The role of governance in shaping EU agri-environmental policies

The role of governance in shaping EU agri-environmental policies

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Summary

This dissertation investigates agri-environmental governance within the European Union Common Agricultural Policy (CAP), with a particular focus on Agri-Environmental and Climate Measures (AECMs) and their capacity to pursue and achieve environmental objectives. Over the past decades, AECMs have become one of the main policy instruments through which Environmental Policy Integration (EPI) is operationalised within the CAP. Strong scientific evidence from various disciplines, spanning from ecology, economics and behavioural sciences, have examined AECMs' environmental ambition and performance. Yet the governance dimensions remain comparatively underexplored. Existing research often treats governance arrangements as a contextual constraints rather than as constitutive dimensions shaping how environmental objectives are defined, negotiated, translated into policy instruments, and implemented in practice. This dissertation aims to explore the role of governance in shaping both the environmental ambition and performance of agri-environmental policies in the EU.

The PhD pursues three overarching objectives: i) to investigate how AECMs governance is structured and which actors shape decision-making processes across governance levels; ii) to analyse how governance arrangements influence the environmental ambition and performance of AECMs, including the barriers emerging from these arrangements; and iii) to examine how different Member States pursue environmental objectives through diverse governance and policy configurations under the CAP Strategic Plans 2023-2027. More broadly, the research aims to better understand how interactions across governance levels, policy instruments, and actor configurations mediate the relationship between environmental

objectives and policy design and implementation within EU agri-environmental policies.

The research adopts an interdisciplinary perspective combining insights from system thinking, policy analysis, participatory research and multi-level governance studies. Methodologically, the dissertation combines qualitative and comparative approaches, including systematic literature review, conceptual framework development, case-study analysis, and cross-country comparative assessment. Four complementary papers structure the dissertation: i) a systematic review of scientific literature on AECMs governance, ii) a regional case study in France focus on barrier analysis, iii) a comparative analysis of CAP Strategic Plans across EU Member States, and iv) a reflexive and forward-looking perspective, connecting governance insights with broader debates on agri-environmental policy and the future CAP reform post-2027.

The findings show that AECMs governance is embedded within a complex multi-level and multi-actor system characterised by negotiated interactions, institutional interdependencies, and asymmetric power relations. Agricultural administrations and sectoral organisations occupy structurally dominant positions in policy design and implementation processes, while environmental actors often remain more peripheral despite formal participation mechanisms. The research further demonstrates that commonly identified barriers to AECMs ambition and performance, such as ambiguous policy design, farmers' selection bias, transaction costs, spatial mismatches, and implementation fragmentation, cannot be fully understood nor resolved independently from the governance arrangements in which they are embedded. Governance therefore shapes not only implementation conditions, but also the scope and meaning of environmental ambition itself.

The analysis also shows that Member States do not converge towards a single governance model for pursuing environmental objectives under the CAP. While the implementation of the subsidiarity principle enables contextual adaptation, it also generates coordination challenges, can reinforce power imbalances and lead to uneven distributions of environmental ambition across MS, policy instruments and governance levels. The findings therefore highlight that environmental ambition depends not only on better design of individual measures within policy instruments, but also on the coherence across governance levels and actor configurations.

Résumé

Cette thèse examine la gouvernance agro-environnementale au sein de la Politique Agricole Commune (PAC) de l'Union européenne, en s'intéressant plus particulièrement aux Mesures Agro-Environnementales et Climatiques (MAEC) et à leur capacité à poursuivre et atteindre des objectifs environnementaux. Au cours des dernières décennies, les MAEC sont devenues l'un des principaux instruments de politique publique à travers lesquels l'Intégration des Politiques Environnementales (EPI) se concrétise au sein de la PAC. De résultats scientifiques issus de diverses disciplines (écologie, économie et sciences comportementales) ont examiné l'ambition et la performance environnementales des MAEC. Cependant, les dimensions de gouvernance restent, en comparaison, peu explorées. Les recherches existantes traitent souvent les dispositifs de gouvernance comme des contraintes contextuelles plutôt que comme des dimensions constitutives façonnant la manière dont les objectifs environnementaux sont définis, négociés, traduits en instruments de politique publique, et mis en œuvre dans la pratique. Cette thèse vise à explorer le rôle de la gouvernance dans la construction de l'ambition et de la performance environnementales des politiques agro-environnementales au sein de l'UE.

La thèse poursuit trois objectifs généraux : i) analyser la manière dont la gouvernance des MAEC est structurée et identifier quels acteurs façonnent les processus de décision aux différents niveaux de gouvernance ; ii) analyser comment les dispositifs de gouvernance influencent l'ambition et la performance environnementales des MAEC, y compris les obstacles qui en découlent ; et iii) examiner comment les différents États membres poursuivent leurs objectifs environnementaux à travers des configurations de gouvernance et de politique publique diverses, dans le cadre des Plans Stratégiques Nationaux de la PAC 2023-2027. Plus largement, la recherche

vise à mieux comprendre comment les interactions entre niveaux de gouvernance, instruments de politique publique et configurations d'acteurs façonnent la relation entre objectifs environnementaux, conception et mise en œuvre des politiques agro-environnementales au sein de l'UE.

La thése adopte une perspective interdisciplinaire, mobilisant des apports issus de la pensée systémique, de l'analyse des politiques publiques, de la recherche participative et des études sur la gouvernance multi-niveaux. Sur le plan méthodologique, la thèse combine des approches qualitatives et comparatives, incluant une revue systématique de la littérature, le développement d'un cadre conceptuel, des analyses d'études de cas, et une évaluation comparative entre pays. La thèse s'articule autour de quatre articles complémentaires : i) une revue systématique de la littérature scientifique sur la gouvernance des MAEC, ii) une étude de cas régionale en France centrée sur l'analyse des obstacles, iii) une analyse comparative des Plans Stratégiques Nationaux de la PAC entre États membres de l'UE, et iv) une perspective réflexive et prospective, reliant les enseignements sur la gouvernance aux débats plus larges sur la politique agro-environnementale et la future réforme de la PAC post-2027.

Les résultats montrent que la gouvernance des MAEC s'inscrit dans un système complexe, multi-niveaux et multi-acteurs, caractérisé par des interactions négociées, des interdépendances institutionnelles et des relations de pouvoir asymétriques. Les administrations agricoles et les organisations sectorielles occupent des positions structurellement dominantes dans les processus de conception et de mise en œuvre des politiques, tandis que les acteurs environnementaux demeurent souvent plus périphériques, malgré l'existence de mécanismes formels de participation. La recherche démontre en outre que les obstacles couramment identifiés à l'ambition et à la performance des MAEC (le

manque de clarté dans la conception des mesures, l'auto-sélection des agriculteurs participants, les coûts de transaction et la fragmentation de la mise en œuvre) ne peuvent être pleinement compris ni résolus indépendamment des dispositifs de gouvernance dans lesquels ils s'inscrivent. La gouvernance façonne donc non seulement les conditions de mise en œuvre, mais également la portée et la signification même de l'ambition environnementale.

L'analyse montre également que les États membres ne convergent pas vers un modèle unique de gouvernance pour poursuivre les objectifs environnementaux dans le cadre de la PAC. Si la mise en œuvre du principe de subsidiarité permet une adaptation aux contextes locaux, elle génère également des défis de coordination, peut renforcer les déséquilibres de pouvoir et conduire à une répartition inégale de l'ambition environnementale entre États membres, instruments de politique publique et niveaux de gouvernance. Les résultats soulignent ainsi que l'ambition environnementale ne dépend pas uniquement d'une meilleure conception des mesures individuelles au sein des instruments de politique publique, mais également de la cohérence entre les niveaux de gouvernance et les configurations d'acteurs.

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List of Acronyms

Acronym	Definition
AECM(s)	Agri-Environmental and Climate Measures
AECP(s)	Agri-Environmental and Climatic Projects
AES	Agri-Environmental Scheme(s)
CAP	Common Agricultural Policy
CSP(s)	CAP Strategic Plan(s)
DG AGRI	Directorate-General for Agriculture and Rural Development (European Commission)
DPI	Differentiated Policy Implementation
EAFRD	European Agricultural Fund for Rural Development
EC	European Commission
EPI	Environmental Policy Integration
EU	European Union
GAEC(s)	Good Agricultural and Environmental Conditions
IAD	Institutional Analysis and Development (framework)
JRC	Joint Research Centre
MFF	Multiannual Financial Framework
MS(s)	Member State(s)
M&E	Monitoring and Evaluation
NRPP	National and Regional Partnership Plans
OECD	Organisation for Economic Co-operation and Development
PRI	Proportional Reduction in Inconsistency
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QCA	Qualitative Comparative Analysis
SMR(s)	Statutory Management Requirement(s)
TFEU	Treaty on the Functioning of the European Union
WCED	World Commission on Environment and Development

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The introduction section

1. The Introduction chapter

This PhD thesis lies at the intersection between agri-environmental policy and governance and has been shaped by an interdisciplinary journey bridging literature stream, theoretical and methodological approaches and ultimately aiming to navigate through the complexity of agri-environmental governance. The main research interest (and slight obsession) has been to understand how agri-environmental policies are designed, implemented, and ultimately perform. For this, the research questions are built on both how governance structures shape policy instruments, and how policy and contextual realities, in turn, reveal the limits and possibilities of governance.

Agri-environmental policy research draws from multiple disciplinary traditions, spanning from ecology (e.g. Batáry et al., 2015; Fischer & Wagner, 2016; Kleijn et al., 2006), economics (e.g. Balana et al., 2015; Bertoni et al., 2020; Fellmann et al., 2023), sociology, and behavioural sciences (e.g. Bartkowski et al., 2023; Brown et al., 2021; Sattler & Nagel, 2010; Schulze et al., 2023), among others. Despite their different epistemological foundations, these strands of literature converge in documenting the spatial, ecological, and behavioural complexity of agri-environmental systems, and in highlighting the persistent gap between policy objectives and observed outcomes. They also provide key insights into barriers and levers for policy reforms, which constitute an important empirical and conceptual foundation for this PhD.

Governance studies, and more broadly political science, offer complementary analytical frameworks, methodological approaches and empirical evidence. Concepts such as multi-level governance (Bache et al., 2016; Hooghe & Marks, 2001; Howlett, 2009; Jordan, 2001; Thomann et al., 2019) provide a structured lens to understand how authority and decision-

making are distributed across levels in the EU, and how agri-environmental policy instruments are shaped through interactions between institutional actors (e.g. Bazzan, Candel, et al., 2023; Matzdorf et al., 2013; McCarthy et al., 2018; Sattler et al., 2023; Schomers et al., 2015; Westerink et al., 2017). Additionally, they inform on the regulatory space in which agri-environmental policies are embedded, including how instruments are designed and implemented.

A key analytical thread of this work is the relationship with scales and levels. The link between farm-level dynamics and policy-level processes, as well as the dynamics occurring across EU, national and regional levels are deeply interdependent (Beckmann et al., 2009; McCarthy et al., 2018). EU and national policies are ultimately enacted at farm level, while farm-level realities feed back into policy design through multiple regional and national institutional (and more informal) channels. The ambition of this PhD is to contribute to a further understand how levels interact, with particular attention to how governance arrangements mediate it. Those arrangements are tight to a temporal dimension, linking past, present and future, in the same way that they are spatially embedded across (geographical) levels. Institutional and policy legacies continuously shape current possibilities for action by defining what is administratively feasible, politically acceptable, and institutionally imaginable (Benoit & Patsias, 2017; Popp, 2021). These legacies include prior policy choices, established organisational structures, dominant policy paradigms, and accumulated implementation practices, all of which exert a form of power on present-day decision-making. At the same time, the present defined by evolving biophysical, economic, and geopolitical contexts within which agri-environmental governance operates. Climate change, biodiversity decline, market volatility and shifting political priorities at EU and global levels all contribute to continuously reconfiguring the conditions of policy and farm-level actions. These contextual dynamics

do not affect all actors uniformly but are differentially experienced and interpreted depending on their position within governance systems. Future policy (and farm) decisions have their baselines set within both past and present, where agri-environmental actors, through spaces of discretion, experimentation, and strategic agency, articulate visions and negotiate (more or less transformative) changes (Reyes-García et al., 2026).

From its very beginning the PhD has been driven by a focus on (agri-environmental) actors: their roles, interactions, and the ways in which they shape decision-making processes in agri-environmental governance. This focus has structured both the research questions and the analytical approach. It is through actors' interactions (across administrative levels, policy domains, and territorial contexts) that policy design and implementation take form, and it is also through these interactions that tensions, trade-offs, and underperformance become visible. It is through actors' interactions that the research process, and eventually this PhD manuscript, has been shaped.

In reflecting on this research process, the famous quote on 'sitting on the shoulder of giants', reveals itself as a daily practice. This PhD is a collective endeavour, it has been shaped by theoretical contributions, empirical studies, and ongoing exchanges with researchers, policy and farm-level practitioners. While the PhD is structurally a solitary journey, the production of knowledge involved in it has been deeply embedded in a wider community.

2. The framework chapter: background, perspective & research questions

Agri-environmental policies in the EU have been developed as part of the integration of environmental issues in other policy domains (Lowe & Baldock, 2000). Under a policy perspective, this has been referred to, by both scientific literature and policymakers, as Environmental Policy Integration (EPI) (e.g. Jordan & Lenschow, 2010; Lafferty & Hovden, 2003; Persson et al., 2018; WCED, 1987). The transversal nature of environmental issues has been first recognized worldwide in the 1970s (United Nations, 1973), and in Europe with the Environmental Action Plans since 1973 (Lafferty & Hovden, 2003). This trend further established in the (multi-lateral) policy making of the '80s and '90s, where various international and European policy reforms embedded environmental considerations into broader governance frameworks. At EU level, the Single European Act in 1987 and the Treaty of Maastricht in 1992 provided the first legal basis for a common environmental policy and formalized the principle of integrating environmental protection requirements into other EU policies. At the international level, the United Nations Conference on Environment and Development[1] held in Rio de Janeiro in 1992 further reinforced this approach by promoting sustainable development as an overarching policy objective, thereby encouraging policy coordination across sectors.

As a political and institutional process, EPI entails a reconfiguration of the prioritization of policy objectives, whereby environmental considerations are no longer treated as subordinate, but should be incorporated alongside

[1] Also referred to as the "Rio Earth Summit", the conference marked a major milestone in international environmental governance through the adoption of key agreements and principles, including Agenda 21, the Rio Declaration, and the conventions on climate change and biodiversity.

economic and sectoral goals from the outset (Lafferty & Hovden, 2003). In doing so, EPI aims as well at changing policy outputs, influencing the policy instruments available for implementation at national and regional levels across the EU. Through these changes, it strives to affect policy outcomes, i.e. the concrete environmental effects resulting from policy implementation.

2.1. Agri-environment in the Common Agricultural Policy

In the case of agricultural policy, and in particular of the Common Agricultural Policy (CAP) in the EU, EPI develops within a policy domain historically characterized by agricultural exceptionalism. The latter attributes a special political and institutional status to agriculture, often on the basis of a historical narrative claiming the validity of special rules and treatment of agriculture compared to other economic sectors (Daugbjerg & Feindt, 2017). This exceptionalism is rooted in the post-war foundations of European integration and is legally anchored in Article 39 of the Treaty on the Functioning of the European Union (TFEU), that states that the CAP should help increasing productivity, stabilize markets, ensure the availability of supplies, and maintain reasonable prices for consumers (Matthews, 2023).

Subsequent CAP reforms since its establishment in 1957 have progressively broadened the range of objectives it pursues (

Table 1). Beyond its original focus on productivity growth and market stabilisation, the policy has incrementally incorporated a range of objectives. This marked an attempt to add public good provisioning to agricultural policies, and covered topics as farm income support, market orientation, rural development, territorial cohesion, food quality and safety, animal welfare, and, more recently, climate action and environmental protection (Candel & Daugbjerg, 2025).

The MacSharry reform of 1992 marked a first step towards incorporating environmental considerations into the CAP. It introduced set-aside requirements, whereby direct payments for larger farms were made conditional on allocating a share of land to non-productive use. It also established the first agri-environmental measures, providing payments to farmers who voluntarily adopted environmentally friendly farming practices. These measures operate through multi-annual contracts spanning between five and seven years, aimed at ensuring long-term environmental commitments, and provide payments tied to the costs incurred or income foregone by farmers.

The subsequent Agenda 2000 reform in 1999 introduced voluntary cross-compliance for Member States, linking part of direct payments to the fulfilment of basic environmental and animal welfare standards. This reform also allowed Member States to transfer financial resources between pillars, enabling the reallocation of funds across the two pillars[2] where additional support was required. The Fischler reform in 2003 introduced the decoupling

[2] The CAP is structured around two "pillars." Pillar I includes market measures and direct payments to farmers (and in the current programming period eco-schemes), primarily aimed at income support and market stabilisation, and is fully financed by the EU budget. Pillar II covers rural development policy, including AECMs, and is co-financed by Member States. The two pillars differ in their objectives, governance arrangements, and financing mechanisms, with Pillar II generally providing greater flexibility, enhanced subsidiarity and multi-annual interventions.

of direct payments from production through the Single Payment Scheme[3]. It also made cross-compliance mandatory, requiring farmers receiving income support to respect statutory environmental, food safety, and animal welfare standards, as well as rules related to the maintenance of land in good agricultural and environmental condition. In doing so, environmental issues became structurally embedded within income support mechanisms, as the full receipt of direct payments became conditional upon compliance with baseline requirements; non-compliance could lead to reductions in payments, while support would generally still be granted provided minimum standards were respected. The 2013 CAP Reform under Commissioner Dacian Cioloș introduced the greening, making 30 per cent of direct income support conditional on compliance with three environmental requirements: i) the maintenance of permanent grassland, ii) the allocation of at least five per cent of arable land as ecological focus areas, and iii) crop diversification. The reform also introduced degressivity and capping as voluntary instruments, giving Member States the option to rebalance and reshape the distribution of Pillar I and Pillar II payments (Alons, 2017).

