished: qualitative and quantitative. The term 'qualitative data' refers to information regarding the compliance status of the operator, with each requirement listed in a checklist. Therefore, the CAs collect qualitative data regarding the operators' adherence to each specific requirement. For example, Table 7 shows an example of qualitative data collected from a checklist for the organic farming CS.

However, certain CSs require the collection of quantitative data, that is, actual data values for the specific requirements. For example, Table 8 illustrates an example of actual data values collected for an animal welfare CS. The quantitative data can be used for the calculation of an overall score that determines whether the operator can be certified or not (see Figure 14 for an example of the score calculations for the Welfair CS).

Table 7. Template of qualitative data collected from farmers through a checklist, organic farming CS

Requirement(s)	**Compliance Checking of requirements' compliance**	**Compliance**
Soil management and fertilisation		
Organic vegetable production will utilise tillage and cultivation practices that maintain or increase soil organic matter, reinforce soil stability and biodiversity, and prevent soil compaction and erosion.	Check records of work and cultivation practices performed.	✓/×
Soil fertility and biological activity have been maintained through multi-year crop rotation, including leguminous crops as main or cover crops for rotational crops and other green manure crops.	Verify crop production plan to confirm rotation, including leguminous crops.	✓/×
Soil fertility and biological activity have been maintained through the application of animal manure or organic material, preferably composted, from organic production.	Ask the farmer. Request fertiliser records. Note the fertilisers used. Request delivery notes / invoices for fertilisers indicated in the records.	✓/×
The farmer has not used nitrogen mineral fertilisers.		✓/×
The total amount of animal manure has not exceeded 170 kilograms of nitrogen per hectare of agricultural area used.	Conduct a nitrogen balance per hectare from all animal-derived fertiliser elements applied.	✓/×
Pest, disease and weed management		
Damage caused by pests has been prevented using system-specific resources, implementing actions favouring the presence of natural enemies.	Verify if the farmer has designed and implemented preventive measures favouring biological processes.	✓/×
Damage caused by pests has been prevented through system-specific resources, including species and variety selection, diverse materials, crop rotation, cultivation techniques and thermal processes in soils, including vapour in protected soils.		✓/×
Products and substances used in traps and dispensers must be prevented from being released into the environment and coming into contact with cultivated plants. Traps and dispensers should be safely disposed.	Check the proper use and management of waste generated on the farm (containers, plastics, pipes, meshes, etc.).	✓/×
Accountability / registry of operations		
Material balance control (i) type and quantities of products delivered to the unit and, where applicable, acquired materials and their use, including product composition; (ii) nature and quantities of stored products; and (iii) type and quantities of products leaving the farmer's unit or group of farmers to the recipient's premises or storage facilities.	Document verification, including stock and financial records, covering aspects outlined in Article 1.5 of Delegated Regulation (EU) 2021/771.	✓/×

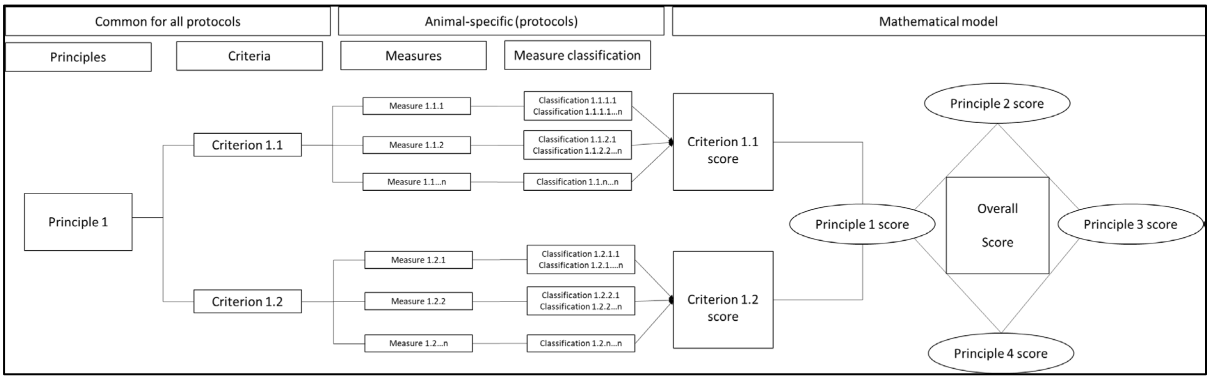
Source: Compiled by the authors based on semi-structured interviews.

Table 8. Example of actual data values collected during an on-site visit, the method of collection and the time required for the collection, Welfair CS

Measure	Method to collect the required data	Time	Data value
Body condition score	Score (assessed by the inspector) 0 – Satisfactory body condition: at most two body regions classified as too thin 2 – Very lean: indicators for 'too thin' present in at least three body regions	1.6 minutes/animal	Percentage of very lean animals (score 2)
Number of animals using the water points	Counting (assessed by the inspector)		Number of animals using the water points
Coughing	The number of coughs is counted using continuous observations in pens or, in the case of very large pen sizes, in segments of the pens. Per segment, not more than 25 animals should be assessed on average. Total net observation time is 120 minutes (assessed by the inspector)	1.6 minutes/animal	Mean number of coughs per animal and 15 minutes
Agonistic behaviours	Assess the occurrence of agonistic behaviours (assessed by the inspector)	Total 120 minutes (minimum 10 minutes/12 pens)	Mean number of aggressive behaviours per animal and hour
Cohesive behaviours	Assess the occurrence of cohesive behaviours (assessed by the inspector)	Total 120 minutes (minimum 10 minutes/12 pens)	Mean number of cohesive behaviours per animal and hour
Access to pasture	Assess the availability of pasture (assessed by the inspector): yes/no		Number of days with access to pasture per year
	The animal unit manager is asked about pasture management		Number of hours per day on pasture
Avoidance distance	Score (assessed by the inspector)		Percentage of animals that can be touched
	0 – The assessor can touch the animal		Percentage of animals that can be approached closer than 50 cm but not touched
	1 – The assessor can approach closer than 50 cm but cannot touch the animal		Percentage of animals that can be approached as closely as 50–100 cm
	2 – The assessor can approach within 50–100 cm		Percentage of animals that cannot be approached as closely as 100 cm

Source: Compiled by the authors based on 2024 Welfair standards (http://www.welfarequalitynetwork.net/media/1088/cattle_protocol_without_veal_calves.pdf).

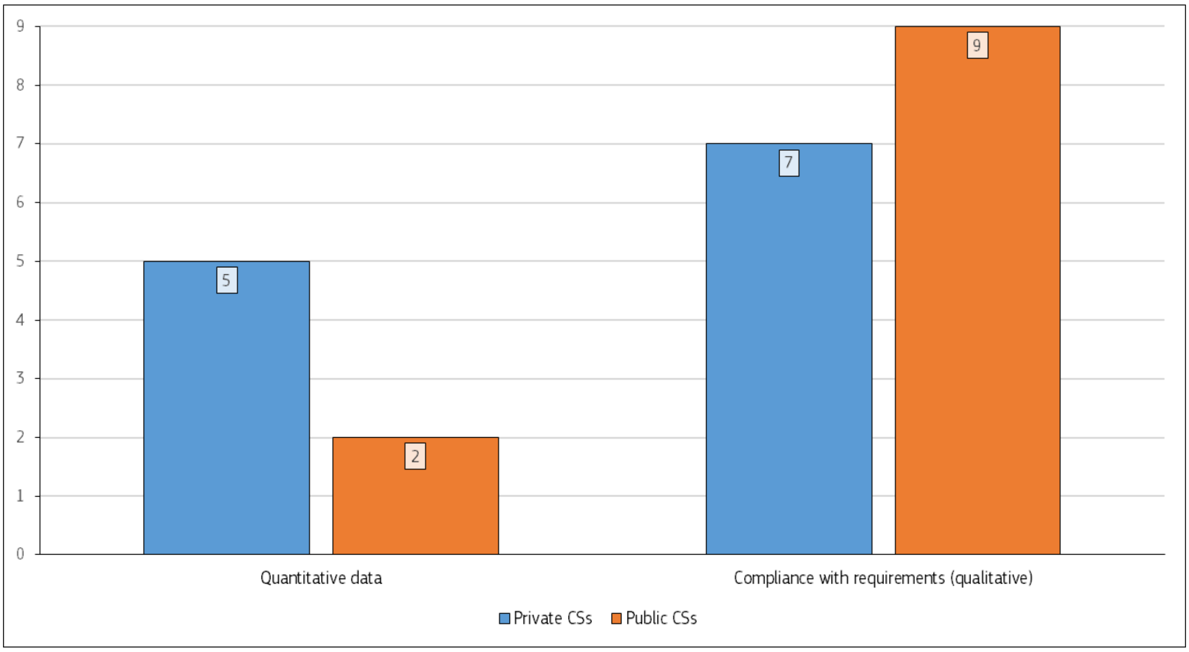
Figure 14. Graphical example of the overall score calculated by the Welfair CS



Source: Compiled by the authors based on 2024 Welfair standards (http://www.welfarequalitynetwork.net/media/1088/cattle_protocol_without_veal_calves.pdf).

In general, all covered CSs, irrespective of whether they are private or public, rely on qualitative information for their certification processes; in other words, they all have to follow a defined checklist and verify that the requirements therein are fulfilled by operators. As for the collection of quantitative data, this is significantly less common. However, private CSs are more likely than public CSs to collect quantitative data (Figure 15).

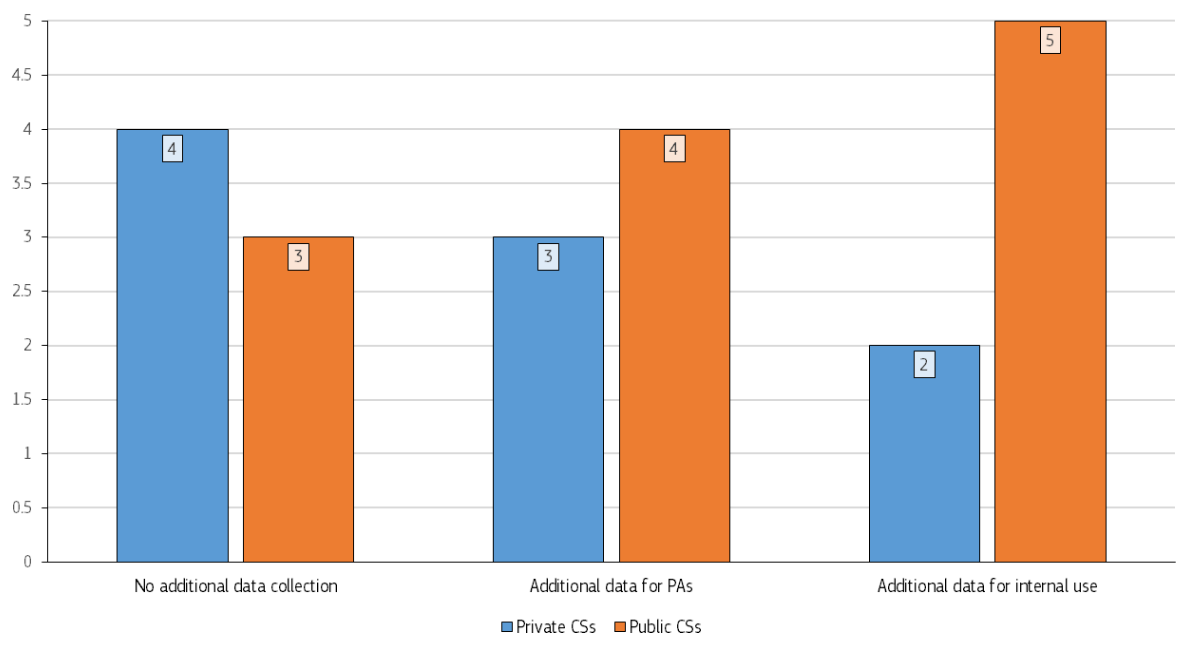
Figure 15. Number of covered CSs by type of data collected and legal nature of the CSs



NB: The same CS could be represented in more than one option.
Source: Authors' calculations based on semi-structured interviews, online survey and desk research.

The PAs may request that the CAs collect additional data and information beyond what is required by CS regulations (e.g. data about areas, crop varieties, production volumes). Likewise, the CAs themselves may collect additional information and data for internal purposes (e.g. reporting and analysis). Figure 16 shows that, for some public and private CSs, PAs ask for additional information, as reported by four and three respondents, respectively. The collection of additional data for internal use seems more frequent when public CSs are involved. The reliance of public CSs on qualitative checklists does not require the collection of quantitative data. However, if such values are needed for internal purposes or requested by the PA, then the CA must collect them separately.

Figure 16. Number of covered CSs by type of additional data collection and the legal nature of the CSs



NB: The same CS could be represented in more than one option.

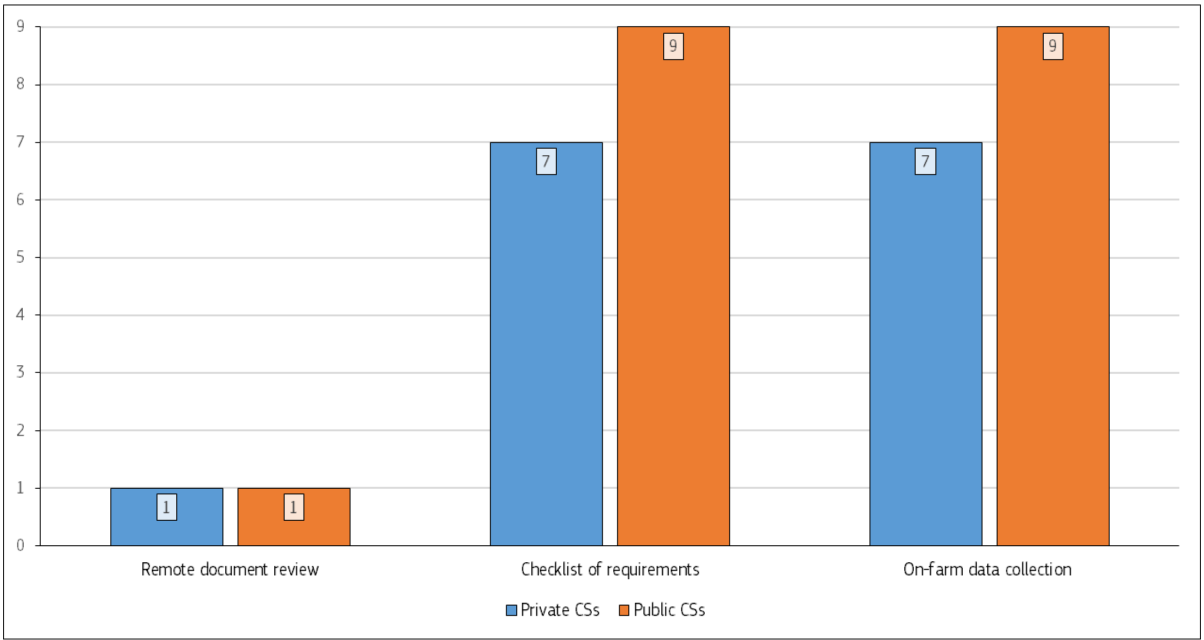
Source: Authors' calculations based on semi-structured interviews, online survey and desk research.

6.3. Data collection methods

The methods of data collection refer to the main form in which data have to be collected. The checklist refers to a structured and organised list of specific requirements that needs to be verified systematically during the certification process, assessing the compliance of the operator with the specified requirements. It involves verifying the operator's adherence to each specific requirement on the list. Usually, this requires the CA inspectors performing an on-farm official control and checking existing documentation (e.g. farms' bookkeeping or veterinary records) to verify whether the relevant activities of operators (e.g. plant protection, fertilisers use) are compliant with the CS's requirements. Sometimes the CA performs direct measurements/observations on-site to obtain the data required for certification purposes (e.g. visual inspection, laboratory tests performed by CAs; see Table 8 **Error! Reference source not found.Error! Reference source not found.**for an example of visual inspection and direct measurement carried out during the on-site visit for an animal welfare CS). Often, the checklist does not require the recording or collecting of the quantitative data of the underlying data.

In contrast, when the CS requires that actual data values be gathered, the CA usually collects them from existing documents (e.g. bookkeeping records, laboratory tests performed by the farmer) and/or sometimes performs direct measurements/observations on-site to retrieve the data. Data collection may also be completed through remote document review by CAs (e.g. laboratory tests performed by the farmer and sent to the CA) as well as through established processes for data sharing and exchange with relevant PAs. Figure 17 shows that all covered CSs rely on a checklist, and the official controls have to be performed by an on-farm physical inspection. Performing checks remotely is uncommon, with only two CSs, one public and one private, reporting such data collection.

Figure 17. Number of covered CSs by data collection method and legal nature of the CSs



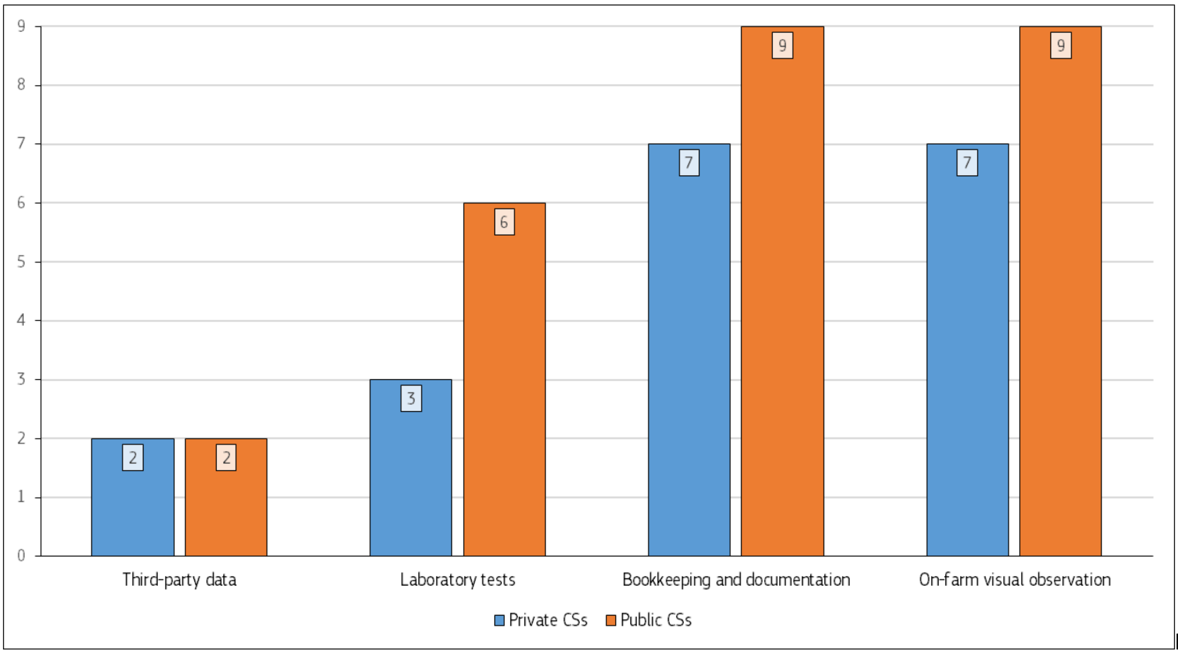
NB: The same CS could be represented in more than one option.

Source: Authors' calculations based on semi-structured interviews, online survey and desk research.

6.4. Data sources

Data sources describe from where the CAs' inspectors collect the data, which can include (i) the farms' bookkeeping records and other documents (e.g. veterinary records, legal certifications) (see Annex II for examples of the data collected from farms' bookkeeping records), (ii) on-site visual observations by the CAs' inspectors (see Table 8 **Error! Reference source not found.**for examples of observational data collected during the on-site visit), (iii) results from laboratory tests performed by the CAs or the farmer (e.g. multiresidue tests for pesticides, water quality results) and/or (iv) data provided by a third party (e.g. data provided by the certification body of private CSs, or other PAs collecting different data, such as the national veterinary service). As shown in Figure 18, all covered CSs rely on farm bookkeeping records as a source of data, together with other documents (e.g. veterinary records of antibiotics). Likewise, the data collected via visual observations of farm activities by the CA inspector are a source of data common to all CSs. Public CSs rely more on laboratory tests as a source of data (six out of nine), while only a few of the private CSs use them (three out of seven). It is important to note that laboratory test data are not systematically used for all farms, but often for only a sample of farms based on either random sampling or risk assessment, particularly in the case of public CSs (e.g. the EU organic farming scheme). Data provided by third parties are rarely mentioned as a data source, with only two public and two private CSs using these data.

Figure 18. Number of covered CSs by data source and legal nature of the CSs



NB: The same CS could be represented in more than one option.

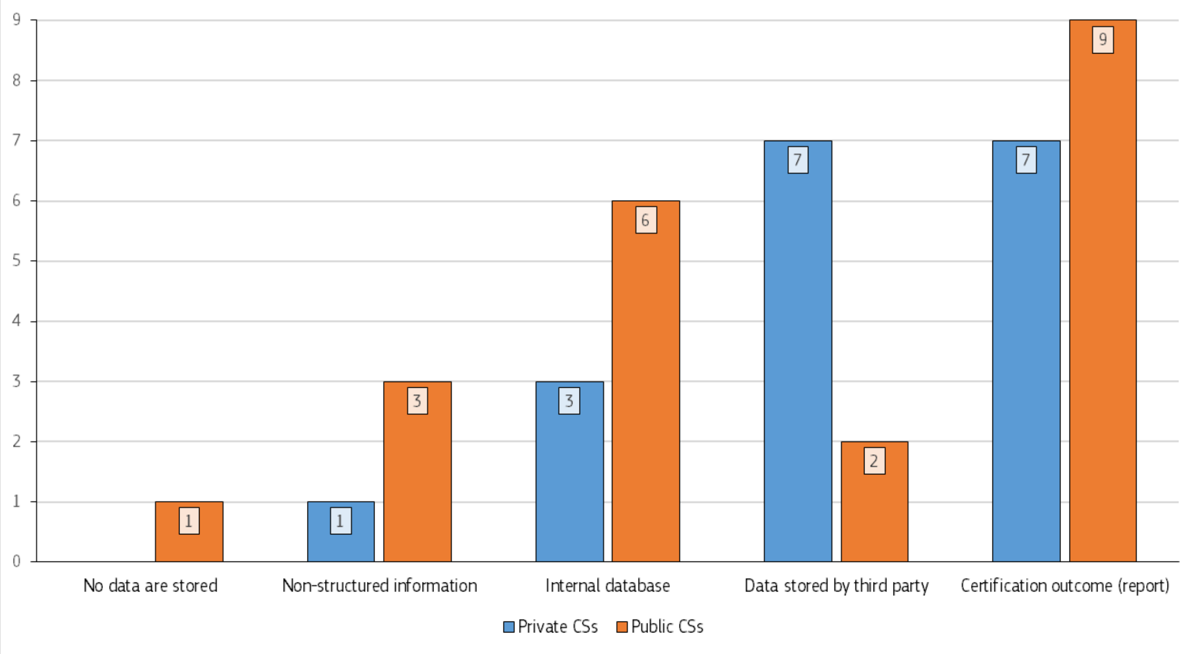
Source: Authors' calculations based on semi-structured interviews, online survey and desk research.

6.5. Data management

How data are managed refers to the ways in which data are stored and managed by the CAs once collected. The data collected may be migrated directly to a third party's dataset (usually the owner of the CS in the case of private CSs), stored and structured in a CA's internal database and/or stored as non-structured information (e.g. photos or copies of documents). In some cases, no data are stored by the CA, either because they are migrated directly to the third party or because the CS does not require any data collection and only the verification of compliance with the checklist needs to be assessed. Usually, a certification report detailing the outcome of the certification process is produced (e.g. based on the checklist of verified requirements).

All analysed public CSs produce a certification report, which is eventually delivered to the operators, to the certification body in charge of the scheme in the case of private CSs or to the competent PA in the case of public CSs. For the majority of the private CSs, the data are stored in a third-party database and transmitted to the certification body. In the case of public CSs, the data were reported to be stored in a third-party database in only two instances. This means that, in these cases, either the data collected are directly transmitted to the PA or the PA in charge does not retain the data but relies on a different PA to manage them. For public CSs, it is more common for the data to also be stored in an internal database (in six cases). Conversely, for private CSs, this is less common (in three cases), as the data collected are usually stored by the certification body managing the CS. Likewise, it is more common for public CSs than for private CSs to store non-structured information (in three cases and one case, respectively). This is due to the more qualitative nature of the data collected for public CSs and the often legal requirement of collecting evidence by the certifying agency (e.g. the EU organic farming scheme). No data are stored in one case, a public CS, and, instead, the data are migrated directly to the PA (Figure 19). According to respondents, even if data are stored in the CA's internal databases, they are usually not readily available to be provided to third parties, such as the FSDN, because of differences in data portal systems and database structuring and variable definitions.

Figure 19. Number of covered CSs by type of data management and legal nature of the CSs



NB: The same CS could be represented in more than one option.

Source: Authors' calculations based on semi-structured interviews, online survey and desk research.