The most recent reform, establishing the CAP for the 2023-2027 programming period, introduced a New Delivery Model based on CAP Strategic Plans designed by Member States within a common EU framework (Regulation (EU) 2021/2115). This reform strengthened subsidiarity by granting greater flexibility in policy design while shifting the CAP overall governance logic towards a performance and results-based approach, and

[3] Under the Single Payment Scheme farmers receive payments based on area-based criteria rather than current production levels. Eligibility is conditional upon maintaining agricultural land in good agricultural and environmental condition (GAEC) and complying with statutory management requirements (SMRs), i.e. cross-compliance.

by integrating environmental and climate objectives across both pillars, notably through the introduction of eco-schemes[4] under Pillar I.

[4] Eco-schemes are a new instrument introduced under the CAP 2023-2027, established by Regulation (EU) 2021/2115. Unlike AECMs, which fall under Pillar II (rural development) and are co-financed by the EU and Member States through multi-annual contracts (typically 5-7 years), eco-schemes are part of Pillar I (direct payments), are financed entirely by the EU budget (through the European Agricultural Guarantee Fund), and operate as annual, voluntary commitments that farmers can choose to enter or exit from year to year. Member States are required to allocate a minimum share of their Pillar I budget (at least 25% for the 2023–2027 period) to eco-schemes, though the specific menu of eligible practices is designed by each Member State within its CAP Strategic Plan, subject to European Commission approval. Eco-schemes reward farmers for adopting practices beneficial to climate, environment, biodiversity, or animal welfare that go beyond baseline conditionality requirements.

Table 1: CAP reforms introducing environmental objectives, and specific key changes that occurred

CAP reform	Date	Key changes
MacSharry reform	1992	Set-aside requirements; first agri-environmental measures
Agenda 2000 reform	1999	Voluntary cross-compliance for Member States; enabled transfers of financial resources between CAP pillars
Fischler reform	2003	Decoupling of direct payments; mandatory cross-compliance
CAP 2013 reform	2013	Introduced greening; introduced voluntary degressivity and capping
New Delivery Model Reform	2021	Introduced CAP Strategic Plans; strengthened subsidiarity and flexibility in implementation; introduced eco-schemes under Pillar I

Yet, this diversification of objectives and consecutive (environmental) reforms have not fully translated into a rebalancing of their relative importance in both policy design and implementation of the CAP policy mix (i.e., across policy objectives, instruments, and their calibrations) (Grohmann & Feindt, 2023). Under the current policy model, environmental objectives are pursued alongside (and often in tension) with objectives related to agricultural competitiveness, income support, and sectoral performance. While environmental objectives have gained visibility in policy discourse during previous CAP reforms, their support has been constrained by the relatively smaller share of CAP funding allocated to environmentally oriented instruments compared with income support under Pillar I (**Figure 1**). As shown in **Figure 1**, agri-environmental subsidies and greening measures were absent in the early CAP, gradually emerged (with limited ambition) in the subsequent reforms, and while Pillar II instruments under Rural Development have provided a growing share of resources for environmental measures, this growth has plateaued in recent years.

Following the farmers' protests in early 2024, the European Commission and EU co-legislators introduced a series of CAP simplification measures aimed at reducing administrative burden, yet most of the proposed changes affected the increasing flexibility in the implementation of environmental

conditionalities (Finger et al., 2024; Läpple et al., 2026). Environmental requirements attached to conditionality and GAEC standards were partially relaxed through derogations and amendments under the Regulation (EU) 2024/1468[5].

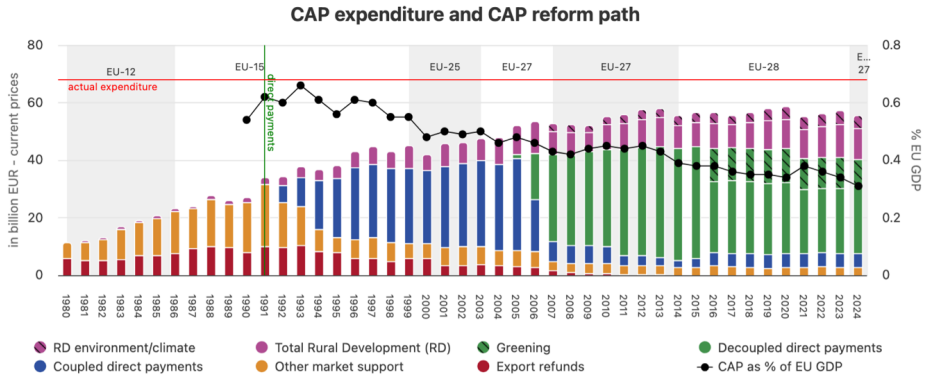


Figure 1: CAP expenditure and reform path across funding types[6]

While EPI depends on budgetary allocation, another dimension concerns design features of agri-environmental measures, including the conditions attached to subsidy disbursement and the regulatory requirements. These design elements are intrinsically linked to the type of farming practices promoted: measures targeting productive activities, (e.g., crop rotations), differ in their environmental implications from those promoting non-productive practices (e.g., flower strips, hedges). Additionally, the contextual suitability of farming practices, that could vary across farms, regions and ecosystems, also plays a role.

[5] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-targeted-amendments-of-cap-regulations

[6] Sources: CAP expenditure: European Commission, Directorate-General for Agriculture and Rural Development (Financial Report). GDP: Eurostat. Annual expenditure in current prices https://agriculture.ec.europa.eu/data-and-analysis/financing/cap-expenditure_en

Additionally, EPI efforts aimed at challenging the implicit hierarchy of CAP objectives have encountered persistent resistance from key stakeholders shaping CAP governance, including agricultural ministries, farmer unions, and sectoral economic actors. This governance configuration has been decisive in defining the limited space for manoeuvre available to EPI in pursuing its objectives. Nevertheless, despite these structural constraints, a distinct agri-environmental policy has gradually emerged within the broader CAP framework (**Figure 2**). This policy is embedded in the so-called green architecture.

The green architecture refers to the set of mandatory and voluntary instruments intended to integrate environmental and climate objectives into agricultural support. In the 2023–2027 CAP, it comprises enhanced conditionality, eco-schemes under Pillar I, and Agri-Environmental and Climate Measures (AECMs) under Pillar II (Dupraz & Guyomard, 2019). Under the mandatory part, conditionality rests on two distinct types of rules: Good Agricultural and Environmental Conditions (GAECs), defined within the CAP legal framework itself, and Statutory Management Requirements (SMRs), which originate from other EU legislation on animal welfare, public, animal and plant health, and the environment and climate, but are integrated into the CAP as a condition for receiving income support. Unlike GAECs, SMRs bind all farmers under EU law regardless of whether they participate in the CAP; what the CAP adds is a financial enforcement mechanism, making these obligations a condition for payment.

This means that EU environmental policy and the CAP are deeply intertwined, and this is channelled through directives that form the core of the EU's environmental policy corpus and that, spanning topics from biodiversity to water quality, have a direct effect on agricultural land use. For example, the Habitats Directive, the Birds Directive, the Water Framework Directive, and the Nitrates Directive have CAP's own environmental

instruments (i.e. SMR) and were integrated into CAP conditionality progressively, mainly between the 1990s and the early 2000s, as successive CAP reforms broadened its EPI (**Figure 2**).

More recent pieces of EU environmental legislation, such as the Nature Restoration Law and the Soil Monitoring Law, have not (yet) been integrated in the same way: both are still at the stage of national implementation, with Member States currently drafting the national plans required under each regulation, and neither is at present explicitly referenced within CAP's mandatory instruments.

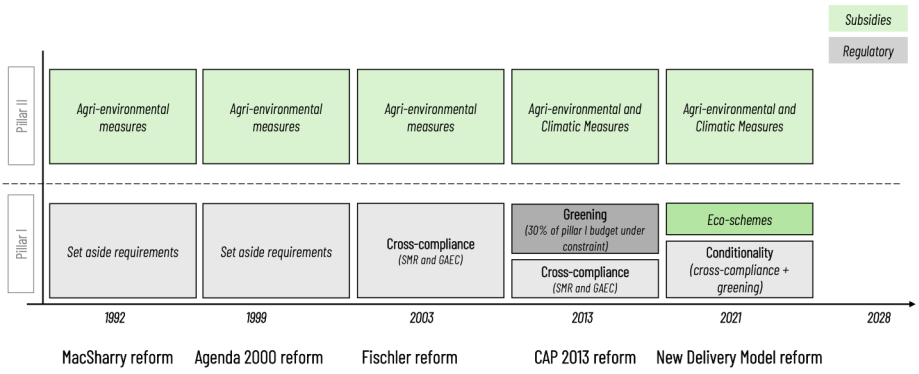


Figure 2: The CAP green architecture across the CAP reforms

Under the Regulation (EU) 2021/2115, voluntary instruments are also defined. Eco-schemes, also regulated under Pillar I, are voluntary annual payments designed to incentivize practices that go beyond this baseline, and AECMs under Pillar II are as well voluntary subsidy schemes that support multi-annual and should push even further agri-environmental practices to achieve environmental objectives. By focusing on actions beyond baseline regulatory requirements, they aim to deliver additional environmental benefits, aligning with environmental and climatic objectives

of the CAP[7]. AECMs and eco-schemes, though both classified as voluntary instruments, differ substantially in their institutional history. As previously mentioned, AECMs were first made mandatory for Member States to offer under the 1992 MacSharry reform. This means that, by the 2023–2027 CAP, they had therefore been designed and implemented (and eventually evaluated) across several reform cycles. On the other hand, eco-schemes were introduced only in the 2023–2027 CAP, as a Pillar I instrument. The CAP 2023–2027 requires Member States to allocate at least 25% of their direct payments budget to climate, environment, and animal welfare purposes through eco-schemes. Both though have similar regulative framing, as Member States have been required to include them in their CAP programmes, though the farmer participation has remained voluntary (an overview on main characteristics of both AECMs and eco-schemes is provided in **Table 2**.

[7] In the CAP 2023-2027 framework, AECMs primarily contribute to three Specific Objectives, as described in Article 6, Regulation (EU) 2021/2115: Specific Objective 4, which aims to support climate change mitigation and adaptation, including the reduction of greenhouse gas emissions and enhancement of carbon sequestration; Specific Objective 5, which focuses on fostering sustainable development and efficient management of natural resources such as water, soil, and air; and Specific Objective 6, which seeks to halt and reverse biodiversity loss, preserve habitats and landscapes, and strengthen ecosystem services.

Table 2: Overview of main characteristics of Eco-schemes and AECMs under current CAP 2023-2027 framework

Characteristic	Eco-schemes	AECMs
Legal basis (under Regulation (EU) 2021/2115)	Article 31	Article 70
Pillar funding	Pillar I (EAGF)	Pillar II (EAFRD)
Farmers' participation	Voluntary	Voluntary
Contract duration	Annual	5–7 years
Co-financing	100% EU-funded via EAGF	Co-financed: up to 80% EU and minimum 20% national
Minimum budget share (ring-fencing)	25% of the annual direct-payment envelope	35% minimum EAFRD (environmental and climate envelope)
Scope	Must cover at least 2 of 7 listed action areas under the specific objectives	No specific constraints

The extent to which MSs implemented this obligation has varied according to pre-existing national trajectories in agri-environmental policy. For example, Germany, through regionally designed Länder programmes dating to the early 1980s, and the Netherlands, building on its 1975 *Relatienota* framework, were able to draw on existing administrative capacity and monitoring arrangements when adapting to the EU-mandated instrument. Central and Eastern European Member States, by contrast, gained access to agri-environmental co-financing only upon EU accession in 2004, resulting in a comparatively shorter institutional history for AECMs in this group of countries.

Both instruments target a diverse set of environmental topics addressed, allocated different budgetary share, and have high heterogeneity level of ambition reflected in their design, both within and across Member States. AECM topics span biodiversity, water, soil, climate, and genetic and landscape conservation. Eco-schemes address a comparable range of

practices and (e.g. precision farming, crop diversification, extensive grassland management, landscape feature maintenance)[8]. Budgetary allocation also varies: Pillar II's co-financing structure allows Member States to invest above EU minimum requirements in AECMs according to national budgetary capacity and priorities. Eco-schemes are subject to a shared 25% Pillar I threshold, meaning also they are funding exclusively with EU funds. Yet Member State have full discretion over which practices are funded and at what payment level.

2.2. The agri-environmental governance

Within the current CAP legislative framework (i.e., Regulation (EU) 2021/2115, 2021/2016, 2021/2017), voluntary measures are shaped by two (interrelated) elements: i) the subsidiarity principle and ii) a multi-level governance. On the former, the EU principle of subsidiarity is defined by Article 5 of the Consolidated Version of the Treaty on European Union and grants MSs substantial autonomy, allowing them to tailor measures to local needs, yet under common EU-wide objectives. Subsidiarity shapes CAP pillars differently and for Pillar II, which includes AECMs, subsidiarity is more pronounced, allowing MSs to define priorities, select measures, set payment levels, and determine targeting strategies according to local environmental and socio-economic conditions. With the strengthening of subsidiarity in successive reforms, particularly from 2021 onwards, Member States gained greater discretion in designing CAP instruments in general and agri-environmental components in particular.

The PhD focuses primarily on voluntary measures, including both AECMs and eco-scheme. Yet most of the analysis focused on AECMs, and the

[8] For further insights on the range of topics targeted by both AECMs and eco-schemes, see: https://agridata.ec.europa.eu/extensions/DashboardCapPlan/catalogue_interventions.html

choice reflects three considerations. First, the longer implementation history of AECMs corresponds to more established governance arrangements, including the distribution of responsibilities across EU, national, and regional levels, and the mechanisms used for local targeting. Second, this history has produced a correspondingly larger body of empirical evaluation and academic literature on which to draw. Third, the comparatively recent and still-evolving implementation of eco-schemes limits the extent to which their governance arrangements can inform on their effect on their ambition and performance.

2.2.1. Governance as a concept

Before further investigating the specific features characterizing agri-environmental governance, we clarify how the concept of governance is approached in the PhD, even if defining governance is an endeavour on its own, way beyond the scope and reach of this PhD. A multitude of authors, international organisations and policy reports have proposed their own definitions, reflecting the term's disciplinary breadth across political science, public administration, and international relations. Additionally, the concept of governance adapts its meaning (and its characteristics) according to the context in which it is applied. For example, food governance is generally approached through the lens of systems connecting production, distribution, and consumption, focussing on the processes through which diverse actors are incorporated into decision- and policy-making at different levels (Marsden, 2000; Duncan, 2015; Maye et al., 2025; Schneider et al., 2025). Biodiversity governance, on the other hand, is structured primarily around the architecture of international environmental agreements, most notably the Convention on Biological Diversity[9], and its cascading

[9] The Convention on Biological Diversity is an international treaty adopted at the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, with the objective, amongst others, of conserving biological diversity and ensuring the sustainable use of its components. It counts 196

implementation from global to national and local levels. In environmental governance, the focus is mainly on the institutions and processes that determine who makes decisions, with particular attention to the interaction of state, market, and civil-society actors across scales (e.g. Bennett & Satterfield, 2018; Evans & Thomas, 2023; Paavola, 2007).

Given the policy process entry point of the PhD in approaching EU agri-environmental policies, the PhD aligns with (Hill & Varone, 2016), for whom the term governance is used to go beyond a governmental and institutional vision to policy, shifting the attention to the policy-making (and more broadly decision-making) process as a whole. Its research focus is therefore on the broader set of actors, rules, and interactions through which decisions are made and implemented. As this PhD is concerned with agri-environmental governance in the European Union, a second key reference is the work of Liesbet Hooghe and Gary Marks[10]. These scholars developed the concept of multi-level governance to capture how authority in the European Union came to be layered and redistributed across supranational, national, and subnational levels, and how this affected the relationship between the EU and its Member States (Hooghe, 1995; Hooghe & Marks, 2001, 2010, 2003). Their framework contrasts with a state-centric model of European integration, in which national governments act as sole gatekeepers of EU policy, describing instead a model in which authority is dispersed both upward, to supranational institutions, and downward, to regional and local actors.

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parties and sets broad obligations that are implemented through national legislation and policy, leaving parties discretion to interpret its provisions according to national or regional priorities.

[10] Liesbet Hooghe (W.R. Kenan Distinguished Professor of Political Science, University of North Carolina at Chapel Hill) and Gary Marks (Burton Craige Professor of Political Science, UNC-Chapel Hill) are political scientists who have jointly held the Chair in Multilevel Governance at VU University Amsterdam. Their collaboration on multi-level governance began in the early 1990s and produced the influential Type I/Type II distinction (Hooghe & Marks, 2003), later extended through the Regional Authority Index and the theory of European integration (Hooghe & Marks, 2009).