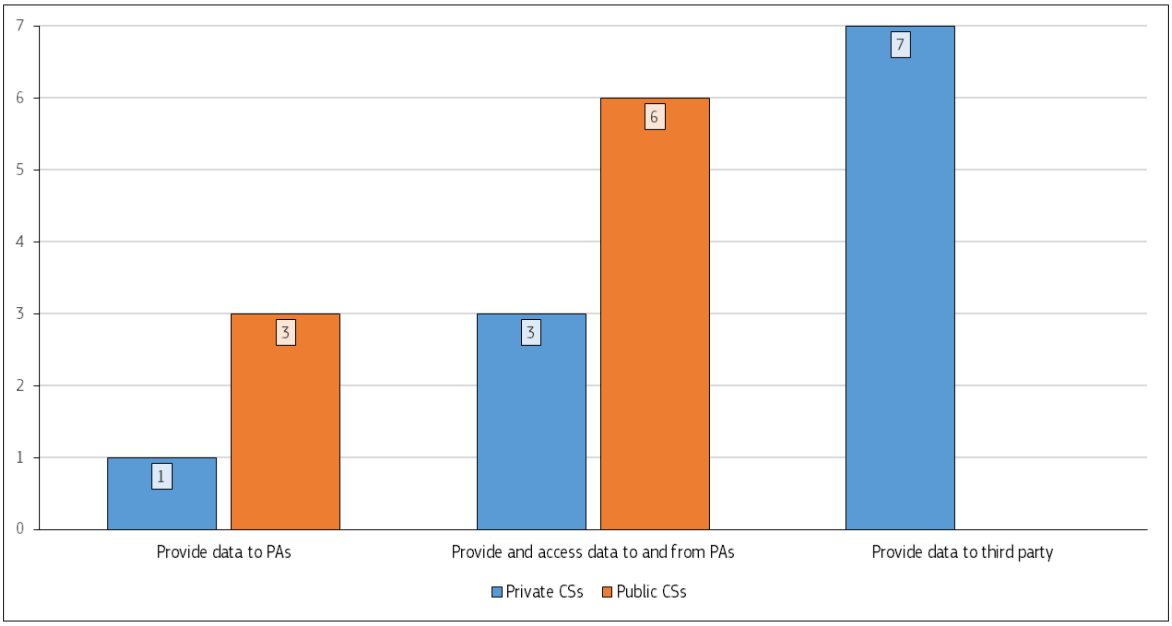
6.6. Data exchange with third parties

Data exchange with third parties and/or PAs describes whether data are transmitted to competent PAs or to a private third party exclusively, and whether or not CAs have access to the data managed by PAs. It is important to note that the primary objective of CAs is to certify the compliance of farmers with the requirements of the CS, while data sharing with third parties falls outside CAs' primary scope, unless it is directly relevant to the certification process (e.g. to obtain information from a relevant third party to be used in the certification process). According to the results reported in Figure 20, all data collected by private CSs are provided to the certification body in charge of the CS. None of the interviewed public CSs provides data to private third parties (e.g. private CAs), while all transmit the data collected to the PA. However, not all interviewed public CSs have access to the PA's data that may be required for certification purposes (e.g. access to the veterinary service information or the national paying agency). In six cases, the interviewed public CSs have access to the PA's data, while in three cases access to public data is not available. For private CSs, in three cases out of seven, PA data are both provided and accessed by the accredited CA, and in one case there is unilateral data exchange with the PA. It should be noted that the data exchanged with PAs does not necessarily include all data collected by the CAs. In some cases, the data include only the relevant information required by regulation or necessary for the implementation of the CAP or national policies.

Challenges arise when reporting data values to PAs due to non-harmonised data portals (e.g. different regional data systems being used within the same MS, different data systems being used across CAs), different data requirements (e.g. more or less data being available for the same PAs depending on the region) and different levels of data granularity used within the same MS. Such data heterogeneity hinders the possibility of using data collected in the context of CSs for FSDN purposes. One respondent commented that the absence of an EU-harmonised framework leads to a variety of MS-specific animal welfare CSs, hindering the establishment of uniform and standardised requirements and thus of a standardised data collection system.

Finally, according to several respondents, their corresponding accredited CAs do not have access to the data collected and stored by PAs. This lack of access results in additional costs for collecting information that is already available, increasing the burden on farmers, who frequently have to provide the same data multiple times.

Figure 20. Number of covered CSs by type of data exchange with third parties and legal nature of the CSs



NB: The same CS could be represented in more than one option.

Source: Authors' calculations based on semi-structured interviews, online survey and desk research.

The comments provided by respondents suggest that data collected by private CSs may be more challenging to share directly in the context of the upcoming FSDN, as these data belong to private entities. However, the flexibility of private CSs in defining requirements and managing data could strengthen the FSDN by allowing for the collection of different or additional data, if an agreement on data exchange can be reached. Public CSs benefit from data and/or checklists being stored and managed by public competent authorities, which will facilitate their transmission to the upcoming FSDN. Nevertheless, the digitalisation and coding standards of such data and checklists vary across both private and public CSs. The diverse array of CAs, with varying degrees of digitalisation, IT infrastructure, coding standards and data management systems, would need to adapt to a standardised data portal, such as that of the FSDN, and this will require data collection and management in a specific and homogeneous format (e.g. data granularity, unit of measurement, structure of the dataset). Moreover, much of the information already collected would need to be coded, digitalised and homogenised before being shared with relevant institutions such as the FSDN.

Interoperability between (private and public) CAs as well as with relevant public institutions would need to be improved and reinforced (e.g. through data protection clauses) to reduce the burden on farmers in collecting data and to facilitate more efficient data collection for CAs. This could free up resources, enabling CAs to focus on the collection of specific data that are difficult to record by farmers alone, which could potentially be more supportive of the upcoming data needs of the FSDN.

Best practices can be identified from situations where data exchange between both public and private institutions operates effectively, particularly concerning data protection and a common and/or interoperable IT architecture facilitating data access and exchange. One potentially beneficial approach involves establishing a central contact point (e.g. farmer association, producer organisation) to oversee the entire data collection process and provide assistance to farmers and CAs.

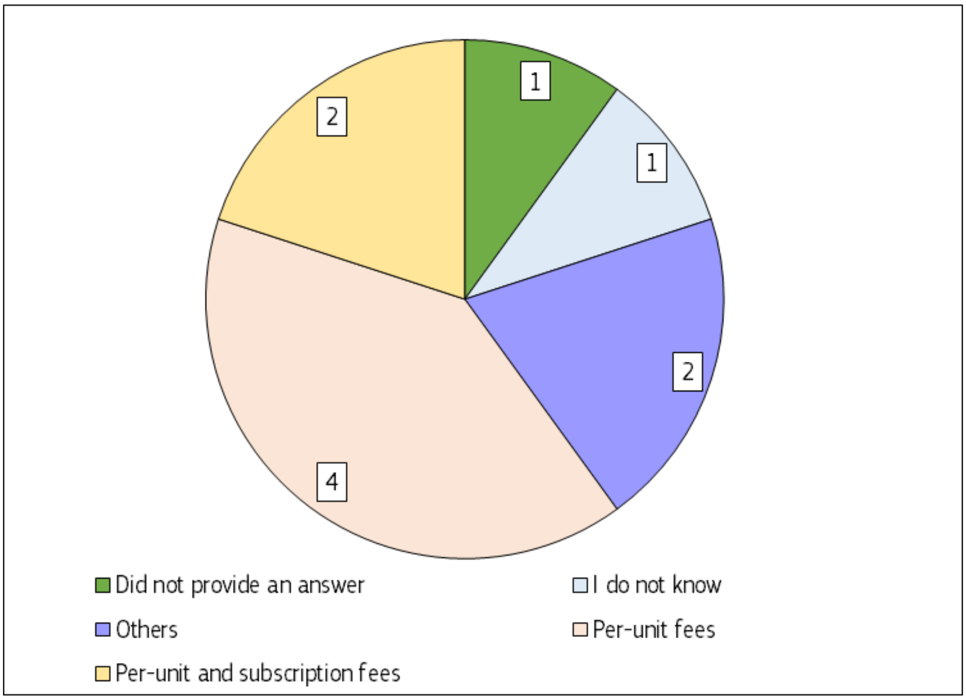
7. Cost assessment

This chapter presents results related to the structure of fees paid by operators for being certified and the assessment of certification process costs. Information was collected from respondents through an online survey, semi-structured interviews and desk research. It is important to note that these cost analyses, including of the structure of fees paid by operators, are based on information collected from CAs and PAs.

Figure 21 shows statistics on the fee types applied by respondents to operators for certification. The majority of respondents (6 out of 10) applies a per-unit fee, which varies based on the size of the operator in terms of area, animals and/or products to be audited, or time spent by CAs on auditing. The fees may also be determined by the distance that the CA inspector needs to travel to inspect farms and the time spent travelling, and the location and characteristics of the farm (e.g. contiguous parcels v parcels spread across a wide territory, type of crops or animals). Two CAs use a mixed-fee structure, combining per-unit and subscription fees. Subscription fees include a fixed fee paid at regular intervals, often annually, when the CS has to be renewed. The two public CAs apply another type of fee structure, where the fee is set in public regulation(s). One PA responded 'I do not know' because the fee applies to the accredited CA in charge of the audits. Note that in some cases the costs are not borne directly by farmers, but public support covers them or deducts them from the amount of CAP subsidies that farmers receive.

As mentioned above, one of the key components of the certification process is the audit of operators, which involves an on-site inspection. The on-site inspection incurs costs for both operators and the CAs, as they both have to spend time conducting/assisting the audit. According to the results of the semi-structured interviews, the duration of the inspection can vary from a few hours for small farms or farms with a less complex production structure to more than 1 day for larger farms and/or farms with a more complex production structure (e.g. with several crops and/or production processes, large animal herds, operations in different locations or plots spread over a large area). Normally, a single inspector carries out the audit, but, in some cases involving complex or multisite farms, two or more inspectors may be involved.

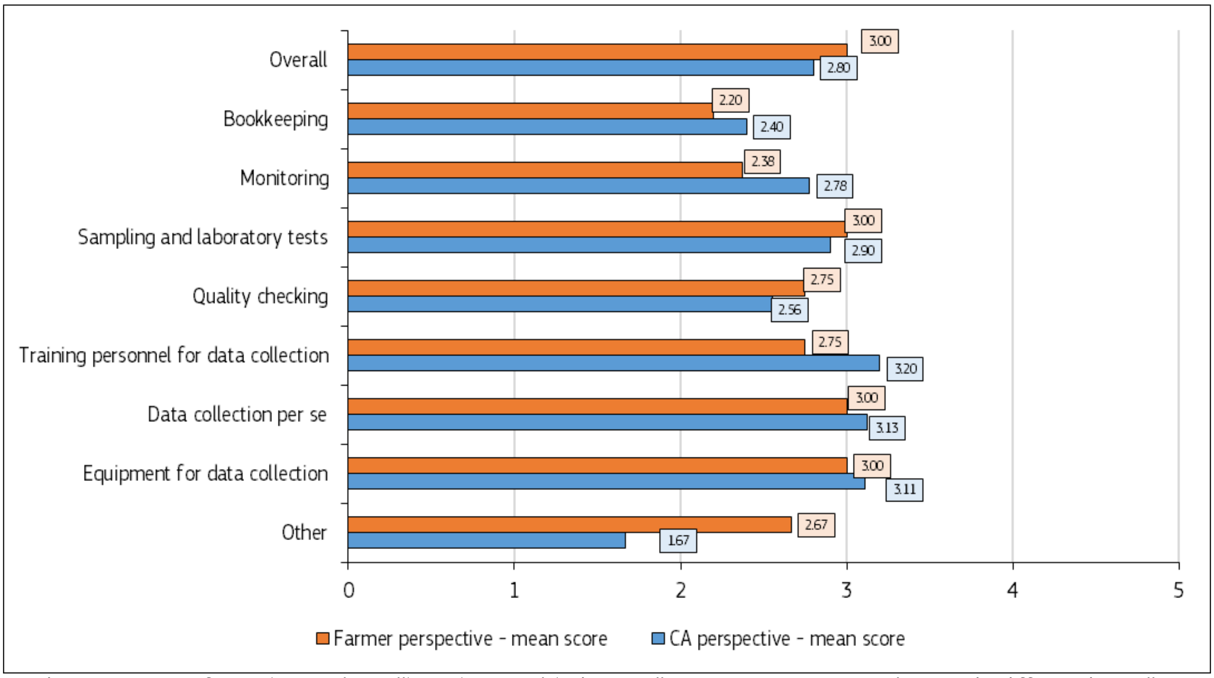
Figure 21. Number of respondents by type of fee structure applied to operators for certification



NB: Respondents could select more than one typology of membership fee structure.
Source: Authors' calculations based on semi-structured interviews, online survey and desk research.

Figure 22 shows how representatives of the CAs rated the cost of the data collection part of certification. Respondents were asked to rate costs on a 5-point scale, with 1 indicating 'not costly at all' and 5 indicating 'very costly'. The overall assessment indicates that the data collection part of certification is somewhat costly for both CAs and farmers, receiving slightly above average scores of 2.8 and 3, respectively. The specific activities/aspects of data collection considered most costly for both CAs and farmers include the data collection process itself, the equipment needed for data collection, and sampling and laboratory testing, ranging between 2.9 and 3.13. For CAs, relatively costly activities also include monitoring (average score of 2.78) and training personnel for data collection (average score of 3.2). For farmers, relatively costly activities rated above average (i.e. above 2.5) include quality checking, training for data collection and other activities. The bookkeeping activity, which is the main data collection exercise for the farmer, is rated as being of relatively low cost for both CAs and farmers, receiving average scores of 2.2 and 2.4, respectively.

Figure 22. Average cost assessment scores for the data collection process in certification for CAs and farmers, as reported by respondents



NB: The scoring ranges from 1 (not costly at all) to 5 (very costly). The overall score is not an average value over the different data collection process activities but an overall score as reported by respondents.

Source: Authors' calculations based on semi-structured interviews and online survey.

8. Main challenges and burdens according to respondents

During the semi-semi-structured interviews, respondents occasionally provided additional insightful comments and perspectives concerning the data collection process from farmers. Interviews were transcribed using digital software, and a text analysis was conducted to identify and gather unstructured information shared during the interviews. The text analysis involved employing a predefined set of keywords and wildcards to search the transcribed text for relevant content. This enables the identification of specific sections where valuable information may be revealed for analysing challenges and burdens associated with data collection process. On identification, pertinent information is highlighted and either paraphrased or quoted in subsequent paragraphs. Specifically, the analysis targeted words such as ([21]) producer; farmer; diffic*; data; collect*; transmi*; authority; paying agency; payment agency; digital*; informat*; cost*; burden; database*; access*; system; exchange; subsid*; CAP; RDP; rural development; and understand*.