A recurring feature scholars and policy practitioners are focussing on is the search for "good" governance models, understood here as the organisational form suited to delivering a (public) good. On this, the EU governance is anchored by the principle of subsidiarity. Subsidiarity, established as a founding principle of the EU Treaties, states that decisions should be taken at the lowest level where an objective can be most effectively achieved, with EU-level action reserved for cases where it cannot. The subsidiarity framing of the CAP governance has been reinforced within the last reform, under the current legislative framework of the New Delivery Model[11].

In the context of AECMs, subsidiarity is reflected in both the funding and governance structures of the policy, notably through the co-financing arrangement between the EU and Member States (Beckmann et al., 2009). These institutional choices are set within a narrative according to which lower levels of governance are better placed than the EU to decide on the design and implementation of agri-environmental policy instruments, on the grounds that proximity to local conditions allows for a closer alignment with environmental objectives. However, the scientific evidence on the link between environmental performance and the implementation of subsidiarity across MS remains mixed, and at times contradictory (Alblas & van Zeben, 2023; Beckmann et al., 2009; Borniotto et al., 2026). AECM governance models can vary along several dimensions. These include the distribution of decision-making authority, coordination mechanisms, administrative arrangements, and payment mechanisms. Recommending

[11] The New Delivery Model introduced under Regulation (EU) 2021/2115 for the CAP 2023-2027, shifts the policy from a compliance-based to a performance-based approach. The EU sets common objectives and basic requirements, while Member States design and implement their own CAP Strategic Plans, tailored to national needs and monitored through a shared performance framework.

For more information: https://agriculture.ec.europa.eu/common-agricultural-policy/financing-cap/new-delivery-model_en

one such model as generally preferable to others therefore risks overlooking the inherent diversity of Member States. Identifying clear policy recommendations that privilege one governance model shaping AECMs (e.g., distribution of decision-making authority, coordination mechanisms, administrative arrangements, payment mechanisms) over other risks overlooking the inherent diversity of Member States. As highlighted by Buller et al., (2017), AECMs are partly embedded in the cultural, institutional, and landscape heritage of each country, making the search for a "perfect" degree of centralization more of an idealistic ambition than a realistic or policy-relevant aim. Furthermore, increased subsidiarity does not necessarily guarantee more environmentally ambitious or context-sensitive AECMs, as enhanced subsidiarity relies on the actors who populate the different governance levels, not solely on the level at which decisions are made.

2.3. The environmental ambition and performance: a disciplinary perspectives

The environmental ambition and performance of AECMs have been the focus of sustained scholarly attention across multiple disciplines over the past four decades, providing insights on a variety of factors that could be leading to it, spanning from budgetary allocation, design, farm-level adoption. The different literature streams (e.g. economics, environmental sciences, behavioural studies, political studies) have focused on distinct aspect of environmental effect and framed them under different conceptualisations. This partly reflects the fact that each of them focusses on different points in the chain of impact. This chain spans from input to activities, output, outcome and impact, and the theory of change

framework[12] describes the causal logic and resting on an assumption about how one stage is expected to produce the next (**Figure 3**).

Each discipline, according to its research area, has been focussing on specific stage of the chain.

Economics, for instance, is primarily concerned with resource allocation and inputs, and specifically with effectiveness and efficiency, comparing later stages of the chain (outcome, impact) against earlier ones (inputs, activities). This translates in cost-benefit analysis (Balana et al., 2011, 2015; Bertoni et al., 2020), transaction costs analysis (Banerjee et al., 2017; Franks, 2010; Schomers et al., 2015; Weber, 2014). It also raises concerns around adverse selection (i.e. farmers who already meet the requirements are more likely to participate, thereby limiting the potential to drive change (Bertoni et al., 2020; Falconer, 2000).

Behavioural sciences focus as well on early stages, mainly on activities and the extent to which they align with the context in which they are implemented (Hasler et al., 2019; Brown et al., 2021). This literature stresses, for example, simplistic conceptualization of farmer behaviour underlying AECMs design (Hasler et al., 2019; Brown et al., 2021).

Environmental sciences on the other end, are more focused on later stage of the chain, examining outcome and impact. Studies in this field, for example, raise issues on spatial mismatches, where the farm-level adoption of AECMs often fails to align with landscape-scale environmental needs

[12] The Theory of Change approach originates in evaluation theory, notably Carol Weiss's argument that social programmes rest on implicit assumptions about how change happens, and that making these explicit strengthens both design and evaluation. Developed further in the 1990s, it has since become a standard tool across development and public policy, mapping the causal chain from inputs to impact along with the assumptions underlying each step.

(Toderi et al., 2017; Früh-Müller et al., 2019; Rotchés-Ribalta et al., 2021), as environmental challenges often transcend individual farm boundaries.

Under a policy process perspective, each stage of the chain is itself the product of a specific moment in the policy cycle[13]. Policy formulation sets the objectives and design features that constitute an AECM's inputs and intended activities; implementation translates these design choices into outputs, such as adopted practices and signed contracts; and evaluation assesses whether these outputs translate into outcomes and, ultimately, environmental impact. Because each discipline privileges a different segment of the impact chain, it implicitly engages with a different moment of the policy process.

As illustrated in **Figure 3**, the two frameworks (i.e. theory of change and policy cycle) unfold along a shared temporal logic, where earlier stages of the policy cycle (agenda-setting, formulation, adoption) correspond to the upstream segment of the theory of change, where objectives are set and resources committed; later stages (i.e. policy implementation and evaluation) correspond to the downstream segment, where those inputs are translated into activities, outputs, and eventually outcomes and impacts. The disciplines mentioned above are therefore also distributed across the policy-cycle stage at which its analytical focus (and potential recommendations) are most directly actionable.

Under such framing, the diverse perspectives highlight distinct dimensions of what counts as meaningful environmental achievement, hence elaborating different concepts and epistemic grounding, that sit at the

[13] The policy cycle framework originates in policy process theory, notably Harold Lasswell's 1950s stages model of the decision process, later systematised by scholars such as Brewer and de Leon in the 1980s. It breaks the policy process into a sequence of analytically distinct stages and remains a widely used heuristic in public policy analysis, despite long-standing criticism that it oversimplifies the far more iterative and non-linear reality of actual policymaking.

interface between what counts as impact and which policy phase is concerned.

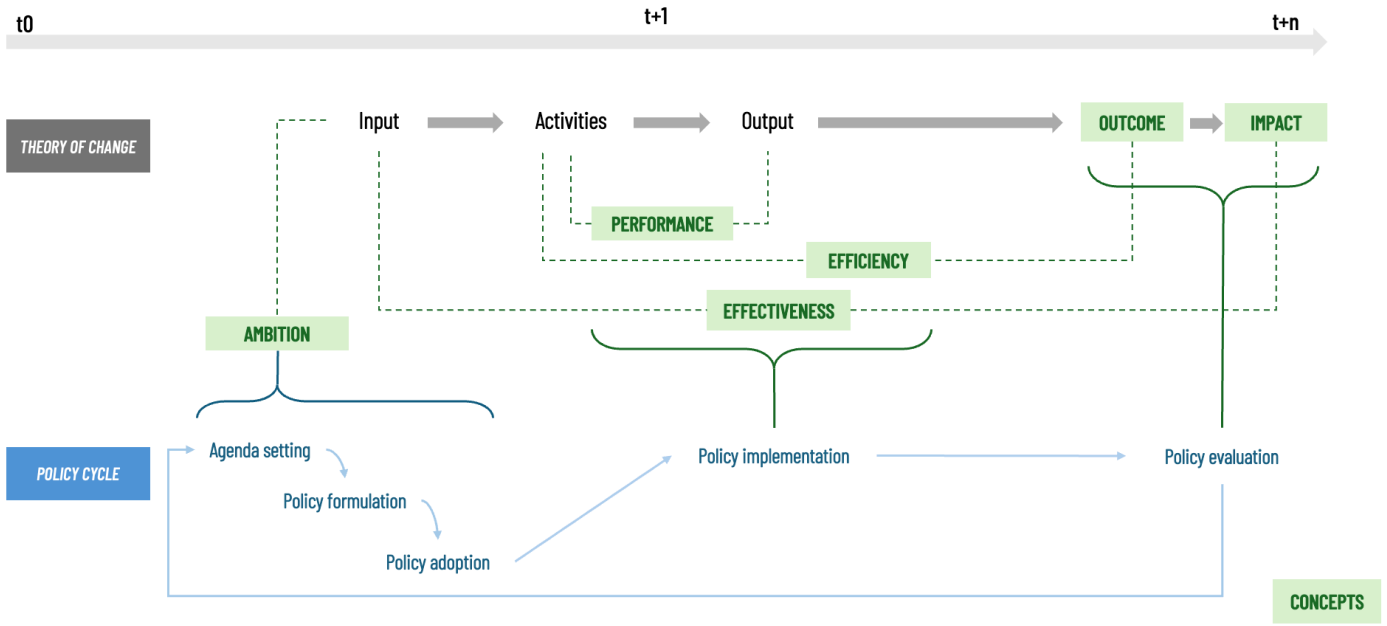


Figure 3: Concepts identified in the agri-environmental literature across main disciplines, the link with the theory of change and its chain of impact, and the policy cycle stages

Table 3: List of concepts used across disciplines, linking agri-environmental policies to environmental objectives

Concept	Emphasis	Discipline(s)
Environmental ambition	Level of resources invested for a particular intervention aimed for environmental benefits	Policy studies, governance, behavioural science
Environmental performance	The functioning of the (environmental) intervention itself, meaning how well the measure is implemented	Agricultural economics, agronomy, environmental management
Environmental outcome	Direct and immediate changes in the environment resulting from the implementation of the intervention	Policy studies, governance
Environmental impact	The long-term effect (positive or negative) of an intervention on the environment	Ecology, environmental science
Environmental effectiveness	Degree to which a measure achieves its intended environmental objectives	Policy analysis, public administration, economics
Environmental efficiency	Relationship between environmental outcomes and resources or costs used	Economics, policy evaluation

Building on these different conceptualisations (**Table 3**), this PhD focuses on the extent to which environmental objectives are both pursued (i.e. ambition) and achieved (i.e. performance) through AECMs, hence focussing more on early stages of the chain of impact, and the earlier stages of the policy cycle. Given the lack of consensus on the definition of the concepts, we define:

i) environmental ambition, as the extent to which policy design and implementation seek to pursue environmental objectives, and

ii) environmental performance, as the extent to which these objectives are effectively realised through implementation processes.

The PhD focusses therefore on the design and implementation arrangements shaping AECMs, rather than on the direct ecological impacts of the measures themselves. Accordingly, the terms ambition and

performance are employed throughout the manuscript to refer to these two complementary dimensions of environmental objective attainment.

2.4. A literature on AECM governance

The PhD grounds itself in existing insights from the AECM governance literature. This literature is composed of contributions from different disciplinary backgrounds, spanning policy studies (e.g. Bazzan, Candel, et al., 2023), environmental and institutional economics (e.g. Mettepenningen et al., 2013; Weber, 2014), rural sociology and human geography (e.g. Benoit & Patsias, 2017; Lowe et al., 2002), and the ecosystem services and payments-for-ecosystem-services tradition (e.g. Sattler et al., 2023; Schomers & Matzdorf, 2013). This disciplinary plurality is also reflected in a diversity of methodological framings: qualitative approaches dominate, largely through semi-structured interviews and discourse or content analysis (Benoit & Patsias, 2017; Lenihan & Brasier, 2009), process tracing (McCarthy et al., 2018), social network analysis , new institutional economics (Smits et al., 2008), qualitative comparative analysis (Westerink et al., 2017). Quantitative political-economy approaches are also present, such as regression analysis (Beckmann et al., 2009). The diverse literature approaches to AECM governance, highlights different features, from networks and alliances among actors, contract and design features in collective settings, the institutional organization of schemes, and the role of intermediaries. Most of these studies go the extra mile of linking those features to AECM ambition and environmental performance.

Overall, this literature is predominantly actor-centred as it often mobilizes the views of key stakeholders directly, primarily through interviews and

surveys, rather than relying solely on secondary data[14]. While the farm level remains the most common entry point, several studies deliberately complement it with the perspectives of public administration and policymakers (both civil servants and elected officials) capturing a range of visions on AECM. The studies are also diverse in their geographical scope, ranging from single-country case studies to comparative analyses spanning multiple Member States or the EU as a whole, and from national- to regional-level focus.

Three key findings are recurring. First, a broad agreement on the variety of roles and actors involved in AECM governance. Spanning from European institutions, agricultural administrations, ministries, regional councils, up to farmers, farmers' associations farmer advisors, each holding a distinct mandate (e.g. regulatory, administrative, advisory, financial) and exerting either direct or indirect influence over decision-making. Some studies further underline how these actors and mandates are distributed across different governance levels (e.g. Beckmann et al., 2009; Bethwell et al., 2022; Zwaan & Goverde, 2010). Second, the literature converges on the importance of actors, highlighting actor networks, power dynamics, and the distribution of roles among public, private and non-governmental actors. Third, regional and national specificities emerge clearly, both from single-country studies documenting distinct governance trajectories and from a set of comparative studies that explicitly engage with cross-country differences, reflecting on the diverse governance arrangements and how they can produce different outcomes depending on institutional and cultural context.

[14] Secondary data refers to information originally collected by others for a different purpose (e.g. official statistics, previously published datasets) and subsequently reused by a researcher for their own analysis, as opposed to primary data collected first-hand

2.4.1. Subsidiarity, (de-)centralization and multi-level governance shaping AECM

This diversity across geographical contexts is grounded in the legal structure of EU governance that specifically shapes the CAP's second pillar. As discussed in Section 2.2, under the subsidiarity principle Member States can define AECM priorities, select measures, set payment levels, and determine targeting strategies according to their own environmental and socio-economic conditions, resulting in an EU mosaic of AECM implementation.

The EU mosaic also encompasses not only the various type of AECM across EU, but also the type of AECM governance adopted in each context, shaping who is involved in running it and how.

Some studies engage directly with this diversity, describing governance arrangements, actors, and roles, aiming to investigate how they are linked to one another (e.g. Prager & Nagel, 2008; Sattler et al., 2023; Schomers et al., 2015; Westerink et al., 2017). Subsidiarity is often introduced as the framing that explains this, and several studies show how differently it takes form once implemented across Member States. Ireland, for example, is described by Lenihan & Brasier, (2009) as a case of sustained centralization, with the Department of Agriculture and Food exercising strong top-down control over both design and implementation. Germany sits at the opposite end, with Weber (2014) and Wilson et al. (1999) showing that the Länder level is central to both design and implementation, even as the national Agriculture Ministry retains responsibility for managing the EU's financial contribution.

Various studies frame this variation also through the concept of multi-level governance (Beckmann et al., 2009; McCarthy et al., 2018; Mettepenningen et al., 2013), used as an analytical device to assess whether a given governance setting is more or less centralized: the more decision-making

power is concentrated at the national level and held by fewer actors, the more centralized the system; the more it is distributed across regional and local levels among a wider range of actors, the more decentralized it is.

The consequences of this degree of centralization for AECM ambition and performance are discussed in several studies, but without converging on a vision of the most adapted governance model. Beckmann et al. (2009) point to the benefits of including local stakeholders and environmental NGOs, implicitly favouring lower centralization, but stop short of defining an optimal degree. Alblas & van Zeben (2023) argues that each additional stage of multi-level implementation introduces a further opportunity for goal dilution, meaning decentralization can just as easily undermine ambition as strengthen it. (McCarthy et al., 2018) go further suggesting that the effects of a given level of centralization are not fixed by design but are actively renegotiated through actor mobilization over time. This comes with no surprise as subsidiarity aims to produce heterogeneous adaptations, so the same nominal degree of centralization can translate into very different governance realities depending on a Member State's institutional traditions, administrative culture, and landscape heritage (Buller et al., 2017).

2.5. The research gaps

The AECM governance literature offers a rich yet uneven account of AECM governance models, actors and arrangements shaping their interactions, and does that across various EU context. It however falls short on three aspects, which are identified in this PhD as research gaps, and which will ground the contribution of the doctoral journey to its academic field.

First, governance remains a comparatively marginal lens within the wider AECM literature, which continues to be dominated by socio-economic and environmental framings. Where governance is addressed, its core concepts,

including ‘governance’ itself, are often loosely or inconsistently defined, limiting comparisons across studies (RG1).

Second, the AECM governance literature mainly relies on case study designs, whether single-country or narrow multi-country comparisons; while well suited to capturing context-specific detail, it constrains the extent to which governance arrangements, and their relationship to ambition and performance, can be assessed systematically across a wider range of Member States, and consequently inform the EU policymaking shaping the broader policy framework of AECM (RG2).

Third, even where the AECM governance literature does link specific governance constraints or lock-ins (being institutional, administrative, or actor driven) to AECM ambition and performance, the role that the multi-level governance framing plays in shaping or explaining these constraints is rarely explored and made explicit (RG3).