Nature of data collection in public and private CSs. The respondents have wide experience in conducting certifications and collect data for both public and private CSs. The respondents highlighted the differences existing between the two, especially in terms of requirements for being certified and the nature of the data collected, advising that, overall, they are 'two different approaches, particularly from a marketing perspective. Retailers often put no value on public standards, they rather ask for higher standards, which are embedded in private certifications'. This is true also when comparing the data collected. Usually, a checklist is used to determine whether or not requirements are fulfilled for a public CS '... we do not collect specific data records in the inspection report, so we do not keep any data in our system', while private CSs often require the collection of quantitative data. Public CSs '... are often just a way for producers to access subsidies', whereas private CSs are mostly required by retailers, as they usually add on top of the public ones in terms of strictness of requirements. However, this is not systematic, as private CSs may also rely solely on checklists. Moreover, some respondents stress how private CSs adapt more easily and faster to societal demands, as requirements can be amended with much less transactional costs. Concerning data storage and management, while CAs are in charge of collecting the data, often the data are stored and managed by third parties, in particular competent authorities and certification bodies in public and private schemes, respectively: 'We [the CA] do not store the data, we just check whether the requirements are fulfilled. The competent public authorities and the private certification bodies, they managed all the checklists'.

Variety of CSs for the same standards. There may be situations, both within MSs and within the EU, where the same standard (e.g. animal welfare), especially if that standard is not regulated at the EU level, can be certified through multiple available CSs, leaving the definition of that standard to be set by MSs or the private sector (e.g. associations, retailers). As a result, multiple CSs may coexist at the MS or EU levels for the same purpose, leading in heterogeneity in the collected data, depending on the requirements of the specific scheme it adheres to. According to some respondents, this '... generates multiple and different approaches within a common EU market, eventually confusing the final consumer and generating different costs for different producers, hence different competitive advantages'. This could be avoided at the MS level '... when there exists a central body within the MS (e.g. national producer associations/organisations, public institutions) managing the specific scheme, hence establishing a single and well-recognised CS, standards are homogenised, hence ensuring no differences in competitive advantages amongst producers'. Similarly at the EU level, overarching legislative frameworks (e.g. an EU directive) defining more homogeneous and clear standards for specific certification purposes may facilitate this process by reducing the burden on operators in general and reducing the differences in data collected between CSs in particular.

([21]) Note that the asterisk (*) stands for a wildcard used in the word search. Whenever the interview was performed in a language other than English, the keywords were translated into the relevant language (i.e. Italian and Spanish). To preserve the anonymity of the respondents involved, all quotes and paraphrased comments are not attributed to any specific MS, CS or CA.

The burden of data collection and interoperability between institutions. According to respondents, 'Data collection is difficult for farmers, they are not accustomed to such specific and structured way of recording the information … and when they are asked to provide all these data together, in one unique solution, is problematic for them'. Farmers potentially possess a vast quantity and quality of data, and such information is often already collected following the bookkeeping principles (obligations). Nevertheless, such information is collected often on paper, and hence in very 'unstructured and heterogeneous' forms. In addition, '… farmers often complain they are spending increasing amount of their time doing office and administrative work instead of farming … Particularly organic farmers, as they are under much more scrutiny than conventional farmers …, their [conventional farmers'] likelihood of receiving an inspection is odd', as they do not take part in any CS.

On the issue of the administrative burden of data collection, respondents often report having limited or no access to data already collected by public institutions, which means that farmers are often asked to provide information to CAs that has been already collected for other purposes by national public institutions: '… they have to do this bookkeeping for other public offices, data that sometimes they have to share again with us … For many years we have had no access to parcels' data, which were collected already by the national paying agency, and this despite we are formally recognised by the Ministry to perform such audits. As you can imagine, we deal with more than 2 million parcels, so data sharing and exchange would have really helped us out … We wasted a lot of time and resources for something that was already available'. According to respondents, this also hampers data exchange between private and public institutions. The main issue reported by respondents is related to data protection, which may be overcome by asking farmers to give permission to share data anonymously with third parties for certification purposes. However, there are also situations in which the data exchange between the CA and the public institutions is 'smooth and effective, with periodical meetings for improving the system', both for public and private CSs.

Several respondents reported that, in some cases, and even within MSs, '… each region has its own IT architecture …, risk assessments are different between regions, and so the data to be collected and eventually transmitted to the public authority are very heterogeneous'. Consequently, the same CA has to deal with different data systems, resulting in additional costs for data management.

Digitalisation. Digitalisation of farmers' data collection is often mentioned by interviewees as a pivotal instrument to gain efficiency by reducing data exchange and management costs. Respondents indicated that there is a relatively high heterogeneity in the adoption of digitalisation and heterogeneity of digital tools used by farmers both across different farmers' groups (e.g. age, education, farm size) and MSs. However, respondents also recognise that among farmers 'the digitalisation process would require a cultural change, a different approach with respect to data', with some envisaging that '… digitalization of bookkeeping records will be challenged by much resistance from farmers'. Nevertheless, providing farmers 'with a deeper understanding on the reasons why data are important' would ease and smooth the adoption of digital solutions: '… the process to gather the data very difficult at the beginning, they don't understand some of the data required, it takes often two or three years to become used to it and therefore easier'. Likewise, the digitalisation of data management on the CA's side would not be costless nor effortless, as '… adding information into an existing system requires very high costs, as well as the maintenance of the database'. Moreover, many CAs do not yet rely on a completely digital platform to manage the data they collect from farmers because much of this is on paper. For example, evidences are often collected through photos, scanned documents and/or typed into a calculation sheet, which are not integrated afterwards into a digital database: '… there are data for which we have the documentation, but the information is not transferred to the general database, we just collect the proof of such documentation'. In other words, much information and data are collected but not ready to be transferred. According to a CA that recently adopted a more digitalised system, the process has been extremely costly and labour-intense, especially when digitalising years of data collected from farmers.

Some respondents stressed how a 'supply chain approach seems pivotal for a smoother digitalisation process'. More specifically, they explain how relying on one 'leader, the representative of the SC, in direct contact with the producers' would allow 'disseminating a digital system for data management more easily, ensuring a homogeneous management and exchange/transmission of data'. An integrated system such as this, they add, will also '… benefit farmers, as a more efficient, contemporaneous control of supply chain data enables efficiency by increasing the likelihood of avoiding issues, besides they are in full control of their own information' (e.g. more efficient control of mass balances, avoiding undesired products compromising the whole chain and entering the market).

Group certification is an example of such coordination, where only one designated agent is responsible for the certification process, represents multiple farmers and provides assistance to them (e.g. administrative aspects, data recording and collection). Indeed '… it is generally difficult for the farmer alone to manage any certification process, in terms of costs but mostly because of the relationship with the CA. The latter has to be impartial, so cannot, by regulation, offer any supporting service to the farmer'.

8.1. The availability and nature of specific data collected by certification agencies

Table 9 provides a qualitative assessment of different data categories related to environmental and social sustainability collected by the interviewed CAs. More specifically, Table 9 reports data availability by main category, and shows their presence in the bookkeeping records, the nature of collected data (i.e. as a checklist or quantitative data), if they are potentially collected multiple times from farmers, and whether or not their definition and recording is heterogeneous across CSs and MSs. It is important to note that due to the extensive lists of data collected by CAs and their limited public availability, the table does not represent an exhaustive list of all data collected by the covered CSs. The data listed under each aggregated data category (i.e. crops, animal production, environmental variables and social indicators) represent only a selection of examples of those actually collected by CAs, and whether they recorded (or not) in the bookkeeping records is also related to the information available to the authors from the interviewed CAs. Nevertheless, Table 9 attempts to provide a general overview of the variables based on the information gathered through semi-semi-structured interviews and desk research for the covered CSs. More detailed data tables are available in Annex II.

Overall, the CAs collect a large spectrum of data related to environmental and social sustainability. The majority of data collected by CAs is from bookkeeping records, particularly for crop-related data, followed by environmental variables and animal-related data. Conversely, social indicators seem to be least frequently recorded in bookkeeping records, as they are not usually included in standard bookkeeping practices. While farm bookkeeping contains a wealth of data, CAs will frequently use only checklists to specify whether or not farmers adhere to CS's requirements. As a result, quantitative data of many variables are often not collected and thus CAs do not have them available in either paper format or a digitalised database, with their original values remaining only in farmers' bookkeeping records (usually on paper). The use of checklists seems to be most common for social variables (primarily collected through private CSs), while a mix of checklists and quantitative data are used for the remaining data categories.

Certain data – in particular crop- and animal-related variables (parcel and surface areas, crop varieties, livestock numbers and species, antibiotic usage, etc.) – are frequently requested from farmers by several institutions. These may include national paying agencies for the management and distribution of CAP subsidies, relevant PAs for animal veterinary services and CAs to verify compliance with CS requirements (animal welfare, organic production, integrated farming, etc.). This is a relatively a common occurrence due to the limited presence of data sharing, the lack of interoperability of data systems between institutions and the lack of harmonised data collection.

Different CSs often require different data for the same or similar environmental or social requirements. The data collected my vary in granularity (e.g. data may be collected per farm v per plot), time frequency (e.g. annual v monthly) or units of measurement (e.g. application of various score schemes and/or scales to measure animal welfare) depending on requirements of the CS. In addition, the type of data collected (GHG emissions, biodiversity indicators, etc.) may vary between MSs, depending on the CS available on the market and/or chosen by farmers.

Table 9. Main data categories collected by the interviewed CAs: examples of available data, nature of collected data, potential duplicate data collection and heterogeneity

Data	Bookkeeping	Nature of collected data		Duplicate data collection	Heterogeneous across CSs and MSs	Comments
		Checklist	Quantitative data			
	Crops			✓		Some information potentially collected by both the national paying agencies and the CAs
Spacing	✓					
Surface	✓		✓			
Rootstock	✓					
Number of plants	✓		✓			
Planting date	✓					
Irrigation method	✓		✓			
Water flow per day or total irrigation	✓					
Cultural operation	✓					
Fertiliser used	✓	✓				
Application method	✓	✓				
Fertiliser quantity per hectare (kg or m^3/ha)	✓	✓				
Nutrient incorporation (kg)	✓	✓				
Crop rotation	✓	✓				
Animal manure / organic material application	✓	✓				
Pest management	✓	✓				
Pesticides use (quantity and quality)	✓	✓				
Cultivation and tillage methods		✓				
	Animal production			✓	✓	Variable types, scoring schemes and scales differ across CSs and MSs Some information is potentially collected by the national paying agencies, the national PAs for animal veterinary services and the CA
Heads	✓					
Species	✓					
Age	✓					
Silage, haylage, forage, compound feed (composition)	✓					
Destination of effluents	✓	✓				
Active substance / product (antibiotics – health control)	✓					
Dosage (antibiotics – health control)	✓					
Quantification (antibiotics – health control)	✓					
Animal behaviour (agonistic/cohesive)		✓				
Annual mortality of adult animals		✓				
Animal cleanliness		✓				
Skin lesions		✓				
Lameness		✓				
Water provision		✓				
Cleanliness of water points		✓				
Number of animals using the water points			✓			
Coughing			✓			
Nasal discharge			✓			
Ocular discharge			✓			
Access to pasture			✓			
Feed composition	✓		✓			

Data	Bookkeeping	Nature of collected data		Duplicate data collection	Heterogeneous across CSs and MSs	Comments
		Checklist	Quantitative data			
Environment variables					✓	Variable types, scoring schemes and scales differ across CSs and MSs
Water usage						
Root depth (m)	✓					
Field capacity (mm)	✓					
Critical cultural content (mm)	✓					
Initial soil water content (mm)	✓					
Reference evapotranspiration (mm)	✓					
Crop coefficient	✓					
Crop evapotranspiration (mm)	✓					
Total precipitation (mm)	✓					
Soil water variation (mm)	✓					
Soil water content – without irrigation (mm)	✓					
Irrigation – reading at end of metre (m3)	✓					
Irrigation – total applied amount (mm)	✓					
Soil water content (mm)	✓					
Water loss (rainfall or excessive irrigation)	✓					
Environmental indicators					✓	Information collected may be CS specific, and hence not available for all MSs
Biodiversity indicators		✓				
GHG emissions indicators		✓				
Presence of genetically modified organisms		✓				
Hedge			✓		✓	
Tree alignment			✓		✓	
Isolated tree			✓		✓	
Woodlots			✓		✓	
Pond			✓		✓	
Unlined ditch			✓		✓	
Traditional stone wall			✓		✓	
Fallow land			✓		✓	
Honey-bearing fallow land			✓		✓	
Wetlands			✓		✓	
High-stem orchard = pre-orchard			✓		✓	
Inter-parcel grass strips			✓		✓	
Permanent grasslands, heaths, pastures and alpine pastures located in Natura 2000 areas			✓		✓	
Grassland areas put into conservation and withdrawn from production			✓		✓	
Total nitrogen input from livestock effluents produced on the farm	✓		✓			
Total nitrogen input from imported livestock effluents	✓		✓			
Total nitrogen input from other imported organic fertilisers	✓		✓			
Total nitrogen input from mineral fertilisers	✓		✓			
Total nitrogen output from exported livestock effluents	✓		✓			
Nitrogen exported by non-forage surfaces	✓		✓			
Nitrogen exported by non-grass forage surfaces	✓		✓			
Nitrogen exported by grassland surfaces	✓		✓			
Phytosanitary in-field applications					✓	The method of collection may be CS specific, with heterogeneous data collection across CSs and MSs
Phenological stage	✓	✓				
Pest	✓	✓				

Data	Bookkeeping	Nature of collected data		Duplicate data collection	Heterogeneous across CSs and MSs	Comments
		Checklist	Quantitative data			
Methodology	✓	✓				
Risk assessment or economic estimation of the attack	✓	✓				
Intervention justification	✓	✓				
Authorisation number / company name	✓	✓				
Name of active substance / biocide / base substance	✓	✓				
Concentration or dose	✓	✓	✓			
Application spray volume	✓	✓	✓			
Treated area (m^2 or ha)	✓	✓				
Applicator number	✓	✓				
Application date	✓	✓				
Type of non-chemical measure	✓	✓				
Measure intensity (number of traps, number of diffusers, etc.)	✓	✓	✓			
Social indicators					✓	Information collected may be CS specific, and hence not available for all MSs
Workers' rights		✓				
Matching qualifications with jobs		✓				
No discrimination policy		✓				
Personnel training programme		✓				
Wages		✓				

Source: Compiled by the authors based on semi-structured interviews and desk research.