2.6. The PhD hypotheses

Building on both literature insights and the derived research gaps, the PhD advances three hypotheses:

H1: Governance has an impact on AECM environmental ambition and performance

This is the foundational hypothesis of the PhD and follows directly from the observation that governance remains a comparatively marginal lens in the broader AECM literature, even though the handful of studies that do engage with it point to a real connection between governance features and environmental outcomes. In the PhD, H1 functions as the premise that justifies and tests whether governance is a key factor shaping how (and if) AECMs pursue and achieves environmental objectives.

H2: Different governance patterns can lead to environmental outcomes

The EU is shaped by a diverse set of governance models and configurations (e.g. degree of centralization, type of actor involved, contract arrangements), yet they can lead to environmental outcomes. In the PhD, H2 anchors the comparative, cross-case empirical work of the literature to move from single-context description toward a more systematic assessment of the diversity of governance patterns, and under which stronger or weaker environmental performance occur.

H3: Multi-level governance frames and explains lock-ins of AECMs

The AECM literature pointed out various shortfalls in their ambition and performance, and the distribution of mandates and interactions across EU, national, regional, and local levels have an influence. Lock-ins can originate at any of these levels (e.g. through path-dependent institutional arrangements, administrative silos, or long-standing alliances between actors) and can also carry across levels, reinforcing or offsetting one another as decisions move from EU regulation down to local implementation.

2.7. The research strategy

This PhD journey entailed choosing a research strategy, composed of the successive choices made throughout the research process. The purpose of this section is to make explicit the range of options, and the reasoning underlying the choices ultimately made. This choice is structured around three main dimensions (i.e. the actors, the policy, and the geographical scope) each of which is presented in turn below. The section's aim is not the convince the reader that the path chosen is best possible option, but rather to clarify the reasoning that guided the choice. In addition, this section presents the initial vision (and intentions) regarding interdisciplinarity and

transdisciplinarity, as methodological and epistemological pillars shaping the PhD as a whole. These initial intentions are revisited in the reflexive chapter (Chapter 8), where they are examined in light of the experiences gather throughout the course of the research.

2.7.1. Actor vision, policy perspective and geographical scope

The first dimension concerns the actors involved in AECM governance. AECM governance is composed of a variety of actors and as mentioned in Section 2.4, much of the AECM governance literature adopts an actor-centred perspective, often engaging directly with these actors through primary data collection and participatory activities. These actors carry different visions of AECM governance and, consequently, represent different entry points from which it can be studied. Two main approaches can be distinguished in this regard: a farm perspective and a policy perspective. The former focuses on the measures themselves and on the operationalisation challenges that governance poses at farm level (Kishioka et al., 2017; Westerink et al., 2020; Zindler et al., 2024). The latter focuses more directly on policy design and implementation, examining how AECMs are designed, coordinated, and implemented as governance arrangements across actors and administrative levels (e.g. Bazzan et al., 2022; Beckmann et al., 2009; Matzdorf et al., 2013; McCarthy et al., 2018; Mettepenningen et al., 2013; Smits et al., 2008). In this dissertation, we adopt the latter.

The second dimension builds on this policy perspective, further distinguishing between a policy process, policy output, or policy outcome lens (Grohmann & Feindt, 2023). The policy process perspective focuses on actors' structural power positions, rooted in institutions, and their effect on policy formulation (Alons, 2017). The policy output perspective focuses on the implementation of policy and the extent to which it changes in line with

a predefined set of objectives (Runhaar, 2016). The policy outcome perspective focuses on actual changes in human behaviour or natural conditions (Biesbroek, 2021), a task made particularly challenging by issues of attribution and measurement (Grohmann & Feindt, 2023), both at farm level (attributing effects to the farming practices implemented) and at landscape level (defining appropriate indicators to measure these effects).

In this PhD, we combine the policy process and policy output perspectives. Our aim is to understand how governance arrangements come about, and how they affect the way policies are implemented and achieve, or fail to achieve, a set of environmental objectives. This means focusing on: i) the design of AECMs at EU and Member State levels; ii) their implementation by actors at national, regional, and local scales; and iii) their operationalisation at farm level.

This leads us to the geographical scope chosen in the PhD, which aims to bridge multiple geographical scales and governance levels by focusing on the interfaces between them, rather than privileging either high-level policy design or individual farm decision-making alone. To do this, the PhD adopts a meso-level analytical approach. As conceptualised by Riera (2026), this approach is centred on scales, and define food and agriculture as systems organised across interconnected scales, including geographical, governance and decision-making, and supply chain dimensions (the latter being relevant more directly with food systems, hence out of scope in this PhD).

In the context of AECMs' governance, geographical levels become part of the research topic rather than solely as a characteristic of the empirical setting. Under the principle of subsidiarity, governance levels are defined and operationalised differently across Member States, and their relationship to geographical levels is not uniform. As a result, the same level (e.g. regional

or national) may correspond to actors, roles and agency residing at different governance levels, depending on the institutional context.

For this reason, the PhD chose to cover all relevant geographical scales (i.e. EU, national and regional), exploiting its research-article structure to set research questions that allow for different and complementary entry points at different geographical scales.

2.7.2. Research questions and research articles

The PhD is grounded in three research questions, each resulting in one or more research articles.

i) Who shapes the AECMs governance and how such governance take place? **(Paper 1; Paper 2)**

ii) What is limiting AECMs environmental ambition and performance, and how this is linked to its governance? **(Paper 2)**

iii) Which strategies are EU Member States adopting to achieve environmental objectives, and which governance levers can be designed and implemented to support this? **(Paper 3; Paper 4)**

Paper 1 is a systematic review of peer-reviewed scientific literature published in English exploring how scientific literature has been i) defining and observing AECMs governance across different geographical contexts in Europe and ii) linking governance to AECMs environmental ambition and performance.

Paper 2 provides a conceptual framework on AECMs governance and conducts a barrier analysis in a regional case study in France, providing empirical findings on a concrete case testing both the conceptual framework and the limits of AECMs' governance in tackling environmental ambition and performance.

Paper 3 is a comparative analysis across all EU Member States, assessing how the subsidiarity discretion they are granted affected either strong or weak EPI across MS CAP Strategic Plans, and identifying key policy and governance pathways leading to strong (or weak) EPI.

Paper 4 is a perspective paper and provides a reflexive exercise on AECMs environmental ambition, bridging the governance perspective insights to the other perspectives to identify key challenges. It provides a proposal on governance levers to tackle the institutional lock-ins constraining AECM performance and strengthen their role towards more sustainable EU agriculture.

Table 4 summarizes how each paper relates to the research gaps and hypotheses identified earlier, as well as to the three dimensions structuring the research strategy (actors, policy, geographical scope).

Table 4: Research gaps, hypothesis, research strategy and the PhD papers

	Paper 1	*Paper 2*	*Paper 3*
Research gaps			
RG 1: governance as marginal perspective	X	X	X
RG 2: case study approach as dominant one	X		X
RG 3: missing link multi-level governance & lock-ins		X	
Hypothesis			
H1: governance has an impact on AECM ambition & performance	X	X	X
H2: Different governance patterns can lead to environmental outcomes	X		X
H3: Multi-level governance frames & explains lock-ins of AECMs		X	
Research strategy			
Actor vision		Policy	
Policy perspective		Policy process & output	
Geographical scope	National	Regional	National/EU

All three papers engage with the first research gap and its corresponding hypothesis (H1), reflecting the overarching premise of this dissertation that governance constitutes a relevant, if underexplored, explanatory factor for AECM ambition and performance. Papers 1 and 3 further address the second research gap and hypothesis (RG2/H2), each moving beyond single-case description: Paper 1 does so by systematically reviewing case studies across the EU, and Paper 3 by comparing governance and policy configurations across all Member States, allowing an assessment of how different governance patterns relate to environmental outcomes. Paper 2, by contrast, is the only paper explicitly engaging with the third research gap and hypothesis (RG3/H3), as it develops and empirically tests a multi-level

governance framework to explain the lock-ins constraining AECM performance in a specific regional case.

2.7.3. An inter and transdisciplinary methodological setting

Insights from different disciplines and sectors are combined in implementing methodological bridges between macro-level policy design and micro-level implementation practices. In this PhD political science, particularly agriculture and environmental policy and governance, work hand in hand with agricultural systems research and sociology. Rather than fragmenting the analysis along disciplinary lines, the PhD adopts a choral approach in which each discipline contributes where it has the strongest explanatory capacity, in line with the definition[15] of interdisciplinarity as provided in Duluins (2025). Moreover, the PhD goes beyond interdisciplinarity as methodological setting, and aims to integrate transdisciplinary methods and approaches, to bridge beyond research, actively engaging with practitioners, in a co-design knowledge endeavour (Popa et al., 2015).

The methodological value added of the PhD lies in i) mastering the different (disciplinary) methodological traditions, ii) ensuring their integration into a coherent framework, that matches the research intentions set by the research questions, and iii) engaging with a broader participatory effort, including both researchers and public policy practitioners as main research partners of the PhD journey.

[15] Interdisciplinarity refers to an approach to research, learning, or problem-solving that integrates knowledge, methods, and perspectives from two or more academic disciplines to address a question, issue, or phenomenon that cannot be fully understood through a single disciplinary lens (Duluins, 2025)

Three key elements support this methodological endeavour. First, a **systemic approach** provides an overarching analytical logic that situates individual disciplinary insights and involved actors within a broader understanding of agri-environmental governance as a system. The system is conceived here as more than the sum of its parts, encompassing both its constitutive elements and the interactions between them. This perspective enables the analysis to capture interdependencies across policy design, implementation practices, and actor dynamics, while offering a coherent framework within which diverse methods can be meaningfully combined.

Second, the PhD adopts a **mixed qualitative-quantitative logic**. This entails a reflexive assessment of where quantitative approaches can generate relevant insights and where qualitative methods are better suited. Given the scope defined by the research questions, excluding either approach would have resulted in a partial understanding of the phenomena under study and weakened the overall analytical quality of the research. Methodological choices are therefore guided by analytical relevance rather than disciplinary convention. By mobilising the complementary strengths of qualitative and quantitative approaches, this logic enhances explanatory depth and robustness, while supporting the consistent integration of diverse methods within a single research design.

Third, the **transdisciplinary network** approach supporting the research process. The PhD is grounded in the ongoing construction of networks involving academic researchers and public policy practitioners, who are engaged both as sources of data and as partners in iterative processes of cross-validation. This approach strengthens the empirical grounding of the analysis and contributes to ensuring the validity, relevance, and practical resonance of the research outcomes.

2.8. The PhD structure

After the introduction and framework chapters (i.e. Chapter 1 & 2), the results section including Chapter 3, 4 and 5 presents the empirical core of the thesis. The research insights developed during the four years' journey of the PhD have resulted in three empirical research articles, two published and one under review at the time of writing. Chapter 3 reflects on how these empirical insights inform (or fall short on) both the research gaps and the PhD hypothesis; eventually the chapter engages with the research limitations.

The three empirical study, along with their analytical components and the subsequent reflections in Chapter 3, collectively inform Chapter 7, the Future chapter, which includes Paper 4, a perspective article.

Upstream, this Framework chapter, Chapter 2, provides the policy and research background within which the PhD scope is defined, identifying the underlying hypothesis that grounds the doctoral journey. Downstream, the Reflexive chapter, Chapter 8, builds on this positioning to further interpret the findings, before leading into the final Conclusion chapter, Chapter 9. **Figure 4** summarizes the PhD structure, aimed at helping the reader navigating the manuscript, both in terms of the content of the PhD and the research (and researcher) journey that have been 'in-the-making' in the last four years.

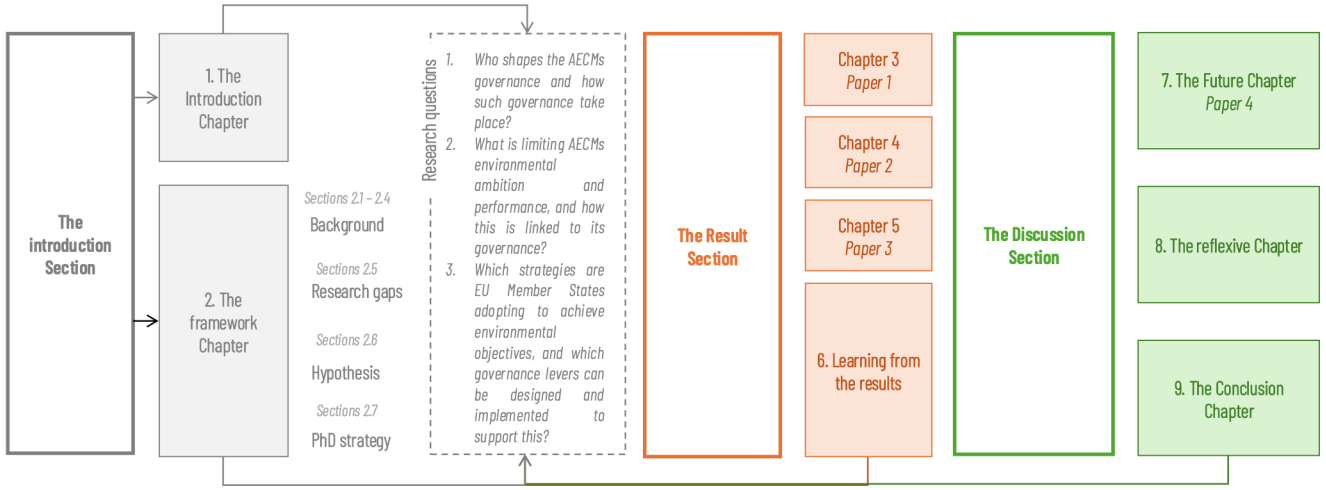


Figure 4: PhD manuscript structure, identifying the links between sections, chapters and research articles (i.e. Papers)

The result section

3. *Paper 1*: Diversity of agri-environmental governance and potential impacts on environmental performance – a systematic review

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Extended abstract

Scope: AECMs' governance has been widely acknowledged, by both research and policy literature, as diverse across the EU, yet no study offers a consolidated overview of this diversity, nor a meta-reflection on its characteristics and their linkage to environmental ambition and performance. Additionally existing research on AECMs tends to treat governance as a contextual or as context-specific feature, without further questioning how (and if) it can actively shape how environmental objectives are defined, negotiated, and implemented. This paper addresses that gap and forms the first empirical building block of the PhD, feeding directly into its first objective: understanding how AECMs' governance is structured and which actors shape decision-making across governance levels.

Link to hypothesis & research gap (Section 2.5 and 2.6): relates to RG1, RG2, H1, and H2. By systematically consolidating a fragmented body of case studies into a single review, it directly addresses RG1, offering the first structured synthesis of a literature in which governance has so far remained a marginal and inconsistently defined lens, and RG2, by moving beyond isolated single-case accounts to compare governance models across 28 studies and multiple Member States. In doing so, it provides cross-case evidence supporting H1, by showing which governance features recur as a

relevant explanatory factor across the reviewed literature, and H2, by documenting that distinct governance configurations (e.g. centralised, decentralised, or mixed models) are associated with different reported outcomes, even if not yet assessed systematically

Methodology: This paper conducts a systematic literature review, following PRISMA 2020 guidelines, of peer-reviewed studies on AECM governance published in English between 1992 and 2024, drawn from the Scopus and Web of Science databases. From an initial pool of 943 records, 28 studies were retained through title, abstract, and full-text screening, and analysed through a structured coding process (using NVivo) covering governance models, actors, and their relationship to environmental performance.

Results: The findings confirm the diversity of AECMs' governance models, ranging from centralized national approaches to highly decentralized regional systems, drawing on evidence from 15 Member States collected across the reviewed articles. The degree of decentralization, multi-level decision-making processes, and the engagement of different actors emerge as key determinants shaping the difference in governance models. The review highlights a tension between centralization and decentralization, where increased subsidiarity enhances local relevance but may lead to policy fragmentation and objective dilution.

The review also identifies three primary governance-related factors influencing AECMs' environmental ambition and performance.

Design-related factors (e.g., contract features and spatial targeting) concern how policy instruments are framed: spatial mismatches between farm-level measures and landscape-scale ecological processes, contract features such as duration and payment structures often negotiated down to secure farmer participation, selection bias linked to compensating actions farmers

would have undertaken anyway, and vaguely defined environmental targets together limit schemes' environmental ambition.

Actor-related factors (e.g., power dynamics and stakeholder participation) reflect the persistent dominance of agricultural administrations and farmers' associations in decision-making. This historical partnership is rarely counterbalanced by an equivalent role for environmental ministries and NGOs, whose formal participation does not translate into comparable influence. This pattern is reinforced by managing authorities' tendency to perceive participatory approaches as a threat to their own legitimacy. Implementation-related factors (e.g., monitoring challenges and transaction costs) relate to limited and unevenly integrated knowledge across governance levels, the administrative burden of monitoring and audit requirements that constrains their contribution to adaptive management, and transaction costs that tend to rise with decentralization, in turn reducing participation and efficiency.

Finally, the results underline the role of path dependency as a cross-cutting factor: long-standing relationships and institutional legacies among key practitioners, such as historical alliances between agricultural administrations and farmer organizations, continue to shape current policy dynamics. It also defines the mandates of the various actors involved, often reinforcing existing power imbalances between agricultural and environmental domains. Together, these results establish the governance framing and analytical categories that structure the rest of the PhD.

3.1. Introduction

The governance of Agri-Environmental Schemes[16] (AES) in the EU has been a research topic over more than the past two decades within the broader

[16]AES is the broader term for EU funding schemes supporting environmentally beneficial farming practices. On the other hand, AECM refers to the individual measures bundled within such schemes, a term that

literature on AES (Batáry et al., 2015; Kleijn et al., 2006; Matzdorf & Lorenz, 2010; Primdahl et al., 2003, 2010; Schulze et al., 2023; Whittingham, 2011; Uthes & Matzdorf, 2013; Lowe & Baldock, 2000; Buller et al., 2017). The AES literature has been largely dominated by ecological and economic perspectives in addressing the challenges within agri-environmental programming in achieving its environmental objectives. However, emerging studies focused on governance-related factors underline their key role in shaping the AES's environmental performance, defined as the extent to which the environmental objectives of an AES can best be achieved (Schomers & Matzdorf, 2013; Uthes & Matzdorf, 2013). The AES governance literature converges on several common elements characterizing the concept of governance: a clear goal or priority to be achieved, a plurality of actors from both public and private entities, dynamic interactions among these actors (Beckmann et al., 2009; Westerink et al., 2017; Bazzan, Candel, et al., 2023; Sattler et al., 2023), and the presence of institutions, rules, and institutional arrangements that shape these interactions (Meyer et al., 2015; Lien et al., 2018; Bazzan, Candel, et al., 2023). Consistent with the multi-level governance framework prevalent in EU public policy studies (Hooghe & Marks, 2001; Jordan, 2001; Hooghe & Marks, 2003; Bache et al., 2016), AES governance research also underlines that decision-making occurs at various levels, affecting both the design features (e.g. spatial targeting, payment structure, duration of contracts) (Bazzan, Daugbjerg, et al., 2023) and the overall governance structure (Beckmann, 2009).

Yet, the evidence generated by AES governance literature is often fragmented across different geographical contexts, reflecting the diversity of

gained prominence after the 2014-2020 CAP reform explicitly added a climate-change objective. In the literature the two acronyms are often used interchangeably, particularly for post-2014 schemes. In this PhD, aligning with the literature, the terms are used interchangeably, keeping the wording used in the published articles

governance models implemented across EU Member States (Beckmann et al., 2009; Sattler et al., 2023; Schomers et al., 2015). AES serve as a policy instrument with specific design features that involve a particular group of actors, while also acting as a farm-level measure that is defined by how it is implemented and put into practice. Under the principle of subsidiarity that governs the second pillar of the Common Agricultural Policy (CAP) in which AES are included, AES design, implementation, and actor interactions vary significantly across the EU. These variations lead to distinct adaptations of the EU policy framework, under different governance models, within each Member State and even at sub-national regional and local levels (Beckmann et al., 2009; Mazorra, 2001; Zwaan et al., 2023). Consequently, the governance models linking policy and farm-level implementation differ widely across the EU.

Several literature reviews have addressed key themes related to AES, mainly focusing on farmer preferences and behavioural determinants in the adoption of AES (Klebl et al., 2023; Schaub et al., 2023; Schulze et al., 2023), but also contractual features (Olivieri et al., 2021). Among these, the review conducted by Uthes & Matzdorf, (2013) serves as a key reference, offering an overview of research topics, major findings, and future challenges associated with AES. Their study highlights governance and institutional environments as critical factors influencing AES environmental performance, calling for higher relevance and empirical implications of AES literature for decision-making processes occurring at both policy and farm level. Despite the initial insights provided by Uthes & Matzdorf, (2013), the evidence from AES governance literature remains fragmented, and navigating through the multitude of studies on AES governance remains challenging. To date, no comprehensive review has systematically synthesized the available evidence on this research topic.

Against this background, the present research aims for a comprehensive overview of the fragmented AES governance literature, drawing further insights on the research topic by systematically consolidating evidence on governance models in different EU Member States. By examining the features of the AES governance models, through AES design, implementation, and actor interactions, this review highlights the diversity of governance approaches and their implications for their environmental performance. In doing so, it enhances the empirical and policy relevance of AES governance research, facilitating a more coherent understanding for both scholars and practitioners.

For this, we address the following research questions:

1. What characterizes AES governance models (i.e., AES design, implementation, and actor interactions) in different EU Member States?
2. What does the literature reveal about the linkage between AES governance features and AES environmental performance?

The paper is structured as follows: Section 2 outlines the methodological framework of the study; Section 3 presents the results, addressing each research question separately; Section 4 discusses the findings, synthesizing insights from both research questions and reflecting on overall AES governance; and Section 5 concludes with key recommendations and final remarks.

3.2. Methodology

This study employed a systematic literature review guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement (Page et al., 2021). The PRISMA framework was selected for its

robustness and replicability, providing a transparent approach to identifying, selecting, and synthesizing relevant studies (**Figure 5**). The review was conducted using two major bibliographic databases, Scopus and the Web of Science Core Collection, which offer extensive coverage of peer-reviewed publications. Both databases index a broad spectrum of scholarly outputs, including journal articles, conference proceedings, books and book chapters, editorials, and review papers, as well as other scientific and technical documents across diverse disciplines, ensuring comprehensive coverage of relevant literature.

3.2.1. Search terms

Search terms were categorized into four thematic areas, as presented in **Table 5**, with the design of the search strategy drawing inspiration from Klebl et al., (2023). The search strategy aimed to retrieve articles based on three main thematic areas, derived from the research boundaries set by the two research questions: i) the policy instrument (i.e. the agri-environmental schemes), ii) the policy framework (i.e. the Common Agricultural Policy) and iii) the research topic (i.e. governance). We did not include references to specific Member States, as agri-environmental schemes and the CAP inherently encompass the geographical scope (i.e., the EU and its related MS). In other words, we selected articles based on their references to agri-environmental schemes, excluding those that focused solely on geographical context without discussing these schemes.

For the first two categories, we included various synonyms and alternative spellings or acronyms. To address governance-related aspects, we relied on the authors' knowledge of pertinent literature. We selected a few key references to extract frequently recurring terminology used to refer to "governance," which informed the "research topic" category in **Table 5**. The timespan focused on publications from 1992 to 2024, reflecting the

beginning of AES implementation under the MacSharry reform across Member States. Environmental performance was not explicitly targeted through keyword selection but was addressed through the coding process during the analysis phase. This strategy, while excluding some articles, reduced noise in the dataset, ensuring a focus on the core literature relevant to the study's objectives. The research design is grounded in the assumption that, for our study, AES governance literature includes elements of AES environmental performance literature. Still, the latter do not always explore elements of AES governance. This assumption ensures the targeting of articles where a direct link between AES governance and AES environmental performance is explored. Including all AES environmental performance studies would result in a broader and less targeted literature set, potentially diluting this focus.

Table 5: Search terms organized per category

Policy instrument	(((agri-environment* OR agrienvironment* OR agri-climate-environment* OR aecm*) AND (measure* OR scheme* OR program* OR programme*))
Policy framework	AND (CAP OR "common agricultural policy" OR policy)
Research topic	AND ("governance" OR institution* OR multilevel OR multi-level OR sub-national OR region* OR admin* OR meso* OR meso-level OR intermedia* OR subnational OR subsystem OR sub-system)))
Time span	AND PUBYEAR > 1992 AND PUBYEAR < 2025

3.2.2. Article screening and selection

The review process involved three main phases: i) title screening, ii) abstract screening, and iii) full-text screening (Supplementary Materials – Annex 1). We firstly remove all duplicates, then screened titles, excluding articles outside the geographical scope of EU and not written in English. During the abstract screening phase, two reviewers independently evaluated the abstracts against the predefined inclusion criteria in **Table 6**.

Table 6: List of inclusion criteria at abstract screening

Inclusion criteria
1. Focused on governance & implementation of AES
2. Focus on AES predominantly, even if using other subsidy schemes as comparison
3. Peer-reviewed papers
4. In EU and MS
5. Timespan of the policy framework and instrument (from 1992 to 2024)
6. Written in English

When uncertainty arose, an inclusive approach was adopted, including articles for further review. Following the abstract screening, the reviewers met twice to resolve divergent scoring and finalise the selection of articles. The full-text screening phase, conducted solely by the first author, involved a full-length screening of the articles to identify those meeting all inclusion criteria. A few articles were not retrieved and, therefore, were excluded from the review. Reasons for exclusion were systematically documented, and four primary exclusion categories were identified, as summarised in **Figure 5**. Full-text screening focused primarily on the results and discussion sections, selecting papers that provided detailed insights into the functioning of governance models. Specifically, we included studies that offered an in-depth understanding of the processes linking actors and their mandates across the design and implementation phases of AES governance.

Papers were excluded if they lacked granular information on governance models, treating governance only as a contextual element or referencing it without detailing its functioning. Additionally, some papers were excluded during the title and abstract screening as their focus, while appearing relevant to AES, ultimately addressed subsidy frameworks beyond the scope of this research. One paper was excluded due to its full text being in French, despite an English abstract, and another was excluded after the full text

revealed a geographical focus outside the EU, which was not clearly stated in the abstract

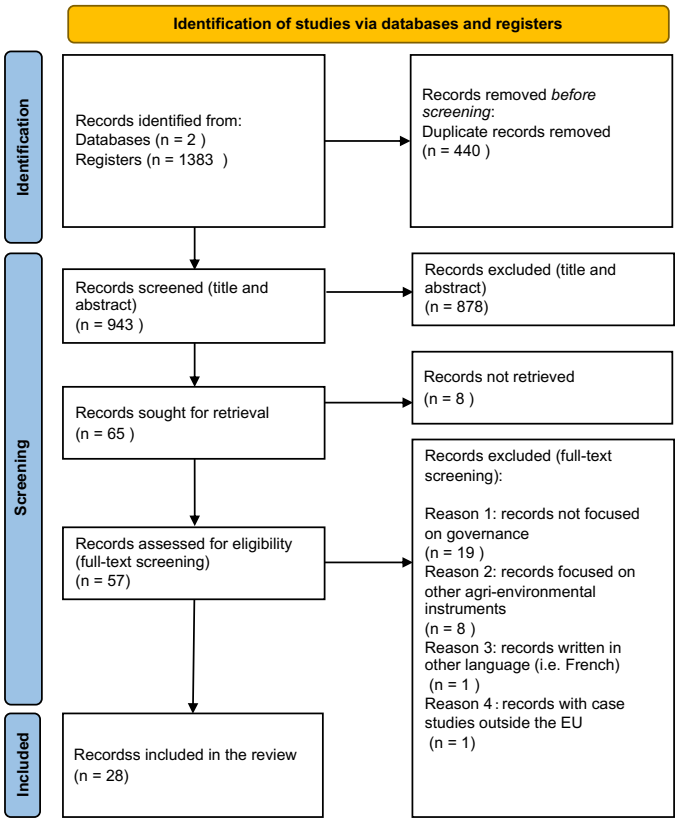


Figure 5: Identification, screening, and inclusion process of relevant studies[17]

3.2.3. Coding phase

A comprehensive coding process was carried out using NVivo software to analyse the selected articles. The coding architecture provided in the Supplementary Materials – Annex 2 primarily involved retrieving information under i) *case attributes* and ii) *qualitative codes*.

[17] Source Authors' compilation, based on the PRISMA 2020 flow diagram

Case attributes captured quantitative metadata for each article, including publication year, methodology, and study location. These attributes were assigned based on a full-text review but were not linked to specific sections of the articles. They provided descriptive statistics and facilitated comparative analyses across studies and geographical contexts, informing the results presented in **Section 3.3**.

Qualitative codes identified key concepts relevant to the research questions, specifically AES governance models across Member States and the relationship between governance factors and AES environmental performance. Governance-related codes grouped information on (i) key actors, (ii) governance features associated with different models, and (iii) references to the multi-level nature of governance. We identified these three thematic areas through an iterative process, observing that information on governance models in the reviewed articles consistently clustered around these themes. This alignment reflects both the characteristics of the policy framework, and the design and implementation feature intrinsic to the AES policy instrument. Given that AES is grounded in the subsidiarity principle, it entails multiple levels of decision-making streams (i.e. different processes of evaluating options and making choices to achieve goals), flexibility in implementation across Member States, and the involvement of different actors depending on the geographical context.

For the link between governance factors and environmental performance, codes were categorised based on recurring arguments across the articles.

The coding strategy was developed and implemented in three phases. In the first, ex-ante phase, the coding architecture was jointly designed, discussed, and validated by both authors to ensure alignment with the research questions and to incorporate closed or clearly operationalised

categories, thereby reducing the risk of interpretation bias. In the second phase, the first author conducted the coding for both case attributes and qualitative codes. In the third, ex-post phase, all ambiguous cases were flagged and jointly reviewed during monthly meetings to ensure consistency and robustness in the interpretation.

The result section provides insights from descriptive statistics derived from case attributes (i.e. Section 3.1), an analysis of governance models and related features aligning with the first research question (i.e. Section 3.2) and an overview of the insights provided by selected articles on the link between governance factors and AES environmental performance, aligning with the second research question (i.e. Section 3.3).

3.3. Results

3.3.1. An overview of the selected studies

The databases retrieved under Scopus and Web of Science were merged, resulting in 1383 records. We retrieved and eliminated 440 duplicates, resulting in 943 that passed the screening phase of the PRISMA method. The remaining 943 records comprised a variety of research outputs, predominantly journal articles (n = 810), followed by review papers (n = 51), book chapters (n = 20), and conference papers (n = 29). While reviewing the title and abstract of these records, we excluded 878 for lack of relevance with the target of this review on AES governance and included 65 for full-text screening. Eventually, only 57 records were retrieved, and the last phase of full-text screening allowed the selection of 28 in the review (**Figure 5** and Annex 1, Supplementary Materials).

The 28 articles, including 27 journal articles and one review paper, were published from 1999 to 2023 (**Figure 6**), with some years having no publication, like 2000, and a window from 2002 to 2007.

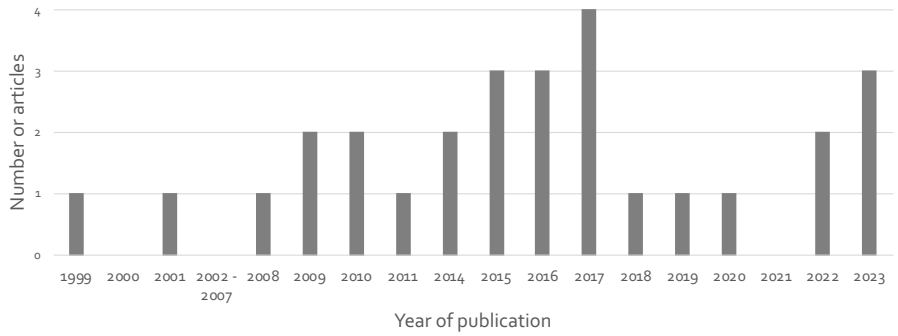


Figure 6: Frequency per year of publication of the selected articles

All selected articles adopted a case study approach, ranging from 15 different Member States. As shown in **Figure 7**, the Netherlands, with 12 cases, is highly represented, reflecting its pioneering role in AES development, having initiated these schemes in the 1980s (Dupraz & Guyomard, 2019). With Germany (9 cases), United Kingdom and Ireland (4 cases), northern EU countries are overrepresented, while studies focusing on southern and eastern EU sub-national regions are less frequent.

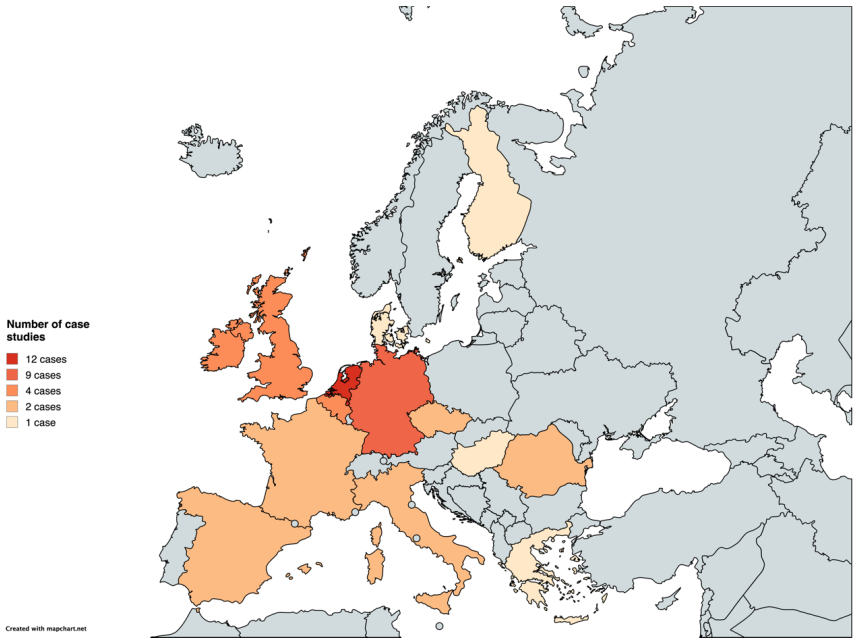


Figure 7: Geographical distribution of the case studies in the selected articles (created with MapChart)

The reviewed papers are evenly divided between studies using single-case and multiple-case designs, showcasing heterogeneity in both categories. The case studies range from national to regional focus, with multiple case studies comparing regions or Member States (MS) across the EU (**Table 7**).