9. Conclusions and discussion

The purpose of this report is to assess the practices used to collect sustainability-related farm data for selected public and private CSs, with the aim of providing insights for the upcoming FSDN, which will expand the data collected to include data on environmental and social issues. The analyses in this report are based on an online survey and face-to-face semi-structured interviews conducted with selected CAs and, in some cases, with the relevant PA accredited to certify the selected CSs, as well as information gathered through desk research conducted for each selected CS. The online survey and semi-structured interviews were conducted between June and October 2023. The CSs considered are those included in the MS CSPs as eligibility criteria for farms to receive certain types of CAP subsidies.

When mapping the CSs from the CSPs, 188 CAP interventions were found to be linked to CSs, and 32 % were generic (i.e. only the main type of CS is defined) and 68 % were specific. The mapped CAP interventions linked to CSs in the CSPs represent 8.4 % of total EU CAP expenditure. Out of the 188 mapped interventions linked to CSs in the CSPs, 25 relevant CSs were pre-selected for consideration in this report. Priority was given to CSs that focus on the environmental and social dimensions of sustainability and ensure a diverse coverage of these aspects.

A total of 10 respondents accepted invitations to participate, including 8 CAs and 2 PAs, covering a total of 16 CSs. This resulted in response rates of 48 % for respondents (10 out of 21 contacted) ([22]) and 64 % for CSs (16 out of the 25 pre-selected). In terms of the coverage of CS categories, the organic category is the most represented (with four CSs interviewed), followed by the organic plus (three CSs interviewed), animal welfare (three CSs interviewed), multipurpose scheme (two CSs interviewed), GAP (two CSs interviewed) and NQS (two CSs interviewed) categories. Of the 16 CSs interviewed, 7 are private and 9 are public. The covered CSs come from nine MSs, with the number of respondents varying between one and two and the number of certification schemes varying between one and four per MS. The share of the total CAP budget (EU expenditure) corresponding to the surveyed CSs amounts to 5.2 %. This in turn corresponds to a coverage rate of 62 % for the covered CSs of the total CAP budget linked to the CSs in the CSPs. Of the 16 CSs interviewed, 13 were linked to Pillar 2 and 11 to Pillar 1, of which 11 were specifically linked to direct payments ([23]).

The key findings of the report can be summarised as follows (see also Figure 23).

Monitoring of operators by CAs. Monitoring is a crucial aspect of the certification process, and it involves auditing operators to verify their compliance with a CS's requirements. This step is also fundamental to data collection, as it leads to the collection of information needed to verify operators' compliance. An important element of auditing is the collection of data at operators' premises. The results show that all CSs interviewed audit all operators that wish to be certified. In addition, random sampling or risk-based checks of operators are undertaken. Four public CSs also allow for group certification, that is, they audit a sample of farmers belonging to a group of operators that is certified. Additional checks and group certification are common within private CSs, where five out of seven CSs provide for additional checks and/or allow for group certification. Likewise, seven out of nine public CSs and five out of seven private CSs apply a risk assessment, hence applying additional checks to those operators with a higher risk of non-compliance.

Type of data collected by CAs. Data collection for CSs involves collecting both qualitative and quantitative data. Qualitative data include mainly the results of the verification of operators' compliance with specific CS requirements (e.g. based on checklists) ([24]) and quantitative data include quantitative data linked to CS requirements. All covered

([22]) For some CSs, more than one CA or PA was contacted and interviewed.

([23]) Note that a single CS may cover both Pillar 1 and Pillar 2, as well as various CAP payments.

([24]) The checklist includes a structured and organised list of specific requirements that need to be systematically checked during the certification process to verify that the operator's activities comply with the requirements of the CS.

CSs collect qualitative data (checklist). The collection of quantitative data (quantitative data) is much less common; however, private CSs seem to be more inclined to collect quantitative data than public CSs, while public CSs tend to rely more on qualitative information.

Data collection methods and data sources used by CAs. The data collection method usually involves an official on-farm inspection carried out by the CA's inspectors. Data collection methods may also be supplemented by remote verification of documents by the CA (e.g. laboratory tests carried out by the farmer and sent to the CA) and/or data sharing and exchange with relevant PAs, but these practices are less common.

The data sources used to verify operators' compliance with CS requirements (checklist) include primarily the existing operators' bookkeeping records and documents and on-site visual observations by CAs' inspectors. Other data sources include laboratory tests performed by the CAs or farmers and data provided by a third party (e.g. data from national veterinary services, satellite data). Overall, all covered CSs use bookkeeping records and documents and on-farm observations as data sources. Laboratory tests and data provided by a third party are used less frequently by CAs (by 9 public and 4 private CSs, respectively, out of the total 16 covered CSs).

Data management. The data collected by private CSs are usually migrated directly to a third party's dataset (all CSs interviewed), usually to the certification body responsible for the CS, whereas the data collected by public CSs are more likely to be stored and structured in a CA's internal database (six out of nine CSs interviewed). Similarly, public CSs are more likely than private CSs to store the collected data in a non-structured format (e.g. photos or copies of documents) (three cases and one case, respectively). In addition, all of the CSs interviewed produce a certification report containing the outcome of the certification process, which is communicated to operators and also to the certification body in charge of the scheme in the case of private CSs or to the competent PA in the case of public CSs. Even if data are stored in the CA's internal databases, they are usually not readily available for sharing with third parties, such as the FADN/FSDN, due to differences in data portal systems and database structuring and variable definitions.

Data exchange with third parties. As for data management by CAs, the exchange of data with third parties depends on whether the CA is private or public. While all public CSs interviewed transmit the collected data to the relevant PAs, none of them provides data to private third parties (e.g. private CAs). However, not all public CSs interviewed have access to data from PAs that may be required for certification purposes (i.e. only six out of nine CSs interviewed have access to data from PAs). All private CSs provide the collected data to the certification body in charge of the CS. However, only three private CSs provide and have access to data from relevant PAs, and one only has a unilateral exchange relationship with (i.e. provides data to) PAs ([25])**.** Overall, it is important to note that data exchange with third parties falls outside the primary scope of CAs, unless such exchange is directly relevant for obtaining information for certification purposes. Key factors limiting potential data exchange between CAs and third parties include non-harmonised data portals, different data requirements and different levels of data granularity applied by different CAs and PAs.

Cost of certification. The majority of respondents (6 out of 10 interviewed CAs) apply a fee structure based on unit costs, which vary according to the size of the operator in terms of area, animals and/or products to be audited, the complexity of the production structure and the time spent by the CA on the audit. The remaining respondents apply some other type of fee structure (two respondents follow the fee set in public regulation) or were not able to provide details.

([25]) Note that the data exchanged with the PAs does not necessarily include all data collected by the CAs. In some cases, it includes only the relevant information required by regulation or necessary for the implementation of the CAP or national policies.

The process of auditing operators, a key part of the certification process, incurs costs for both operators and CAs due to the time required for conducting on-site inspections. The duration of inspections varies, ranging from a few hours for small or less complex farms to more than a day for larger or more complex operations, and, in some cases, multiple inspectors may be involved.

When respondents rated the cost of the data collection process on a 5-point scale, with 1 being 'not at all costly' and 5 being 'very costly', the results show that the overall cost of the data collection part of certification is somewhat costly for both CAs and farmers, receiving slightly above average scores of 2.8 and 3, respectively. In terms of specific activities of the data collection process, the most costly activities/aspects for both CAs and farmers include the data collection process itself, the equipment needed for data collection and sampling and laboratory testing, ranging from 2.9 to 3.13. For CAs, relatively costly activities also include monitoring (with an average score of 2.78) and training personnel for data collection (average score of 3.2). For farmers, relatively costly activities, that is, activities rated above average (i.e. above 2.5), include quality control, training for data collection and other activities. The bookkeeping activity is considered of relatively low cost for both CAs and farmers, with scores of 2.2 and 2.4, respectively.

The availability and nature of specific data collected by certification agencies

- CAs collect a wide range of data related to environmental and social sustainability. Most of the data collected by CAs are derived from farmers' bookkeeping records, particularly crop, environmental and animal data. Data on social indicators are less commonly recorded.

- While bookkeeping records contain a wealth of data, CAs often only complete checklists for many variables. The use of checklists seems to be most common for social variables, while a mixture of checklists and quantitative data is used for the remaining data categories. As a result, the quantitative data of many variables are not available to the CSs, either in paper form or in a digitalised database, with the original values remaining in only the farmers' bookkeeping records (usually on paper).

- It is common for several institutions to request crop and livestock data from farmers. This is due to limited data sharing, lack of interoperability between data systems and non-harmonised data collection practices.

- CSs often use different data definitions and collection methods for the same or similar environmental and social variables, resulting in differences in detail, frequency of collection, units of measurement and types of data collected between CSs and MSs.

Main challenges and burdens of the data collection process according to respondents

- Data collection for public and private CSs differs in terms of the requirements for being certified and the nature of the data collected, with private certification often being more stringent and responsive to societal demands. Public certification is often seen as a way for producers to access subsidies, while private certification is more often required by retailers.

- The same standard, especially if that standard is not regulated at the EU level (e.g. animal welfare), may be certified by several CSs within MSs or the EU, leading to heterogeneity in the data collected, potentially creating confusion for consumers and different costs for operators, leading to different competitive advantages. To avoid this, some respondents suggest the creation of central bodies within MSs to manage the specific scheme, or the adoption of overarching legal frameworks at the EU level to establish homogeneous standards for specific certification purposes. This could reduce the burden on operators in general and the differences in data collected between CSs in particular.

- Although farmers usually have a large number of data, they struggle with the specific and structured data collection required for certification because data collected by farmers are usually unstructured and on paper, and farmers are often not used to managing and maintaining these data in a consolidated and consistent format. Furthermore, according to some respondents, certified farmers, especially organic farmers, are increasingly frustrated by the amount of time they need to spend on administrative tasks. Moreover, organic farmers feel that they are under more scrutiny than conventional farmers.

- The interviewed CAs highlight the administrative burden of having limited access to data already collected by public institutions, resulting in the duplication of efforts by farmers who are often asked to provide information that has already been collected by national public institutions for other purposes. This lack of data exchange and sharing between CAs and public institutions wastes the time and resources of CAs and farmers.

- The CAs interviewed emphasise the importance of digitalising farmers' data collection methods to increase efficiency and reduce costs, but they also note that there is a high degree of heterogeneity in the adoption of digitalisation and in the types of digital tools used by farmers, and that many CAs do not necessarily use a fully digital platform to manage the data they collect from farmers. They acknowledge that cultural change and training are needed to facilitate the adoption of digital solutions, and that this process can be challenging and costly for both farmers and CAs. Some CAs interviewed emphasise the importance of a supply chain approach for a smoother digitalisation process, suggesting that having a leading organisation in charge of direct contact with operators could facilitate the dissemination of digitalisation tools. In addition, group certification and agricultural extension services, which make use of data provided by farmers, are sometimes perceived to facilitate the cultural change needed for smoother data collection and transmission.

The present study is not without its limitations, most notably the relatively small sample of respondents. This limitation restricts the analysis to a non-representative pool of sustainability-related CSs, in terms of both the types of CSs examined and their geographical coverage. As a result, the findings may not fully capture the diversity and nuances of CSs across different sustainability issues, sectors and regions.

Discussion and implications for the Farm Sustainability Data Network

The analyses in this report suggest that data on environmental and social sustainability do exist (at least with farmers), but that significant efforts are needed to collect the quantitative data and make them consistent/harmonised, digitalised and available.

Farmers' bookkeeping records and on-site visual observations by CA inspectors are the main sources of sustainability-related data used by CAs for the certification process for both private and public CSs. However, the wide variety of bookkeeping systems within and between MSs, coupled with the low level of digitalisation, hinders a potential transfer of such data for the upcoming needs of the FSDN.

As far as CAs are concerned, data from private CSs may be more difficult to share with external parties, including the FADN/FSDN, as they belong to private entities. However, flexibility in defining requirements and managing data could strengthen the FADN/FSDN if an agreement on data exchange can be reached. Data exchange with public CSs is more feasible, as they already cooperate extensively with the relevant PAs, which will make it easier for them to transfer data to the FADN/FSDN.

There are also several challenges in transferring data from CAs for potential use in the FADN/FSDN. The main challenge is that CAs often only complete checklists indicating farmers' compliance with requirements, rather than collecting quantitative data, which means that they do not necessarily have data that can be shared. This is primarily because the main role of CAs is not to collect data per se, but rather to certify farmers' compliance with CS requirements and this does not require the detailed collection of quantitative data. Other challenges that would have to be overcome for possible data exchange between CSs and the FADN/FSDN are the heterogeneous nature of data portal systems, differences in database structuring and the variable definitions applied by CSs. These challenges are in addition to the farm-level challenges mentioned above, and may hinder the establishment of a seamless data link between CAs and the FADN/FSDN.