Table 7: Count of papers per geographical scope (i.e. EU vs MS) & type of case study approach (i.e. multiple case studies vs single case study)

Geographical reach	EU		MS		Total
Case study scale	*National*	*Regional*	*National*	*Regional*	
Multiple case studies	3	3	N/A	8	14
Single case study	N/A	N/A	7	7	14
Total	3	3	7	15	28

Of the studies reviewed, 15 focus on regional case studies within specific MSs, eight employ multiple-case designs, and seven focus on single cases (**Table 7**). This emphasis on the regional scale aligns with the subsidiarity principle governing the AES policy framework, which allows delegating significant decision-making authority to regional levels.

The methodologies adopted in the selected articles include qualitative, quantitative, and mixed methods, with a notable dominance of qualitative approaches (for specific information on methods see **Table 8** and **Table 9** providing all information retrieved during the case attribute coding phase). Among the 28 studies reviewed, 18 employed qualitative methodologies, 9 utilized mixed methods, and only 1 relied exclusively on quantitative methods. Data sources also varied significantly: seven studies used semi-structured interviews, two conducted desktop research, and two implemented surveys. The remaining 17 studies combined multiple data sources, often integrating above mentioned data types, relying on both primary and secondary data. Regarding the types of AES analysed, 17

studies focused on action-based AES contracts (i.e., payments for adopting specific practices, regardless of outcomes), while 4 examined collective-based AES (i.e., agreements requiring group coordination for landscape-scale benefits), predominantly in the Netherlands (3) and Ireland (1). Additionally, 3 studies explored multiple contract types, and 4 did not specify the contract types included in their analysis.

Table 8: List of selected studies and related meta-data information retrieved from case attributes coding phase – single case study

Location of the study	Location of the study - specific	Authorship	Year	AES type	Period under study	Data type	Methodology	Methodology - specific
National	Czech Republic	Prazan & Theesfeld	2014	Means-based (Grassland measures)	2009-2011	Semi-directed interviews	Qualitative	Not specified
	Germany	Schomers et al.	2015	Means-based	2011-2012	Mixed	Qualitative	Not specified
	Ireland	McCarthy et al.	2018	Collective	2000 - 2016	Desktop research	Mixed	Process tracing
	Spain	Mazorra	2001	Means-based	1994-2001	Mixed	Mixed	Not specified
	The Netherlands	Alblas et al.	2023	Collective	2016-2022	Mixed	Qualitative	Applied Thematic Analysis
	The Netherlands	Smits et al.	2008	Not specified	Not specified	Desktop research	Qualitative	New institutional-economics
	United Kingdom	Hejnowicz et al.	2016	Means-based	CAP 2007 - 2013	Survey	Mixed	Not specified
Regional	Belgium	Dedeurwaerdere et al.	2015	Means-based	CAP 2007 - 2013	Mixed	Mixed	Thematic analysis, bi-probit model
	Germany	Hirsch et al.	2022	Means-based	2015-2020	Mixed	Qualitative	Content analysis
	Germany	Weber	2014	Means-based	2011	Semi-directed interviews	Qualitative	Coding
	Ireland	Lenihan & Brasier	2009	Means-based	200-2006	Mixed	Qualitative	Discourse analysis, coding

The Netherlands	Bazzan et al.	2023	Collective	CAP 2014-2020	Semi-directed interviews	Qualitative	Theory-building or inductive process tracing
The Netherlands	De Vries et al.	2019	Collective	Multiple	Mixed	Qualitative	Coding
The Netherlands	Zwaan & Goverde	2010	Green Services	2001-2009	Mixed	Qualitative	Not specified

Table 9: List of selected studies and related meta-data information retrieved from case attributes coding phase – multiple case studies

Location of the study	Location of the study - specific	Authorship	Year	AES type	Period under study	Data type	Methodology	Methodology - specific
EU	France, Germany, Ireland, The Netherlands, United Kingdom, Belgium,	Sattler et al.	2023	Result-based, collective, land tenure, value chain	Not specified	Survey & desktop research	Mixed	Not specified
	Austria, Denmark, Greece, Romania, The Netherlands	Vesterager et al.	2016	Means-based	1994-2013	Mixed	Qualitative	Not specified
	Germany, Spain	Wilson et al.	1999	Means-based	1993-1996	Mixed	Mixed	Not specified
EU & Regional	Belgium, Czech Republic, Finland, France, Germany, Ireland, Italy, The Netherlands, United Kingdom	Beckmann et al.	2009	Not specified	2006	Survey	Quantitative	Regression analysis
	Austria, Germany, The Netherlands,	Bethwell et al.	2022	Mixed	CAP 2014-2020?	Mixed	Qualitative	Not specified
	Belgium, France, Germany, The Netherlands, United Kingdom,	Westerink et al.	2017	Means-based, collective	1996-2016	Semi-directed interviews	Mixed	Qualitative comparative analysis
Regional	France	Benoit & Patsias	2017	Means-based	CAP 2007 - 2013	Semi-directed interviews	Qualitative	Coding
	The Netherlands	Franks	2010	Not specified	Not Applicable	Mixed	Qualitative	Not specified
	Germany	Hauck et al.	2016	Not specified	CAP 2014-2020	Semi-directed interviews	Mixed	Social Network Analysis
	Hungary	Kovács	2015	Means-based	2011-2014	Mixed	Qualitative	Not specified

Romania	Manolache et al.	2020	Means-based	CAP 2014-2020	Mixed	Mixed	Social Network Analysis
The Netherlands	Runhaar et al.	2017	Means-based, collective	2000-2016	Mixed	Qualitative	Not specified
Italy	Toderi et al.	2017	Means-based	CAP 2007 - 2013	Semi-directed interviews	Qualitative	SLIM diagnostic framework
Belgium	Van Herzele et al.	2011	Means-based	2008	Mixed	Qualitative	Not specified

3.3.2. A diversity of AECM governance models across EU Member State

The next four sub-sections provide insights into the analysis of the qualitative codes, exploring the first research question on AES governance models in different EU Member States. To do so, we explore: i) the multi-level framework characterizing the AES governance, along with different degrees of centralization, ii) different governance arrangements, and iii) interactions across AES governance actors (**Figure 8**).

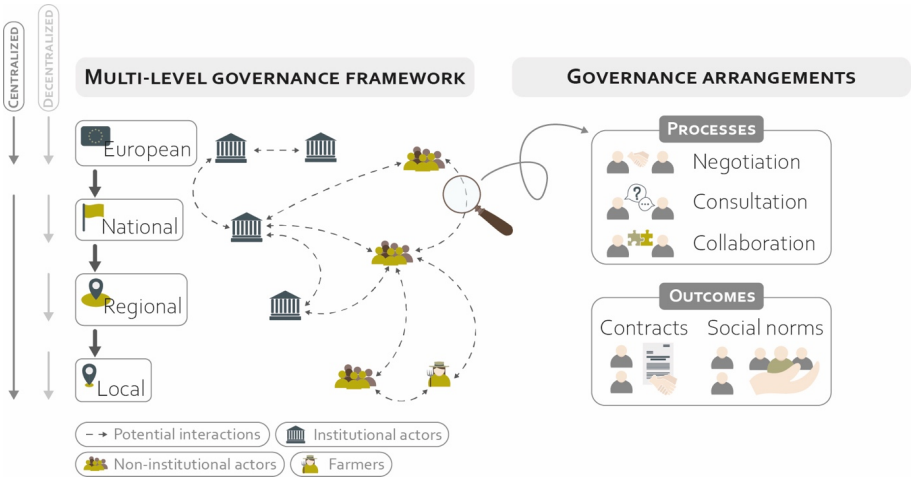


Figure 8: An overview summarizing the main dimensions explaining the diversity of AES governance models[18]

3.3.2.1. Decentralization & multi-level governance

The AES governance in the EU operates within a recognized multi-level governance framework (Beckmann et al., 2009; McCarthy et al., 2018;

[18] The figure illustrates how Member States may adopt either centralized or decentralized arrangements within a broader multi-level governance framework, involving stakeholders operating across different governance levels and geographical scales. These stakeholders include both institutional and non-institutional actors, whose interactions are mediated through processes such as negotiations, consultations, or collaborative arrangements. Such processes may take place in isolation or in combination. Ultimately, these interactions lead to two main types of outcomes: i) formal contracts, for instance agreements between governmental agencies and farmers for AES enrolment, and ii) informal arrangements expressed as social norms, such as the development of trust and shared expectations among actors.

Mettepenningen et al., 2013). In the review, we identified 18 studies explicitly mentioning governance levels, and the multi-level nature of AES governance. A key element for the multi-level governance of AES is the degree of (de)centralization in their design and implementation across MS, with decision-making responsibilities distributed among local, regional, and national levels (Beckmann et al., 2009; Mazorra, 2001; Sattler et al., 2023; Schomers et al., 2015; Zwaan & Goverde, 2010). While the multi-level framework structures AES governance by defining distinct governance levels, (de)centralization determines the distribution of decision-making mandate across these levels, shaping both design and implementation. The subsidiarity principle is key in the AES multi-level governance model guiding agri-environmental policies across the EU. Under such principle, the EU establishes general policy guidelines through Council and Commission regulations, creating a framework for MS decision-making (Beckmann et al., 2009). Member States then determine whether to delegate responsibilities to lower levels of government, such as regional or local authorities, for developing AES. The EU encourages decentralized policy design (Benoit & Patsias, 2017), a stance reflected in AES funding structures where the EU co-financing the budget. At the same time, MS or regions decide on program specifics and cover the remaining costs (Beckmann et al., 2009).

Member States have responded differently to this flexibility (**Table 10**), resulting in varied governance models ranging from centralized national approaches to more decentralized one governing AES (Beckmann et al., 2009). However, drawing a strict line between centralized and decentralized models is difficult, as Member States often combine elements of both, and in some cases explicitly adopt mixed governance features. As Runhaar et al., (2017) points out governance models may even evolve over time, with centralized systems progressively delegating responsibilities and moving towards more decentralized structures. The degree of centralization is

discussed in each paper according to the specificity of each case study, yet some elements reoccur across the studies.

A first one is the responsibility cascade: in decentralized models, regional or provincial governments often receive the mandate for AES implementation and further delegate operational tasks, such as subsidy allocation or the designation of targeted areas, to local entities (Alblas & van Zeben, 2023; Bazzan, Candel, et al., 2023; Benoit & Patsias, 2017; de Vries et al., 2019; Mazorra, 2001; Prazan & Theesfeld, 2014). In contrast, centralized systems tend to keep responsibilities at the national level (Lenihan & Brasier, 2009). In both cases, however, the cascade from the EU to the Member State is a constant feature of the CAP framework and the subsidiarity principle governing it (Beckmann et al., 2009; Bethwell et al., 2022).

A second reoccurring element is the role of collective dynamics, specifically in decentralized models in shaping the AES implementation. While most studies focus on farmers' collectives, and their role in the AES governance (Alblas & van Zeben, 2023; Bazzan, Candel, et al., 2023; Manolache et al., 2020), the reviewed studies mention other collective forms of decision-making, involving for example local authorities, civil society actors or farmer advisors (de Vries et al., 2019; Manolache et al., 2020; Sattler et al., 2023).

A third recurring element is the delegation of technical advice to farmers, which is frequently entrusted to local actors or authorities. This occurs in both centralized (Lenihan & Brasier, 2009) and decentralized models (Hejnowicz et al., 2016; Prazan & Theesfeld, 2014; Van Herzele et al., 2011). By contrast, strategic responsibilities remain consistently with the Ministry of Agriculture and its departments, also in both decentralized and centralized models.

Taking the entry point of Member States, Beckmann et al., (2009) define France as a more decentralized model and Ireland maintaining a highly centralized system. Benoit & Patsias, (2017) tends to partially disagree, and points out that France has had a traditionally centralized model, and only during the CAP programming period 2007-2013 has delegated key responsibilities to regional level governments and has established a multi-stakeholder committee to manage the implementation of one AES. Alblas & van Zeben, (2023) and Bazzan et al., (2023), focusing on the Netherlands, highlighting a mix of the two types of governance. The Dutch system adopts a decentralized approach in AES implementation and a more centralized approach in AES design, with Provincial governments managing the former and national government for the latter, setting targets and ensuring compliance with EU requirements through national frameworks for controls and sanctions (Alblas & van Zeben, 2023; Bazzan, Candel, et al., 2023). Ireland maintains a more centralized, state-led governance model for AES. The Department of Agriculture and Food exerts strong top-down control over the design and implementation of AES (Lenihan & Brasier, 2009). Belgium has two different dynamics, depending on its two regions, Wallonia and Flanders. Both Flanders and Wallonia exhibit regionalized AES governance, meaning significant decision-making and implementation power resides at the regional level, aligning with the governance structure of the country. However, they differ in the structure and centralization of their advisory systems and various governance arrangements (Beckmann et al., 2009; Dedeurwaerdere et al., 2015; Van Herzele et al., 2011; Westerink et al., 2017). Various studies have also explored Germany as a case study (Hirsch et al., 2022; Schomers et al., 2015; Wilson et al., 1999; Weber, 2014), underlying a highly decentralized approach to AES governance. The level of Länder (i.e., the regional or federal state administrative level, positioned between the national government and municipal authorities) is key for both

the design and implementation of AES (Weber, 2014; Wilson et al., 1999). At the national level, the German Agriculture Ministry manages the Community contribution to financing individual schemes (Wilson et al., 1999).

Table 10: Member States and type of governance identified by the reviewed studies (i.e. centralized, decentralized or mixed, mixing elements of both type)

Member State	Type of governance	Related reviewed studies
Austria	Not specified	Vesterager et al., 2016
Denmark	Not specified	Vesterager et al., 2016
Finland	Decentralized	Beckmann et al. 2009
Greece	Not specified	Vesterager et al., 2016
Hungary	Centralized	Kovács, 2015
Belgium - Wallonia	Centralized	Beckmann et al. 2009; Dedeurwaerdere et al., 2015; Van Herzele et al., 2011;
Belgium - Flanders	Decentralized	Beckmann et al. 2009; Sattler et al., 2023; Van Herzele et al., 2011; Westerink et al., 2017
Czech Republic	Decentralized	Beckmann et al. 2009; Prazan & Theesfeld, 2014
France	Decentralized	Beckmann et al. 2009; Benoit & Patsias, 2017; Sattler et al., 2023; Westerink et al., 2017
Germany	Decentralized	Beckmann et al. 2009; Bethwell et al., 2022; Hauck et al., 2016; Hirsch et al., 2016; Sattler et al., 2023; Schomers et al., 2015; Weber, 2014; Westerink et al., 2017; Wilson et al., 1999
Ireland	Centralized	Beckmann et al. 2009;Lenihan & Brasier, 2009; McCarthy et al., 2018; Sattler et al., 2023
Italy	Decentralized	Toderi et al., 2017
Romania	Not specified	Vesterager et al., 2016; Manolache et al. 2020
Spain	Mixed	Mazorra, 2001; Wilson et al., 1999
The Netherlands	Mixed	Alblas et al., 2023; Bazzan et al. 2023; De Vries, 2019; Franks, 2010; Runhaaret al., 2017; Smits et al., 2008; Vesterager et al., 2016; Zwaan & Goverde, 2010
United Kingdom	Decentralized	Beckmann et al. 2009; Hejnowicz et al., 2016; Sattler et al., 2023; Westerink et al., 2017

The question of whether AES governance is more effective under higher or lower levels of centralization could be explored mainly through comparative analyses across Member States, shedding light on the respective

advantages and limitations of each approach. Out of the 28 studies retained, six were comparative analyses (Beckmann et al., 2009; Bethwell et al., 2022; Sattler et al., 2023; Vesterager et al., 2016; Westerink et al., 2017; Wilson et al., 1999). Among these, Beckmann et al., (2009); Bethwell et al., (2022) and Vesterager et al., (2016) engage most directly with the relationship between the degree of centralization and environmental performance. Beckmann et al., (2009) highlights the benefits of including local stakeholders and environmental NGOs, implicitly pointing towards lower levels of centralization that prioritize inclusiveness, though the emphasis is more on inclusion than on defining an optimal degree of centralization. A similar focus on local dynamics is found in Westerink et al., (2017). Vesterager et al., (2016), while addressing related questions, considers centralization mainly through political and institutional capacity, underlining their role in enabling AES to achieve environmental objectives. Bethwell et al., (2022), by contrast, stresses the influence of regional context, showing that both more centralized and more decentralized elements can be effective depending on conditions.

Also studies focussing on one case study seem to align with such conclusions; Benoit & Patsias, (2017), referencing (Dinnie et al., 2015; McCauley, 2008; van Zeijl-Rozema et al., 2008), argues for a shift from command-and-control management toward bottom-up and multi-stakeholder processes that balance authority and resource sharing. The significant role of regional and local interests in AES governance suggests these dynamics can shape policy design and implementation (Mazorra, 2001). However, decentralization is complex, involving both degrees of decision-making autonomy and distinct structural choices. While some improvements can occur within existing structures, Beckmann et al., (2009) notes that others may require structural reforms. Yet, determining an 'optimal' governance model remains challenging due to differing

perceptions of public goods and services. Decentralization also presents risks, as pointed out by Alblas & van Zeben, (2023), as each stage of multi-level implementation introduces opportunities for goal dilution, potentially undermining the EU's objectives (H. A. C. Runhaar et al., 2017).

In conclusion, the reviewed studies provide a diversity of messages, underlying a potential trade-off in defining the governance model: on the one hand, it warns of weakened policy goals through decentralization; on the other hand, it emphasizes that empowering local governments can better align AES with local environmental needs. Overall, recommendations of the selected studies tend to concentrate on policy design, objectives, instruments, and funding, rather than explicitly on the degree of centralization. With the partial exception of Beckmann et al., (2009), none provide a structured comparative assessment of the conditions under which different levels of centralization contribute to AES environmental performance.

3.3.2.2. Governance within and across levels

Beyond the multi-level governance framework shaping decision-making in AES, the reviewed studies provide valuable insights into the decision-making process (i.e. process of evaluating options and making choices to achieve goals). The findings reveal reoccurring governance features defining the general policy framework of AES and determining how decision-making power is distributed within and across governance levels (Beckmann et al., 2009; Zwaan & Goverde, 2010). Bethwell et al., (2022) notes that vertical governance structures shape AES schemes, as the European Commission mandates Member States to implement these programs through CAP Pillar II regulations. Dedeurwaerdere et al., (2015) further emphasizes that AES is often managed by centralized follow-up committees within Member States or by regional authorities, reflecting a top-down approach in the design and

monitoring of schemes. However, various studies point out a certain degree of coordination among actors at the same governance level in shaping decision-making outputs (Beckmann et al., 2009). For example, Beckmann et al., (2009) underlines the dynamics occurring at the EU level, where coordination occurs between the EU Council, Commission, and Parliament for the drafting of the EU regulations governing the CAP, and consequently the AES. (Dedeurwaerdere et al., (2015) introduce the concept of co-governance, noting that while the design features of AES typically rely on government actors, there are cases where governance is shared with non-governmental actors, thereby expanding the range of governance levels.

3.3.2.3. Governance arrangements

If the distribution of decision-making power within and across levels is pivotal in shaping AES governance models, governance arrangements also play a key role by shaping actors' interactions (Meyer et al., 2015; Lien et al., 2018; Bazzan, Candel, et al., 2023). The reviewed studies identify a variety of those arrangements, which we organize as follows: arrangement processes (i.e., structured interactions that organize relationships and actions among actors) and arrangement outcomes (i.e., the formal and informal agreements resulting from organized processes).

We identified three main types of arrangement processes identified in the reviewed articles: negotiations, consultations, and collaborations.

Formal and informal negotiations occur across all governance levels and influence AES design and implementation. For instance, Prazan & Theesfeld, (2014) highlight negotiations between farmers and administrators regarding specific AES implementation features, such as fertilizer use at the farm level. Negotiations also occur between the EU, national and regional actors concerning AES design features (Toderi et al., 2017; Wilson et al., 1999).

Consultations involve information exchanges decision-makers initiate to reduce knowledge gaps or gather feedback on AES implementation (Bazzan, Candel, et al., 2023). However, as Dedeurwaerdere et al., (2015) noted, consultations are non-binding and do not shift decision-making power to other actors. Despite this, many stakeholders are frequently consulted in AES governance (Beckmann et al., 2009), often across governance levels. Collaboration is frequently mentioned in the literature but is often vaguely defined. Studies typically identify who collaborates with whom but provide limited insight into how collaboration influences decision-making.

The arrangement outcomes identified in the reviewed articles are: contracts and social norms. Contracts represent formal, binding agreements between two or more actors in AES governance. These can occur within or across governance levels. Examples include land use agreements between farmers and landowners (Hauck et al., 2016), AES contracts between regional administrations and farmers (Beckmann et al., 2009; Lenihan & Brasier, 2009; Mazorra, 2001), and agreements between the EU and Member States (Beckmann et al., 2009). AES contracts can involve individual farmers, collectives, or value chain actors (Sattler et al., 2023). The EU also imposes binding guidelines on Member States concerning contract duration, payment calculations, and monitoring systems (Prazan & Theesfeld, 2014; Schomers et al., 2015). Additionally, EU institutions are bound by public spending accountability, necessitating monitoring activities and control systems (Weber, 2014).

Social norms, as informal agreements, shape participation in AES, particularly among farmers (Dedeurwaerdere et al., 2015). Dedeurwaerdere et al., (2015) emphasize the role of personal values in motivating farmers' engagement, showing that socio-cultural and ecological considerations matter alongside economic concerns for financial viability. Their study

discusses how such values can act as tipping points in decision-making, especially when farmers face choices about alternative practices and broader farm management strategies. Social norms also influence collaborative networks in governance structures. Closely related to social norms is trust, identified as a critical factor in effective AES implementation (Bazzan, Candel, et al., 2023; de Vries et al., 2019; Dedeurwaerdere et al., 2015). Trust affects farmers' decisions to join collective contracts, perceptions of administrative systems, and the stringency of control systems (Smits et al., 2008). de Vries et al., (2019) introduces the concept of institutional trust, defined as "the basis for expectations towards individuals that are not familiar."

3.3.2.4. The actors involved in AECM governance

AES governance brings together diverse actors whose interactions are mediated through agreements and frequent exchanges. The actors involved in AES governance include governmental entities at multiple levels (i.e. national, regional, and local), farmers, environmental NGOs, researchers, and public agencies. Farmers play a central role in the operationalization of AES related farming practices, as they are responsible for implementing agri-environmental measures (Hauck et al., 2016), yet decision-making for AES design and implementation is shared across diverse actors.

This review retrieved the main types of actors mentioned across the selected studies, identifying 15 main actor types, as presented in **Table 11**. The studies varied in the specificity with which they identified actors. While some studies provided precise details, others used vague categories such as “intermediaries”, the “EU”, “local actors”, “policymakers”, or “farmer groups”. Such general terms often lack clarity regarding these actors' legal status or composition. For instance, the term "policymaker" does not

specify the governance level (e.g. design, implementation) or policy arena (e.g. European, national) in which they operate.

Table 11: Main actor types identified in the selected studies, and information on their related social sphere, their main role in AES governance and their influence, either direct or indirect, of the AES decision-making process

ID	Actors	Societal sphere	Role	Influence on AES decision-making process
1	Agricultural administrations	Public	Administrative	Direct
2	Agricultural ministry	Public	Regulative	Direct
3	Departmental and regional councils	Public	Regulative & administrative	Direct
4	Environmental administrations	Public	Administrative	Indirect
5	Environmental ministry	Public	Regulative	Indirect
6	European institutions	Public	Regulative	Direct
7	Farmer advisors	Private or public	Advice	Indirect
8	Farmers	Private	Operationalization	Mixed
9	Farmers associations	Private or public	Advocacy and representative	Direct
10	Farmers collectives	Private or public	Operationalization	Mixed
11	Financial institutions	Private	Finance	Indirect
12	Governmental agencies	Public	Regulative & administrative	Direct
13	Municipalities	Public	Regulative & administrative	Indirect
14	National government	Public	Regulative	Direct
15	NGOs & environmental associations	Non-governmental	Advocacy	Indirect

As summarized in **Table 11**, most actor types identified in the studies belong to the public societal sphere, reflecting the public nature of subsidies that support AES. The reviewed studies also highlight a distinction in actors' roles in AES governance. While some actors play active, direct roles in steering the

AES governance (e.g. Agricultural ministry), others are more indirectly involved (e.g. Environmental ministry). This distinction is cross-cutting public and private spheres, as both categories include actors with direct and indirect roles in AES governance (**Table 11**).

Multi-actor agreements are pointed out as key in AES governance. They play a role in AES governance by formalizing relationships, commitments, and interactions among diverse actors, including governmental bodies, NGOs, private sector entities, and farmers (Sattler et al., 2023). The authors point out that intermediary organizations, which could vary across national and regional contexts, facilitate communication and exchanges among stakeholders, mediating across varying levels of governance and interests (Prazan & Theesfeld, 2014; Schomers et al., 2015; Westerink et al., 2017). Interactions among actors are mediated through formal networks, such as multi-stakeholder committees, and informal mechanisms, such as trust-building initiatives and knowledge-sharing platforms. For example, in the Netherlands, farmers' collectives work with provinces to develop AES plans while maintaining a dialogue with national and European bodies through organizations like *BoerenNatuur* (i.e., an organization that coordinates farmer-led collectives for AES implementation under AES collective contracts) (de Vries et al., 2019). These arrangements are often characterized by decentralized governance structures, participatory decision-making, and collaborative implementation processes. Multi-stakeholder arrangements often foster inclusivity and coordination to align priorities and contributions (Prager & Nagel, 2008). Yet, it is pointed out that some actors play a dominant role in AES governance. This is mostly true for agricultural ministerial departments and related agencies that dominate the decision-making of AES governance (Beckmann et al., 2009; Benoit & Patsias, 2017; Westerink et al., 2017).

Geographical variation emerges when comparing the reviewed studies. For example, in Germany, local conservation associations (LCAs) exemplify bottom-up governance that affects the interactions across actors, with strong NGO participation. On the other hand, the decentralized French model often retains centralized oversight (Benoit & Patsias, 2017; Schomers et al., 2015). Dutch AES models prioritize informal interactions and collective decision-making among farmers, distinguishing them from more hierarchical approaches observed elsewhere (de Vries et al., 2019).

3.3.3. Mechanisms & factors linking AECM governance to AECM environmental performance

This section answers the second research question, providing insights into the several factors the reviewed studies identified as linking AES governance features to environmental performance.

In the reviewed studies, the concept of environmental performance is not always defined, and when is the case, the studies provide a diversity of perspectives. Some authors, such as Bazzan, Daugbjerg, et al. (2023); Prazan & Theesfeld (2014) and Van Herzele et al. (2011), use the lens of success, focusing on the design features of AES and how these influence implementation outcomes. However, as Bazzan, Candel, et al., (2023) notes, linking design success directly to measurable environmental outcomes is complex and often inconclusive.

Across the reviewed corpus, the term “performance” appears in 18 papers, typically referring either to the capacity of AES to deliver certain public goods (Hejnowicz et al., 2016) or to the extent to which they meet their stated objectives (H. A. C. Runhaar et al., 2017). The term is frequently associated with, or used interchangeably with, effectiveness (e.g., Beckmann et al., 2009; de Vries et al., 2019; Hirsch et al., 2022; Schomers et al., 2015) , and may be qualified as either environmental or ecological performance. The

term is frequently associated with, or used interchangeably with, effectiveness (Beckmann et al., 2009; Schomers et al., 2015), and may be qualified as either environmental or ecological performance. Other authors explicitly favour effectiveness (e.g., Beckmann et al., 2009; de Vries et al., 2019; Hirsch et al., 2022; Schomers et al., 2015), defining it as the ability to achieve environmental aims. Beckmann et al., (2009), Hirsch et al. (2022) also discuss efficiency, distinguishing between environmental effectiveness and economic efficiency. For the purposes of this study, environmental performance is defined as the extent to which the environmental objectives of an AES can best be achieved. This definition serves as a broad common denominator across the reviewed studies. Even when studies do not explicitly define the term, apply differing definitions, or use alternative terminology such as effectiveness or success, their usage can, at least partially, be related to this objective-oriented understanding.

The factors identified in the literature can be categorized into three primary groups: design-related, actor-related, and implementation-related. A cross-cutting factor is also identified. The next section examines each category of governance-related factors in detail, with a summary presented in **Figure 9**.

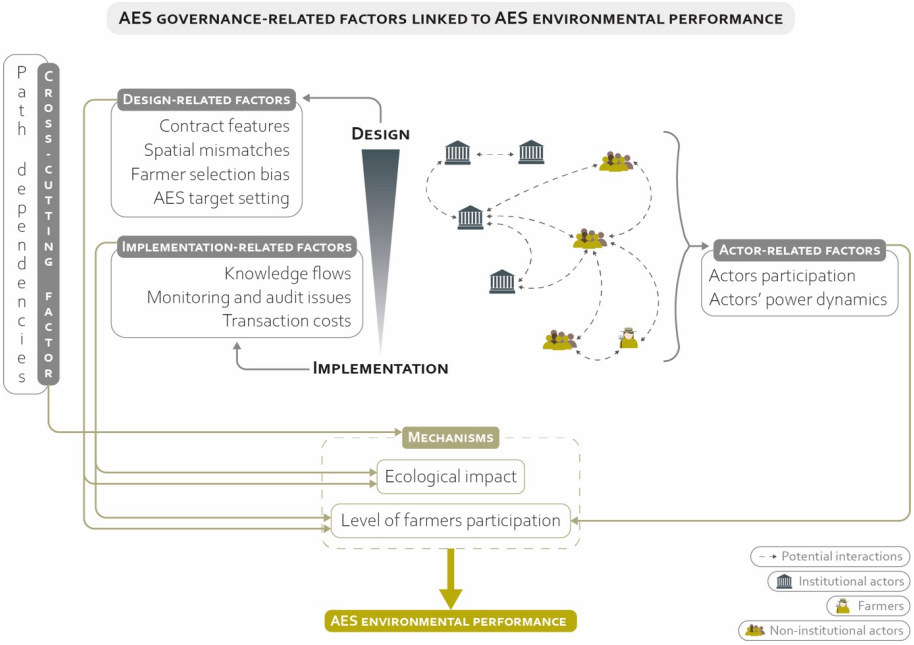


Figure 9: An overview of the main governance factors linked to the environmental performance of AES[19]

While these factors do not directly determine environmental performance, they influence two key mechanisms: the extent of farmer participation in AES and the ecological impact of AES.

For the latter, the notion of ecological impact is here framed from a policy perspective, mainly in relation to the dimensions specified in policy objectives, often referring to issues on species richness (Smits et al., 2008). This conceptualization may differ from definitions used in other literature streams, such as ecology or ecosystem services, where the notion of ecological impact is often broader and more finely articulated. This

[19] The figure distinguishes three core categories: design-related factors, implementation-related factors, and actor-related factors. Each of these operates at a different stage of the governance process: design-related factors at the policy formulation stage, implementation-related factors during delivery, and actor-related factors more broadly across the governance process through their interactions. A fourth factor, path dependency, is identified as a cross-cutting factor influencing all stages. These governance factors shape AES environmental performance through two key mechanisms: i) the ecological impact generated by AES implementation, and ii) the level of farmers' participation.

perspective is consistent with Smits et al., (2008) who argue that AES efficacy depends on the participation rate among farmers and the ecological results of farming practices under AES. Rather than treating farmers' participation and ecological impact as final outcomes, we conceptualize them as pathways through which governance-related factors shape AES environmental performance by influencing participation patterns and the ecological impact of AES interventions (**Figure 9**).

3.3.3.1. Actor-related factors

Actor-related factors include the role of the participation of different types of actors in AES governance, their interactions, and the power dynamics resulting from these interactions.

Discussions on actor participation primarily focus on including environmental actors (e.g., Environmental ministries, NGOs, and environmental associations) in AES actor networks (Beckmann et al., 2009; Benoit & Patsias, 2017; Dedeurwaerdere et al., 2015) and the degree of decentralization, including the involvement of local actors (Beckmann et al., 2009; Toderi et al., 2017). Several studies emphasize the importance of shared responsibility through co-management dynamics (Toderi et al., 2017), particularly in phases such as AES design (Bazzan, Candel, et al., 2023) or other implementation stages (Van Herzele et al., 2011).

Power dynamics are widely acknowledged in the literature (Beckmann et al., 2009; Benoit & Patsias, 2017; Lenihan & Brasier, 2009; Manolache et al., 2020; Mazorra, 2001; Toderi et al., 2017). There is a general consensus that agricultural administrations and farmers' associations hold the most influence in AES governance (Beckmann et al., 2009; Benoit & Patsias, 2017; Lenihan & Brasier, 2009). Benoit & Patsias, (2017) highlight that an equivalent collaboration with environmental stakeholders does not counterbalance the historical partnership between administrative bodies

and agricultural organizations. This aligns with broader concerns regarding the limited participation of environmental actors, which does not allow their knowledge and agendas to be part of the AES governance and thus potentially limiting AES environmental performance. Toderi et al., (2017), referencing to Prager & Nagel, (2008) points out that authorities often perceive participatory approaches as threatening their power and legitimacy.

3.3.3.2. Design-related factors

Design-related factors encompass structural and strategic dimensions central to framing AES policy. Based on the literature review, we identified four key categories of factors linked to AES environmental performance: spatial mismatches, AES contract features, selection bias within the AES farmer population, and AES target setting.

A significant concern involves AES zoning, with studies frequently emphasizing spatial mismatches between AES measures and environmental threats and the fragmentation of AES implementation across landscapes (de Vries et al., 2019; Prazan & Theesfeld, 2014; Schomers et al., 2015; Smits et al., 2008; Toderi et al., 2017; Westerink et al., 2017). These mismatches arise because ecological and biophysical processes in agriculture operate at landscape rather than farm scales (Kleijn et al., 2011 citing McKenzie et al., 2013; Prager et al., 2012; Toderi et al., 2017). AES measures often target individual farms instead of broader contiguous areas, limiting their environmental performance. Innovative contract models, such as collective AES contracts, are proposed as solutions. These models show ecological and economic potential by fostering cross-farm territorial approaches (Bazzan, Candel, et al., 2023) and reducing transaction costs (Franks, 2010). However, administrative constraints, including payment levels and subsidy distribution, remain unresolved.