The degree of interoperability of datasets between PAs and CAs is rather limited. Limited interactions between different IT systems of the relevant organisations and their lack of standardisation in terms of both architecture and data protection issues make the integration process complex and costly (European Commission, 2024). Data exchange is often unidirectional, that is, from CAs to PAs, whereas the reverse is less common. Therefore, for the FADN/FSDN to benefit from existing databases, it would be necessary to develop the interoperability of existing databases and improve the processes for sharing data (including in relation to data protection) with national FADN/FSDN liaison agencies. This would contribute to a reduction in administrative costs for farmers as well as for the relevant institutions involved in data collection.

Private CSs, managed by third-party certification bodies, often employ a standardised data management tool across all CAs, including dedicated digital software to manage the certification process (i.e. from the definition of the checklist to the final certification documentation), which promotes more efficient and homogeneous data management and data transmission. The European Commission already has a direct communication channel with some public CAs, particularly when involved in the organic CS through the European Organic Certifiers Council. Such organisations (e.g. the IFOAM Organics Europe group) could be used to facilitate standardisation and homogenisation of data collection and requirements, thus facilitating a direct and uniform communication channel with the CAs involved in the CS and the relevant PAs.

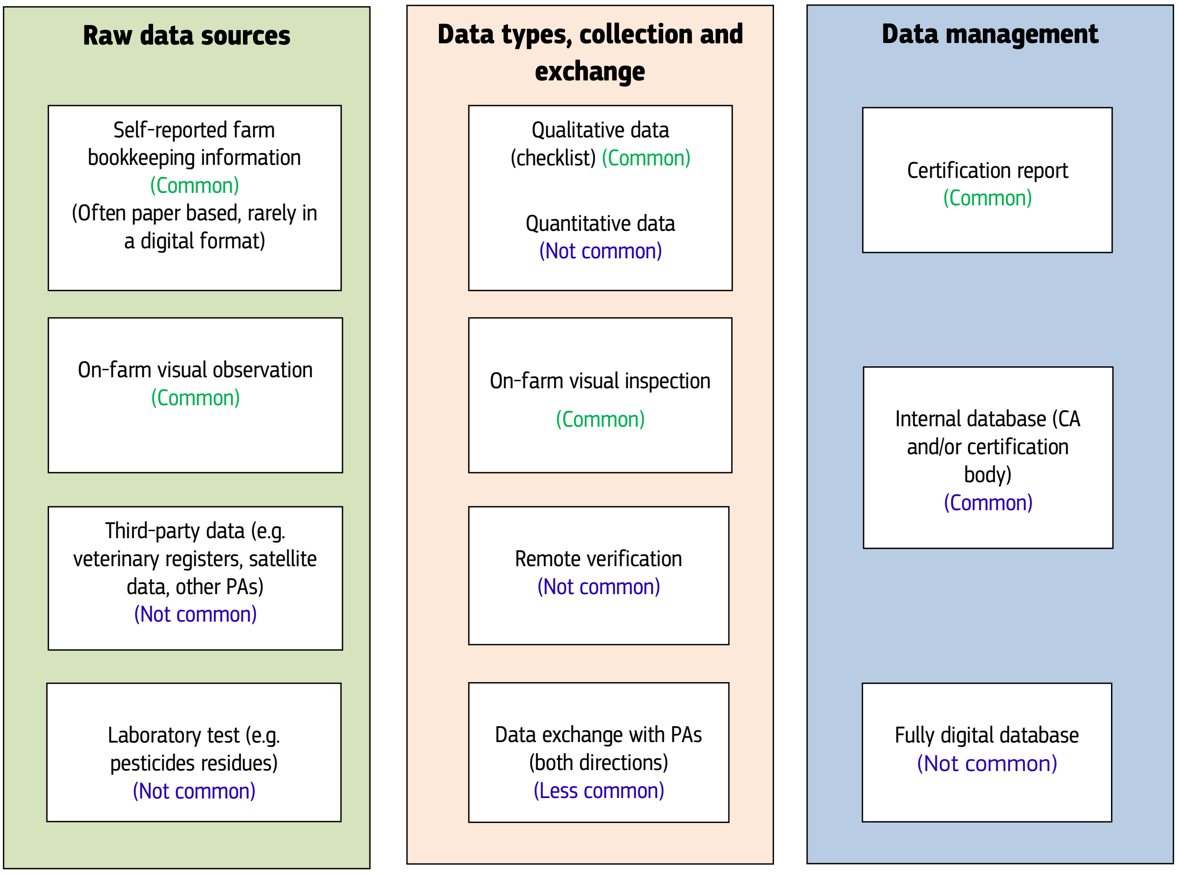
According to the respondents, increasing farmers' understanding of the use of the data is important for motivating farmers to provide data. (Farmers can be motivated through, for example, information campaigns explaining how the data collected in the FADN/FSDN are used and what the implications are for the farming sector, providing clear examples of how past and/or future empirical results are used and/or will be used by policymakers.) Similarly, providing incentives for farmers to participate is important for increasing their willingness to participate, such as in the form of an advisory service (e.g. training on how to use benchmarking within the FADN/FSDN, availability of reports and online tools, and supporting investment decisions through predictive analytics) or direct rewards (e.g. points for meeting eligibility criteria for EU-funded schemes and data-driven decision-making) (European Commission, 2024). Another method for fostering farmers' participation is through cooperation with organisations that have direct contact with farmers (e.g. cooperatives and farmers' associations) ([26]); these organisations can positively support the whole process, in particular through training or supporting implementation of digitalisation. One of the advantages of using these organisations is that they have a good knowledge of farmers' needs and constraints, and can better overcome the fixed costs that many farms face when adopting new practices.

It is important to note that a limitation of the data collected for certification purposes and their use for policy support is linked to the voluntary nature of participation in CSs, which determines the population of farmers from whom data are collected. In essence, data are collected for only part of the total EU farming population (i.e. for those who self-select to adopt a particular CS), as conventional farming is not subject to verification by CAs. As a result, a dataset constructed solely on the basis of information available from CSs – even if the data from the CSs

([26]) For example, according to Turland and Slade (2020), associations are among the top groups of actors with whom farmers are willing to share big data.

can be effortlessly transmitted to the FSDN platform – would not be a representative sample of either individual MSs or the EU as a whole, thus introducing a selection bias.

Figure 23. Graphical summary of findings



Source: Compiled by authors based on semi-structured interviews, online survey and desk research.

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Annex I. Online survey

Mapping certification schemes' data requirements

Fields marked with * are mandatory.

Mapping certification schemes' data requirements

The study aims to **identify synergies (and gaps)** between relevant **certification schemes** and the **Farm Sustainability Data Network (FSDN)**, the ongoing initiative of the European Commission to expand the scope data collection on EU farms to include data on their environmental and social practices.

A **sustainable food system** "provides and promotes safe, nutritious, and healthy food of low environmental impact for all current and future EU citizens in a manner that itself also protects and restores the natural environment and its ecosystem services, is robust and resilient, economically dynamic, just and fair, and socially acceptable and inclusive. It does so without compromising the availability of nutritious and healthy food for people living outside the EU, nor impairing their natural environment" (SAPEA, 2020).

The study will cover **certification schemes (CS)** mentioned in the **CAP Strategic Plans** as eligibility criteria for farmers' application to **Direct Payments and/or support from measures under the second pillar of the CAP**, besides further certification schemes that might be relevant in the context of this study.

The objective is to enhance the understanding of the **sustainability-related information/data** that farmers are required to collect in order to be certified. The main focus is on the **environmental and social pillars of sustainability**, **disregarding the collection of standard data** (e.g., hectares, value of production, utilized agricultural area, etc.). The study also focus on how this data is collected, the level of detail of the information collected, as well as the reporting practices that are used.

The finding of the study will serve to guide the development and improvement of the Farm Sustainability Data Network (FSDN) in line with the objectives of the Common Agricultural Policy, the Green Deal and its Farm to Fork (F2F) and the Biodiversity Strategies.

The Certification Agency

* Is your Certification Agency involved in:

- Defining and managing the Certification Scheme (e.g., defining the scope of the scheme, designing the technical specifications)
- Auditing/certifying process (e.g. data collection)
- Both of them
- I do not know

* How many Certifications Schemes in the field of agriculture/food are you certifying?

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- More than 10
- I do not know

* Does the Certification Agency engage with official national and/or international bodies to align with their requirements?

Minimum 1 selection(s)

- No engagement
- EU Institutions
- Extra-EU Institutions
- National Institutions
- NGOs
- Others
- I do not know

* Is the Certification Agency aware of the Common Agricultural Policy, its general functioning, and the related payments?

- Yes
- No
- I do not know

* Is the Certification Agency aware about the inclusion of its Certification Scheme into the CAP Strategic Plan?

- Yes
- No
- I do not know

Certification Scheme:

* What is the main type of your certification scheme?

- Public (i.e., set by EU/MS regulation)
- Private (e.g. set by industry associations, private companies, etc.)
- Mixed private-public
- Other
- I do not know

* Could you please select to which stage the Certification Scheme applies to?

Minimum 1 selection(s)

- Raw agricultural product/Livestock
- Production process (either agricultural or industrial/artisanal process)
- Processed food product (e.g. cheese)
- Other
- I do not know

* At what level is the Certification Scheme working?

Minimum 1 selection(s)

- EU level
- International (extra-EU)
- National
- Local/regional
- Other
- I do not know

* Could you please define the nature of the Certification Scheme?

- Business-to-Business (B2B)
- Business-to-Consumer (B2C)
- Both
- I do not know

* Does the Certification Scheme have any label/logo/trademark/claim on the final product?

- Yes
- No
- I do not know

* Could you please identify the Member States in which the Certification Scheme is applied?

Minimum 1 selection(s)

- Austria
- Belgium
- Bulgaria
- Croatia
- Cyprus
- Czechia
- Denmark
- Estonia
- Finland
- France

- [ ] Germany
- [ ] Greece
- [ ] Hungary
- [ ] Ireland
- [ ] Italy
- [ ] Latvia
- [ ] Lithuania
- [ ] Luxembourg
- [ ] Malta
- [ ] Netherlands
- [ ] Poland
- [ ] Portugal
- [ ] Romania
- [ ] Slovak Republic
- [ ] Slovenia
- [ ] Spain
- [ ] Sweden
- [ ] The whole EU

Whole EU - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Austria - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Belgium - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Bulgaria - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Croatia - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Cyprus - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Czechia - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Denmark - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Estonia - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Finland - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

France - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Germany - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Greece - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Hungary - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Ireland - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Italy - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Latvia - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Lithuania - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Luxembourg - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Malta - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Netherlands - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Poland - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Portugal - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Romania - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Slovak Republic - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Slovenia - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Spain - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Sweden - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

* If the same Certification Scheme is applied in multiple Member States of the EU, do the requirements differ between countries?

- No, the Certification Scheme only applies in one specific Member State Yes,
- the requirements differ between Member States
- No, the requirements do not differ between Member States
- I do not know

* Could you please select the sector(s) to which the Certification Scheme applies?

Minimum 1 selection(s)

- Fishery and aquaculture products and their preparations (including fats and oils) Meat
- and their preparations
- Dairy (including eggs, honey, fats, and other animal products) and their preparation
- Fruit & Vegetables and their preparations
- Beverage and alcoholics
- Cereals, Legumes and Oleaginous and their preparations (including vegetal oils)
- Sugar and miscellaneous (including coffee, tea, cocoa, spices)
- Other
- I do not know

Fishery and aquaculture - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Meat - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Dairy - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Fruit&Vegetables - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Beverages&Alcoholics - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Cereals, legumes and oleaginous - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Sugar&miscellaneous - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Other - Could you please provide with the total number of certified farmers/members?

If you do not know, please, leave it blank

Other - Could you please specify the sector?

* If the same Certification Scheme is applied in multiple sectors/products, do the requirements differ between sectors /products?

- No, the Certification Scheme only applies for one specific sector/product
- Yes, the requirements differ between sectors/products
- No, the requirements do not differ between sectors/products
- I do not know

* Are the requirements of the Certification Scheme designed following a specific EU and/or national policy framework?

Minimum 1 selection(s)

- No, they are not
- Yes, following country-specific policies
- Yes, following the Common Agricultural Policy framework of the EU
- Yes, following the Green Deal framework of the EU (e.g. Farm to Fork, Biodiversity Strategy) Yes,
- following other(s) policy framework(s)
- I do not know

* Overall, could you assess whether the strictness of the Certification Scheme's sustainability-related requirements changed in last 5 years?

- Significant increase in requirements' strictness
- Slight increase in requirements' strictness
- No change in requirements' strictness Slight
- decrease in requirements' strictness
- Significant decrease in requirements' strictness
- I do not know

Could you tell whether such a change was due to:
Minimum 1 selection(s)

- Respond to market demand
- Regulatory requirements (e.g. CAP, F2F, biodiversity strategy)
- Other
- I do not know

Policy and challenges

Does the Certification Agency plan to adjust/change in the near future the data collection practices (e.g. type of data collected, frequency, quality check, etc.) and/or requirements as result of the recent enhancement of sustainability requirements in the EU policies (CAP and the Green Deal)?

- No, no changes envisaged
- Yes, requirements for being certified will change Yes,
- data collection practices will be changed
- I do not know

Does the farmer/member pay any fees/costs?

- No costs/fees are paid by the farmer/member
- Yes, subscription fees (paid at regular intervals)
- Yes, one-time fees
- Yes, per-unit cost (e.g., per certified hectares)
- Yes, other
- I do not know

In your opinion, which are the most costly activities regarding the data collection **in general**?

1 – Not costly at all
2 – Little costly
3 – Somewhat costly
4 – Significantly costly
5 – Very costly

Equipment for data collection (e.g. detectors, IT, drones, etc.)	○ ○ ○ ○ ○
Data collection per se	○ ○ ○ ○ ○
Training personnel for data collection	○ ○ ○ ○ ○
Quality checking	○ ○ ○ ○ ○

Sampling and lab testing	○ ○ ○ ○ ○
Monitoring	○ ○ ○ ○ ○
Bookkeeping	○ ○ ○ ○ ○
Other	○ ○ ○ ○ ○
Overall	○ ○ ○ ○ ○

In your opinion, which are the most costly activities regarding the data collection **for farmers**?
1 – Not costly at all
2 – Little costly
3 – Somewhat costly
4 – Significantly costly
5 – Very costly

Equipment for data collection (e.g. detectors, IT, drones, etc.)	○ ○ ○ ○ ○
Data collection per se	○ ○ ○ ○ ○
Training personnel for data collection	○ ○ ○ ○ ○
Quality checking	○ ○ ○ ○ ○
Sampling and lab testing	○ ○ ○ ○ ○
Monitoring	○ ○ ○ ○ ○
Bookkeeping	○ ○ ○ ○ ○
Other	○ ○ ○ ○ ○
Overall	○ ○ ○ ○ ○

In your experience, which are the three indicators/data that are more difficult to be collected?
In terms of knowledge required for their collection, cost of procedures/equipment, time for collecting the data, etc

	Please, indicate here which indicator/data
1	
2	
3	

Opinions

Please, feel free to express any comment or opinion on the topic

Thank you very much for your time and effort. We really appreciate your valuable contribution.

Annex II. Examples of data collected through bookkeeping in some Member States ([27])

Registry of parcels/plots

Ranking No	Province code	Municipal Code	Aggregated Code	Zone	Polygon No	Parcel No	Enclosure No.	Cultivated Area (ha)	Species	Variety	Rainfed / irrigated	Open air / protected	Integrated pest managem
Parcels with the same agricultural management											Dry, sprinkler, drip or localised, gravity	Free air, plastic, grid, etc.	Organic, integrated production, private certification, conventional, etc.

([27]) The complete templates of bookkeeping used for this report are offered by the GPP (Gabinete de Planeamento, Políticas e Administração Geral of Portugal), the authority managing the CAP national strategic plan of Portugal for 2023–2027 (https://www.gpp.pt/index.php/noticias/pepac-portugal-disponiveis-orientacoes-tecnicas-e-caderno-de-campo-unico); Catalan Generalitat's Consell Català de la Producció Agrària Ecològica organic bookkeeping (https://www.ccpae.org/index.php?option=com_content&task=view&id=49&Itemid=254&lang=ca_ES); and the Spanish Government's electronic Agrarian Holding Information System (SIEX) (https://www.fega.gob.es/en/node/14584).

Registry of phytosanitary protocols (for all common agricultural policy beneficiaries)

Homogeneous area / parcel number						
Ha						
Irrigation type						
Crop and variety						
Expected production (tonne/ha)						
Real production (tonne/ha)						
Date	**Phenological stage**	**Pest**	**Methodology**	**Risk assessment or EEA (economic estimation of the attack)**	**Intervention justification**	**Observations**

Phytosanitary treatment / biocide application						**Establishment where pesticide was acquired**	
Authorisation No / company name	Name of active substance / biocide / base substance	Concentration or dose	Application spray volume	Treated area (m^2 or ha)	Applicator No	Name	No of activity

Non-chemical treatment			**Efficacy of the treatment (good, medium, bad)**
Type of measure	Measure intensity (number of traps, number of diffusers, etc.)	Application date	

Registry of crop activities (for organic and integrated farming producers)

Parcel number	
Spacing	
Rootstock	
No of plants	
Planting date	
Irrigation method	

Date	**Fertiliser**											**Cultural practice**			**Irrigation**	**Harvest**	
	Cultural operation	Fertiliser used	Application method	Applied quantity		Nutrient incorporation (kg)						Intervention or processes	Material or equipment used	Observations/objective	Water flow per day or total irrigation	Process	Quantification
				t	m^3	N	P_2O5	K_2O	MgO	CaO	SO_3				*(mm/m^2 or m^3/ha)*		

Registry of Organic Fertilisation (for applicants to the eco-scheme promoting organic fertilisation)

Nutrient source	**Fertiliser type**	**Livestock species**	**Application date**	**Fertiliser quantity per hectare (kg or m^3/ha)**	**Total N_{Total} per kg or m^3 of fertiliser (mg N_{Total}/kg or v)**	**Total N_{Total} quantity per hectare (kg/ha)**	**Total fertiliser quantity (kg or m^3)**	**Total nitrogen (N_{Total}) applied (kg)**
						Fertiliser quantity × N_{Total} × 1 × 10^{-06}	Fertiliser quantity × area(ha)	N_{Total} × area(ha)

Registry of animal production

Animal species						
Homogeneous area						
Date	**Justification of intervention**	**Change in number of animals**	**Animal feeding**	**General operations and effluent management**	**Health control**	**Production/sales**
	Occurred event	Reason	Silage, haylage, forage, compound feed (composition)	Intervention type	Method, measure	Additives, pastures
	Diagnosis	(Justification document)		Effluent type	Active substance / product	Packaging type
Target animals	Quantification	Quantification	Quantification	Material/equipment	Dosage	Quantification
		Current total count	Parcel / homogeneous zone	Destination	Quantification	Batch No / destination
				Quantification		

Registry of livestock effluents

Quantity of livestock effluents produced on the farm, acquired externally and sold/leased to third parties

Animal category	**Animal species**	**No of animals**	**Quantity of livestock effluents**						**Quantity of N**	
			On-farm production		**Externally acquired**		**Sold/leased**			
			Leachate (m^3/year)	Manure (t/year)	Leachate (m^3/year)	Manure (t/year)	Leachate (m^3/year)	Manure (t/year)	Leachate (m^3/year)	Manure (t/year)

Application of livestock effluents

Parcel No	**Crop**	**Area (ha) where effluents are applied**		**Effluents application**			
		Owned	Borrowed	Type	Origin	Date of application	Quantity (m^3 or t)

Further information

Further data are collected depending on the CAP scheme the producer intends to apply. For instance, those applying to the **efficient use of waters** or **soil conservation** will have to collect more detailed information about the following.

Water usage

- Root depth (m)
- Field capacity (mm)
- Critical cultural content (mm)
- Initial soil water content (mm)
- Reference evapotranspiration (mm)
- Crop coefficient
- Crop evapotranspiration (mm)
- Total precipitation (mm)
- Soil water variation (mm)
- Soil water content – without irrigation (mm)
- Probe reading (% or kPa)
- Probe reading (mm)
- Margin for next irrigation (mm)
- Irrigation – reading at end of metre (m^3)
- Irrigation – total applied amount (mm)
- Irrigation – useful amount (mm) – after irrigation
- Soil water content (mm)
- Water loss (rainfall or excessive irrigation).

Soil conservation

- Fertiliser
- Applied quantity (tonne and m^3)
- Nutrients delivered (N, P_2O_5, K_2O, MgO, CaO, SO_3, B)
- Elements supplied by soil (as per soil analysis)
- Elements supplied by irrigation water (as per irrigation water analysis)
- Total applied in subplot or homogeneous zone (kg)
- Total applied per hectare (kg/ha).

Examples of data collected through CSs

Example from an animal welfare certification scheme: types of data per measure, collection methods and scores

<table>
<tr><th colspan="2">1 star Beter Leven</th><th colspan="2">3 stars Beter Leven</th></tr>
<tr><th>Standard</th><th>Criterion</th><th>Standard</th><th>Criterion</th></tr>
<tr><td>Feed</td><td>The proportion of milk or a milk replacer in the ration fed to veal calves is a maximum of 50 %</td><td colspan="2" rowspan="3">n/a</td></tr>
<tr><td>Feeding milk</td><td>All calves are fed milk at least three times a day. The milk is administered in equal portions to the calves in three or more feeding sessions</td></tr>
<tr><td>Drinking teats</td><td>The milk is administered to the calves by drinking teats up to at least 6 weeks of age</td></tr>
<tr><td>Length of feeder</td><td>All the calves can drink milk at the same time. The feeder offers a length of at least 0.40 m per calf, or there is at least one drinker per calf</td><td>Length of feeder</td><td>There is a minimum of one feeding place for roughage for each calf. The length of the feeder is at least 0.55 m for each calf</td></tr>
<tr><td>Roughage provision up to 15 weeks of age</td><td>From arrival on the farm up to the age of 15 weeks, the calves are provided with an average of 1 500 g of roughage per day</td><td rowspan="2">Roughage</td><td rowspan="2">The calves have unlimited access to roughage</td></tr>
<tr><td>Roughage provision from 15 weeks of age</td><td>From the age of 15 weeks, the calves are provided with at least 3 300 g per day</td></tr>
<tr><td rowspan="3">Action plan for barn climate</td><td rowspan="3">If the standards for the barn climate are systematically exceeded for 2 months and correcting these standards permanently is not possible, an improvement plan for the air quality must be established</td><td>Measuring the barn climate</td><td>There is an automatic system that measures the following climate parameters in the barn: indoor temperature, CO_2 concentration, ammonia concentration and humidity</td></tr>
<tr><td>Monitoring the barn climate is discussed</td><td>The results of monitoring the barn climate are discussed with the farm's contracted veterinary practitioner at least once every 6 months</td></tr>
<tr><td>Action plan for barn climate</td><td>If the standards for the barn climate are systematically exceeded for 2 months and correcting these standards permanently is not possible, an improvement plan for the air quality must be established</td></tr>
</table>

NB: n/a, not applicable.

Source: Compiled by the authors based 2023 Beter Leven standards (https://beterleven.dierenbescherming.nl/zakelijk/en/participate-2/company-type/livestock-farms/calves/).

Example from an animal welfare certification scheme: types of data per measure, collection methods and scores

Principle	Criterion	Measure	Method to collect the required data	Sample size	Time	Classification
1. Good housing	1.1. Comfort around resting	1.1.1. Time needed to lie down 1.1.2. Cleanliness of the animals	See the protocol for further details			
1. Good housing	1.2. Ease of movement	1.2.1 Pen features according to live weight 1.2.2. Access to outdoor loafing area or pasture	See the protocol for further details			
2. Good feeding	2.1. Absence of prolonged hunger	2.1.1. Body condition score	View the animal from behind and from the side in the loin, tail head and vertebrae. Animals must not be touched but only watched Animals are scored with regard to four body regions: Tail head – cavity around tail head Loin – visible depression between backbone and hip bones (tuber coxae) Vertebrae – ends of transverse processes distinguishable General – tail head, hip bones (tuber coxae), spine and ribs visible Classification: 0 – Satisfactory body condition: at most two body regions classified as too thin 2 – Very lean: indicators for 'too thin' present in at least three body regions	Sample size depending on herd size. All measures are recorded in the same sample of animals	1.6 min utes/an imal	2.1.1.1. Percentage of very lean animals (score 2)
2. Good feeding	2.2. Absence of prolonged thirst	2.2.1. Water provision 2.2.2. Cleanliness of water points 2.2.3. Number of animals using the water points	See the protocol for further details			

Principle	Criterion	Measure	Method to collect the required data	Sample size	Time	Classificatio n
3. Good health	3.1. Absence of disease	3.1.1. Coughing 3.1.2. Nasal discharge 3.1.3. Ocular discharge 3.1.4. Hampered respiration 3.1.5. Diarrhoea 3.1.6. Bloated rumen 3.1.7. Mortality	3.1.1. The number of coughs is counted using continuous observations in pens or, in the case of very large pen sizes, in segments of the pens. Per segment not more than 25 animals should be assessed on average. Total net observation time is 120 minutes. Recording of coughs is carried out together with social behaviour and resting behaviour observations	Sample size depending on herd size (table available). All measures are recorded in the same sample of animals	1.6 min utes/an imal	3.1.1.1. Mean number of coughs per animal and 15 minutes
	3.2. Absence of injuries	3.2.1. Lameness 3.2.2. Integument alterations	See the protocol for further details			
	3.3. Absence of pain induced by management procedures	3.3.1. Disbudding/de horning 3.3.2. Tail docking 3.3.3. Castration				
4. Appropriat e behaviour	4.1. Expression of appropriate social behaviours	4.1.1. Agonistic behaviours 4.1.2. Cohesive behaviours	See the protocol for further details			4.1.1.1. Mean number of head butts per animal and hour 4.1.1.2. Mean number of displacements (agonistic behaviours except head butts) per animal and hour
	4.2. Expression of other behaviours	4.2.1. Access to pasture				4.2.1.1. Number of days with access to pasture per year 4.2.1.2. Number of hours per day on pasture
	4.3. Adequate human–animal relationship	4.3.1. Avoidance distance				4.3.1.1. Percentage of animals that can be touched 4.3.1.2. Percentage of

Principle	Criterion	Measure	Method to collect the required data	Sample size	Time	Classification
						animals that can be approached closer than 50 cm but not touched 4.3.1.3. Percentage of animals that can be approached as closely as 50–100 cm 4.3.1.4. Percentage of animals that cannot be approached as closely as 100 cm
	4.4. Positive emotional state	4.4.1. Qualitative behaviour assessment	See the protocol for further details			

Source: Compiled by the authors based on 2024 Welfair standards (http://www.welfarequalitynetwork.net/media/1088/cattle_protocol_without_veal_calves.pdf).

Examples of Biogarantie requirements for specific agricultural activities

All sectors	
Type of requirement	**Description**
Protection of biodiversity and ecosystems	
Major	Promote biodiversity and protect ecosystems. They complete the online tool of Biogarantie, Belgium, and indicate the biodiversity and ecosystem measures they take
Major	The farm fields are sown with crops that increase the organic matter content of the soil at least once every 3 years (with an obligation to return crop residues or an equivalent amount of manure). The crops indicated for this measure include green manure, legumes, temporary grasslands, cereal crops, oilseeds and maize
Recommendation	A permanent vegetative cover is present through either living biomass or dead biomass (e.g. mulch)
Herbivore farming	
Feed self-sufficiency	
Major	Each year, farms record the percentage of purchased proteins in the annual ration in the online tool, along with their origin (local, Belgian, EU, non-EU). Local origin means that the proteins come from plants cultivated in Belgium or in the neighbouring regions
Major	Each year, farms record the proportion of grass/clover in the ration through the online tool

Source: Compiled by the authors based on 2023 Biogarantie standards (https://biogarantie.be/wp-content/uploads/2024/01/CDCH-BIOGARANTIE_2024_FR.pdf).

Examples of Naturland requirements

General

Genetically modified organisms and their derivatives, as well as nanomaterials, are forbidden.

Naturland provides lists for different specific activities (e.g. fertilisation) to ensure the application of authorised inputs.

Social responsibility

All workers receive a written contract of employment that outlines the basic conditions of employment.

Workers shall be paid at least the (currently applicable) official national minimum wage, or the wages established through collective bargaining, whichever is the higher.

Plant production

The use of synthetic or surrogate substrates and the cultivation in sacks and containers are not permissible.

For arable farming, a minimum of one fifth of the arable land is to be devoted to main crop legumes.

The quantity of farm manure depends on the forage production of the farm and its associated animal husbandry.

The external nutrient input from organic manure must not exceed 0.5 DU/ha in any given year.

The use of synthetic chemical substances and growth regulators is prohibited.

Water usage

Water management plan comprises records and analysis of consumption, analysis of possible risks in conjunction with water use and a plan of action for the reduction or prevention of these risks.

Water consumption (m^3/ha/a) is to be recorded.

Animal welfare

At least 50 % of the stable area has to consist of solid material (i.e. no gaps or similar).

Sheds must provide sufficient lighting and good climate conditions (e.g. temperature, humidity, fresh air, the avoidance of harmful concentrations of dust and gasses).

Ensure that the animals have access to an adequate water supply.

Young stock and fattening animals must have an opportunity to graze (throughout the grazing period) or to run free all year round.

For laying hens, outdoor grassland access is mandatory, with a minimum of 4 m^2 per hen in the designated grassland area.

Source: Compiled by the authors based on 2023 Naturland standards (https://www.naturland.de/images/01_naturland/_en/Standards/Naturland-Standards-on-Production.pdf).

Example of an Integrated Farm Assurance checklist for fruit and vegetables

Section	Description/principle	Assessment/criterion	Level
Workers' welfare	On-site living quarters are compliant with applicable local regulations, habitable and equipped with basic services and facilities	Visual checking	M
Energy efficiency	On-farm energy use is monitored	Checking the existence of records of on-farm energy use (e.g. invoices detailing energy consumption). In the absence of energy metres (e.g. for small producers), estimations are acceptable	M
GHGs and climate change	A waste management system is implemented	Checking the existence of a waste management system	M
Genetically modified organisms	Adventitious mixing of genetically modified crops with conventional crops is avoided	A visual assessment of the identification of genetically modified crops and the integrity of the storage shall be made	M
Soil management	To improve and optimise soil health, the producer has a soil management plan	Records of soil analyses and crop-specific information shall be available as evidence	M
	Crop rotation for annual crops is implemented, where feasible	Planting dates or crop or field records. Records shall exist for the previous 2-year rotation	m
	Techniques have been used to improve or maintain soil structure and avoid soil compaction	Evidence of the application of techniques (e.g. deep-rooting green crops)	m
Fertilisers and biostimulants	Up-to-date records of all fertiliser and biostimulant applications are kept	Records of each fertiliser (organic and inorganic) and biostimulant application	M
Water sources	Water use at the farm level has valid permits/licenses where legally required	Valid permits/licenses issued by the competent authority available (e.g. for water extraction, discharge)	M
	Treated water used during harvest or postharvest is monitored appropriately	Treated water (e.g. antimicrobial water additives) adhere to a documented monitoring system. The values shall be compared with established parameters	M
	Measures are taken to understand the amount of water used and actions identified for how to increase water use efficiency	Records of the use of crop irrigation / fertigation water	M
	The producer implements prevention measures	Evidence of implementing at least two activities that reduce the need for intervention	M

Section	Description/principle	Assessment/criterion	Level
Integrated pest management	Records of plant protection product applications are kept	Records for all applications of plant protection products, biocontrol agents and postharvest treatments, specifying crop treated, application location, dates from start to end, name and active ingredient or beneficial organism, interval as per the product label, amount of product applied, concentration or rate, type of machinery or equipment used, reason for application and name of the applicator	M

NB: Major (M); minor (m).
Source: Compiled by the authors based on the GlobalG.A.P. checklist (https://www.globalgap.org/what-we-offer/smart-checklist-builder/).

Example of the Risk Assessment on Social Practice (GRASP) add-on checklist for the Integrated Farm Assurance certification scheme

Section	Description/principle	Assessment/criterion	Level
Access to labour regulation information	The workers and the workers' representative are provided with easy-to-understand and up-to-date information (e.g. on minimum wage, holidays, labour unions)	The information shall be available and checked by the inspector	M
Terms of employment documents and forced labour indicators	All workers are legally eligible to work at the production site and on the activities assigned	For each worker, information on their legal eligibility to work is provided by the farmer	M
	The employment terms and conditions documents include up-to-date information on the period of employment, contract type, basic job description, wages, payments, working hours, breaks, holidays and information on maternity or sick leave	The information shall be available and checked by the inspector	m
Payments	Payments to workers are made in accordance with the worker terms and conditions documents	Records of payments, including dates, payment notification used, amount and method	M
Wages	Pay slips or registers show the amount of working time (including overtime) or harvest amount and the wages and/or overtime paid	The information shall be available and checked by the inspector	m
	Wages, payments, number of hours, government social security / pension contributions, and payroll taxes in the pay slip comply with the employment terms and conditions, with national labour regulations, and/or with collective bargaining agreements	The information shall be available and checked by the inspector	M
	All workers earn at least the national minimum wage and/or the collective bargain agreement wage within regular working hours	The CA's inspector shall check the number of regular hours (not including overtime) and minimum wage	M
	Working hours (including overtime, night work and rest days / breaks) with indication of peak/harvesting season are shown in the records	Records on working hours, overtime, night work instructions and breaks shall be available	M

NB: Major (M); minor (m).

Source: Compiled by the authors based on the checklist provided by GlobalG.A.P. (https://www.globalgap.org/what-we-offer/smart-checklist-builder/).

Examples of Bioland requirements for specific agricultural activities

Agricultural activity	Requirement(s)
Crop rotation	• The maintenance of soil fertility • The production of healthy plants • The suppression of weed in fields • The nutrition of animals using the operations own fodder • The achievement of economically feasible yields without the use of chemical fertilisers and chemical products for plant protection To fulfil these functions, crop rotation must contain leguminous plants as main or intermediate crops or as mixed cultures
Fertilisation and humus management	Permissible external fertilisers: • To complement the fertiliser produced within the operation and compensate for any nutrient losses caused by the operational cycle, fertilisers from external farms and organic and mineral fertilisers may be used • The solubility of mineral fertilisers may not be increased by means of any chemical treatment Non-permissible fertilisers: • The use of farmyard slurry and urine and poultry manure from conventional animal farming as well as of fermentation residues of biogas plants being operated solely with conventional fermentation materials is forbidden. In addition, the use of chemical synthetic nitrogenous fertilisers, easily soluble phosphates and other fertilisers not listed is prohibited Sewage sludge and compost: • The use of sewage sludge is prohibited
Plant protection	• The use of synthetic pesticides and growth regulators is forbidden • The use of herbicides is forbidden
Animal welfare	General: • At least 50 % of the total feed for cattle, buffalo kinds, sheep and goats must come from the operation itself or from a regional cooperation, as specified by Bioland. The remaining portion may originate from other Bioland farms or, if not available, from other organically managed farms or, if not available, the purchase of permissible conventional feed must adhere to regulations Feed additives: • The use of feed with active substances or additives such as antibiotics, chemobiotics or hormonal performance boosters [...]is forbidden
Vegetable production	Fertilising: • The total amount of fertiliser from the operation and organic supplemental fertiliser to be used in free range vegetable gardening may not exceed 110 kg of nitrogen per hectare and year
Fruit production	Fertilising: • The total quantity of nitrogenous fertiliser used may not exceed 90 kg nitrogen per hectare of fruit plantation and year • In operations without animals, this amount may be purchased

Source: Compiled by the authors based on 2023 Bioland standards (https://www.bioland.de/fileadmin/user_upload/Verband/Dokumente/Richtlinien_fuer_Erzeuger_und_Hersteller/Bioland-Richtlinien_englisch_2023-08.pdf).

Examples of the checklist used for selected sectors according to their control plans

Sector	Phase	Requirement	Type of cont rol	Frequency	Severity of the Non Confor mities
Fruits	Fertilisation	Conducting soil fertility testing based on soil analysis	D/L	At least every 4 years	m
Fruits	Fertilisation	Conducting foliar analysis	D/L	At least every 4 years	m
Fruits	Fertilisation	Fertilisation and soil fertility improvement in perennial plantations are carried out before establishing the plantation and throughout the entire lifespan	P/D		m
Fruits	Fertilisation	The maximum annual allowable amount of pure nitrogen (kg/ha) for each individual fruit species added by fertilisation is in accordance with the product specifications	P/D	Annually	M
Fruits	Fertilisation	The annual limit for the intake of pure nitrogen from organic fertilisers is less than 170 kg/ha	D	Annually	M
Fruits	Plant protection	Maintenance of permanent green cover in a part of the orchard (not applicable to strawberries)	P	Annually	M
Fruits	Plant protection	The producer keeps records of procedures and the use of plant protection products	D	Annually	M
Fruits	Plant protection	Protection against harmful organisms must be carried out according to the general principles of integrated plant protection	D	Annually	M
Fruits	Plant protection	Analysis for pesticide residues (according to the risk assessment) and in accordance with the requirements of the product specification (maximum residue level)	D/L	At least once a year before harvesting	M
Fruits	Harvesting	Fruit species must reach the prescribed level of soluble solids according to the product specifications	D/L	Annually	M
Fruits	Water usage	Treated wastewater must not be used for irrigation, treatment or post-harvest operations	P	Once every 3 years	M
Fruits	Water usage	Water complies with microbiological requirements, heavy metal content, pesticide residues and industrial pollutants	D/L	Once every 3 years	M
Vegeta bles	Environmental protection, plant protection and fertilisation	Hydroponic production: daily measurements of electrical conductivity and pH of the nutrient solution Nutrient solution analysis for micro and macro elements is performed up to six times a year, using the results to adjust the nutrient solution composition	D/L	Annually	M
Vegeta bles	Environmental protection, plant protection and fertilisation	Required to maintain records of the system for fertilisation carried out in the case of automated hydroponic systems	D	Annually	M
Vegeta bles	Environmental protection, plant protection and fertilisation	Maintain records of the type and quantity of fertilisers, as well as the timing and method of their application on the agricultural field	D	Annually	M
Pork meat	Feeding	The main source of energy in feeding pigs must be maize and barley The main source of proteins in feeding the pigs must be oilseed by-products	P/D	Annually	M
Pork meat	Transport duration	Transport from the producer to the slaughter establishment may not exceed 8 hours	P/D	Annually	M

NB: Documental (D); laboratory analyses (L); physical (P). Major (M); minor (m).

Source: Compiled by the authors based on Croatia's CS Dokazana kvaliteta (https://poljoprivreda.gov.hr/istaknute-teme/hrana-111/oznake-kvalitete/dokazana-kvaliteta/4226)

List of abbreviations

B2B	business-to-business
B2C	business-to-consumer
CA	certification agency
CAP	common agricultural policy
CS	certification scheme
CSP	common agricultural policy strategic plan
Eco-scheme	schemes for the climate, the environment and animal welfare
Envclim	environmental, climate-related and other management commitments
FADN	Farm Accountancy Data Network
FSDN	Farm Sustainability Data Network
GAP	good agricultural practice
GHG	greenhouse gas
HVE	Haute Valeur Environnementale
Instal	setting up of young farmers and new farmers and rural business start-up
Invest	investments, including investments in irrigation
MS	Member State
NQS	national quality scheme
PA	public authority
SQNBA	Sistema di Qualità Nazionale per il Benessere Animale

List of figures

List of tables

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