AES contract design involves balancing broad participation with ambitious environmental goals. Benoit & Patsias, (2017) observes that AES governance actors' reliance on farmers' willingness often leads to strategic negotiations that dilute expected AES environmental effects. Weber (2014) corroborates this, noting concessions in scheme design and the abandonment of specific environmental objectives. Moreover, the selected studies highlight the issue of contract duration, presenting conflicting perspectives. While some argue that the standard duration of five years is excessively long (Benoit & Patsias, 2017; Mazorra, 2001), others contend it is too short (Zwaan & Goverde, 2010). Additionally, Smits et al., (2008) emphasizes the importance of contract renewal, noting that nature restoration is a long-term endeavour that spans several years (Smits et al., 2008).

Selection bias within the AES farmer population raises concerns about the effectiveness of incentives. The reviewed studies question whether AES merely compensates for actions already planned or ongoing. Sattler et al., (2023) argue that by targeting only farmers, AES overlooks the broader array of actors, including landowners, NGOs, food processors, consumers, and residents, who can significantly influence environmental performance.

There is a consensus across studies that vaguely defined environmental objectives and targets, (e.g. encourage farmers to protect and enhance the environment on their farmland by paying them for the provision of environmental services) hinder AES environmental performance. Effective target setting should integrate broader sectoral values and practices to ensure coherence and efficacy of the policy instruments (Alblas & van Zeben, 2023; Prager & Nagel, 2008; H. A. C. Runhaar et al., 2017; Toderi et al., 2017).

3.3.3.3. Implementation-related factors

Implementation-related factors address the operational challenges encountered during the AES implementation phase. The review identifies three key categories: knowledge flows, transaction costs, and monitoring and audit issues.

Knowledge flows are a recurring theme in the reviewed studies, highlighting two main aspects: the limited availability of knowledge in AES decision-making and insufficient integration of knowledge across diverse AES governance actors. As for the type of knowledge, agricultural expertise and management skills dominate the discourse, with some references to the value of local knowledge (Benoit & Patsias, 2017; Manolache et al., 2020; Sattler et al., 2023; Toderi et al., 2017). However, the lack of further details makes it difficult to understand hat is meant by local knowledge.

Limited knowledge, either technical or managerial, negatively impacts decision-making across governance levels (Hejnowicz et al., 2016; Prazan & Theesfeld, 2014; Toderi et al., 2017). Beckmann et al., (2009) goes one step further highlighting that decision-making processes influence how information is collected and used, with information asymmetry often reinforcing power dynamics and excluding actors lacking perceived legitimacy (Benoit & Patsias, 2017).

Monitoring and audit are essential for adapting management strategies and enabling calibration of AES measures or their spatial targeting (Hejnowicz et al., 2016; Benoit & Patsias, 2017; Boonstra et al., 2021 as cited by Sattler et al., 2023). While monitoring supports learning throughout the implementation process, its complexity of related administrative features (e.g. reporting, on-site inspections, audits) presents significant challenges, decreasing its potential contribution to improving AES implementation.

AES literature extensively discusses transaction costs, with references highlighting their influence on environmental performance. Cost and environmental efficiency are closely linked and often influenced by shared factors (Franks, 2010). As a voluntary scheme, AES participation is sensitive to private transaction costs: higher costs reduce economic efficiency, participation rates, and environmental performance (Franks, 2010; Schomers et al., 2015; Weber, 2014). On a broader scale, Beckmann explores the role of centralization in AES administration, noting that increased decentralization typically raises transaction costs.

3.3.3.4. Cross-cutting factor: path dependency

A cross-cutting factor is path dependency, meaning the influence of historical decisions, past institutional arrangements, socio-cultural norms, and actor interactions on the current and future design and implementation of AES policies. In the French case, Benoit & Patsias, (2017) highlight how long-standing collaborations between agricultural organizations and state agencies create institutional inertia, prioritizing traditional corporatist policymaking over ecological reforms. This entrenched alliance is not counterbalanced by similar partnerships in the environmental sector, limiting the potential for "green" advancements. The authors also highlight a legacy of administrative silos, both between agricultural and environmental administrations and within the latter (e.g., environmental departments and water agencies). Such fragmentation reinforces existing power imbalances between policy domains, constraining cross-cutting orientations across agricultural and environmental agendas in AES governance.

Path dependency linked to governance factors also emerges in other national contexts. In Germany, Manolache et al., (2020) illustrate how the success of grassland management networks depends less on past farming practices than on administrative traditions. Social cohesion, clearly defined

rules, and communal forms of management appear as enabling factors, while political and institutional instability act as barriers to successful AES implementation. Schomers et al., (2015) stress that the formation of influential local groups depends on their ability to manage conflicts and reconcile diverging interests, pointing to the evolving nature of actor dynamics. This resonates with findings by Westerink et al., (2017), who stresses how in the Netherlands farmer collectives emerged as central actors in AES governance, and by Smits et al., (2008), who shows how changing property rights shape governance trajectories.

The influence of historical trajectories is further emphasized by Prazan & Theesfeld, (2014) in the Czech Republic. They argue that the rapid institutional transformation of the early 1990s created formal structures almost overnight, while informal norms and practices changed more slowly. This mismatch illustrates how institutional legacies from the socialist period continue to shape the effectiveness of agri-environmental contracts, demonstrating the enduring influence of past paths on current governance dynamics.

3.4. Discussion

As highlighted by Uthes & Matzdorf, (2013), the body of literature on agri-environmental schemes (AES) has continued to expand, encompassing diverse research topics, methodological approaches, and geographical contexts. In recent years, AES governance has emerged as a distinct branch of this literature. While pioneering studies date back to the 1990s and early 2000s, research in this area has grown substantially since 2010. Although several literature reviews have addressed key thematic aspects of AES, such as the comprehensive review by Uthes & Matzdorf, (2013), a synthesis of the main insights specifically related to AES governance has been lacking. This literature review seeks to address this gap by analysing insights from existing

research over the past three decades, highlighting commonalities and differences across AES governance models in various EU Member States, and examining lesson learnt on how governance features influence AES environmental performance. Our findings reinforce the observations regarding AES governance's complex nature, characterized by a diverse array of actors and interactions (Uthes & Matzdorf, 2013).

A key takeaway from the review is that governance is a broad and often normatively framed concept, with its interpretation varying significantly across contexts and authors. This aligns with broader governance literature beyond AES (e.g. Benz & Papadopoulos, 2006; Hill & Varone, 2016; Ruhanen et al., 2010; van Zeijl-Rozema et al., 2008). The reviewed studies define and attribute governance features such as centralization and collaboration inconsistently. Various studies apply their implicit interpretation, often leading to normative assessments of what constitutes "good" or "bad" governance for improving AES environmental performance. However, the systematic analysis conducted in this study reveals recurring elements across the studies, indicating a general coherence in identifying trade-offs associated with different governance models (i.e. centralization vs decentralization, multi-stakeholder engagement, decision-making across and within levels).

The overarching question remains: how can governance models enhance AES environmental performance? Some studies address this question by focusing on specific and innovative AES contract designs, examining governance models embedded within particular contract features, such as collective AES or result-based AES (Bazzan, Candel, et al., 2023; de Vries et al., 2019; McCarthy et al., 2018). Other studies take a geographically specific approach (Dedeurwaerdere et al., 2015; Hirsch et al., 2022; Lenihan &

Brasier, 2009; Weber, 2014), offering high-quality empirical evidence on governance and environmental performance in specific settings.

While these case-specific studies provide critical insights, they offer limited reflections on AES as a policy instrument within the broader constellation of CAP measures. This gap is particularly relevant given the potential interactions between AES and other CAP instruments, which directly influence governance dynamics of the EU agri-environmental policy. Cross-comparative analyses help address this limitation (e.g. Beckmann et al., 2009; Sattler et al., 2023; Westerink et al., 2017), offering a more integrated perspective on AES governance. Nevertheless, further research is needed to explore how different governance configurations within AES interact with the wider CAP framework and the EU agri-environmental policy.

A central issue that emerges from the reviewed studies concerns the tension between centralization and decentralization, with implications for decision-making power across multiple levels. This tension raises a fundamental dilemma: whether to expand the decision-making base to enhance policy relevance and inclusivity or to prioritize a more centralized approach for effective and targeted policy design and implementation. On this, the literature suggests no universal governance solution, and the diversity of proposed approaches does not guarantee that adapted solutions will always be suitable.

Decentralization and multi-actor engagement are necessary for local relevance (Benoit & Patsias, 2017; Mazorra, 2001). However, a certain degree of centralization can avoid diluting objectives (Alblas & van Zeben, 2023; H. A. C. Runhaar et al., 2017). Higher environmental performance of agri-environmental schemes, and more broadly policies, depend on a strategic optimization of these dimensions.

Some perspectives emphasize decentralization as a means to enhance actor representation and inclusiveness, bridging the gap between EU institutions and local realities, and empowering stakeholders. However, other perspectives view decentralization as a potential deregulation and policy dilution vehicle, accelerating EU policy fragmentation and weakening enforcement (Alblas & van Zeben, 2023; H. A. C. Runhaar et al., 2017). Identifying clear policy recommendations that privilege one governance model over other risks overlooking the inherent diversity of Member States. As highlighted by Buller et al., (2017), agri-environmental schemes are deeply embedded in the cultural, institutional, and landscape heritage of each country, making the search for a "perfect" degree of centralization more of an idealistic ambition than a realistic or policy-relevant objective. For this, comparative analyses such as Buller et al., 2017 or others included in our review (Beckmann et al., 2009; Bethwell et al., 2022; Vesterager et al., 2016; Westerink et al., 2017; Wilson et al., 1999; Sattler et al., 2023) are particularly valuable as they allow tracing pathways that have led (or failed to lead) to more successful policy implementation in specific geographical contexts. Approaching solutions in their plurality and as pathways, instead of oversimplified list of recommendations allows the identification of context-sensitive factors that can be fine-tuned to enhance the effectiveness of policy strategies.

Another key insight from our review is the strong imbalance in the literature's focus, with a predominant emphasis on AES technicalities of related farming practices, overlooking the role of actors, governance, and the importance of governance and institutional arrangements. This corroborates earlier observations by Uthes & Matzdorf, (2013), and is reflected in the limited selection of our review, which ultimately retained only 28 studies from an initial pool of over a thousand papers. Despite this, the available literature underscores the critical role of governance features in shaping AES's

environmental potential. While governance may not directly influence environmental performance, it is an essential enabler (or barrier), opening (or closing) windows of opportunity for successful implementation.

A further imbalance concerns the geographical representation of case studies. Our review highlights an over-representation of northern EU countries, with comparatively fewer studies addressing southern Member States. As Wilson et al., (1999) show in their comparison of Germany and Spain, institutional and cultural differences are strongly shaped by both national heritage and broader north–south dynamics. While one should avoid over-simplifying this polarization, such differences are echoed in the extensive review provided by Buller et al., (2017). The relative under-representation of southern contexts in the literature raises concerns, as could partly prevent grasping a full picture of the diversity of governance models within the EU geographical contexts. Addressing this gap would be a valuable research avenue to ensure a more comprehensive assessment of AES governance across the EU.

A fundamental argument emerging from this review is that even the most well-designed AES measures will fail to achieve their intended outcomes if the governance context does not provide the conditions for effective implementation. Our review identifies three overarching governance-related factors influencing AES environmental performance: actor, design, and implementation-related factors. These categories highlight the key areas where policymakers should concentrate their efforts to enhance the likelihood of high AES environmental performance and mitigate potential failures. Together, these dimensions suggest the need for systematic reflection on i) who should be involved, under which role and through which interaction processes (Sattler et al., 2023; Borniotto et al., 2025), ii) which design features can most effectively combine farmer participation with

ecological impact (Alblas & van Zeben, 2023; Benoit & Patsias, 2017; Smits et al., 2008), and iii) how implementation processes can be organized to ensure high coherence (Beckmann et al., 2009; Hejnowicz et al., 2016; Smits et al., 2008).

The findings highlight that actor-related factors, particularly power imbalances in AES governance, limit the inclusion of environmental actors, potentially constraining the environmental performance of AES (Beckmann et al., 2009; Benoit & Patsias, 2017). Design-related factors, such as spatial mismatches and contract structures, further hinder effectiveness, with the dominance of farm-level measures failing to address landscape-scale ecological processes (Prazan & Theesfeld, 2014; Schomers et al., 2015; Smits et al., 2008; Westerink et al., 2017; Toderi et al., 2017; de Vries et al., 2019). Implementation challenges, including limited knowledge flows, high transaction costs, and complex monitoring requirements, reduce efficiency and participation (Benoit & Patsias, 2017; Franks, 2010; Hejnowicz et al., 2016; Prazan & Theesfeld, 2014; Schomers et al., 2015; Toderi et al., 2017). Moreover, path dependency reinforces institutional inertia, preserving traditional policymaking structures that favour agricultural interests over ecological priorities (Benoit & Patsias, 2017; McCarthy et al., 2018; Prazan & Theesfeld, 2014). Despite its critical importance, this aspect remains relatively understudied in the literature. The complex nature of AES governance, involving multiple policy arenas and a blend of governance features evolving over time, creates a multi-actor setting where historical institutional arrangements shape the governance field where stakeholders bring their own agendas and interests.

3.5. Conclusion

This review has provided a comprehensive and systematic analysis of the fragmented AES governance literature. By analysing AES design,

implementation, and actor interactions, it has highlighted the diversity of governance approaches and their implications for environmental performance. Our results show that governance features influence the AES environmental performance, which varies across contexts, aligning with the various governance models implemented across EU member states. This diversity is rooted in its legislative framework, particularly the principle of subsidiarity, which defines the boundaries of AES as a policy instrument and, more broadly, shapes the EU's agri-environmental policy landscape. AES governance models are shaped by different degree of centralization, with historical relationships between key practitioners shaping the current policy dynamics and consequently the mandate among the various actors involved. Additionally, AES governance operates within a multi-level framework, encompassing multiple policy arenas that further add complexity. A "one-size-fits-all" approach does not apply to AES, yet the assumption that "adapted-solutions-always-fit" is also contested, as decentralization alone does not guarantee high environmental performance and the achievement of environmental objectives and targets. In our paper, we suggest that advancing AES effectiveness requires closer attention to three interdependent governance dimensions: the actors involved and their modes of interaction, the design features that can jointly foster farmer participation and ecological impact, and the implementation processes that ensure coherence and consistency across levels.

At the same time, the review points to important gaps and ambiguities that future research should address. First, the literature is heavily weighted towards northern EU case studies, providing a partial picture into governance dynamics in southern contexts, despite the difference in institutional and cultural contexts. Second, governance choices are often insufficiently linked to environmental performance. Clarifying what is meant by "environmental performance," and avoiding vague or weakly

operationalized concepts, will be critical considering the CAP's increasing subsidiarity and Member State discretion. For this our review points out the importance of comparative analyses, as they allow tracing pathways that have led (or not) to more successful outcomes in specific geographical contexts, thereby identifying context-sensitive factors rather than oversimplified solutions. Additionally, integrating governance perspectives more closely with economic and ecological ones would enhance the relevance of future research for policy design and implementation. Finally, widely used terms such as "collaboration" or "governance" require further operationalization to uncover what they mean in practice for AES design and implementation, and how they translate into concrete changes in actor behaviours and interactions.

4. Paper 2: A governance perspective on agri-environmental schemes: actors, roles and barriers

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Extended abstract

Scope: Governance features, such as power dynamics, institutional design, spatial mismatches, transaction costs, have been identified as dimensions affecting AECMs' environmental underperformance. Yet, this evidence rarely brought into explicit dialogue with the AECM literature, and multi-level governance framing. This paper develops a theoretical and analytical framework, tackling the second research question of the PhD, structured around what is limiting AECMs environmental ambition and performance, and how it links to governance features.

Link to hypothesis & research gap (Section 2.5 and 2.6): The paper answers RG1, RG3, and test H1, and H3. It responds most directly to RG3, as it is the only paper to explicitly develop a theoretical and analytical framework and use it to trace how lock-ins and barriers to AECM performance emerge and travel across governance levels, providing the empirical grounding for H3. It also supports H1 and, more indirectly, RG1, by zooming in a concrete regional case (Hauts-de-France) and showing how governance is not a marginal contextual factbut an identifiable and actionable driver of AECM environmental performance, with 40 barriers empirically linked to specific actors and governance roles

Methodology: This paper develops a multi-level (macro-meso-micro) analytical framework for AES governance, building on Sattler et al. (2023) and Ostrom's IAD framework, paired with a barrier analysis linking identified barriers to governance actors and roles through two Boolean matrices. The framework is tested empirically through a regional case study in Hauts-de-France (France), drawing on desktop research, expert consultations, 17 semi-structured interviews, a validation seminar, and a focus group, yielding a final list of 40 barriers to AECM environmental performance.

Results: The case study identifies nine governance roles (i.e. design, fund, coordinate, control & payment, monitor & evaluation, advise, report, transfer knowledge, provision of services) and 12 actor types, from EU institutions to farmers, mapped across the macro, meso, and micro levels and their interfaces. A list of 40 barriers hindering AECMs' environmental performance is identified and grouped into seven categories: technical, power dynamics & relational, organizational, knowledge, institutional, financial, and cultural. Barriers are unevenly distributed across governance levels, roles, and actors, and are not confined to either farm or policy scale. Some remain specific to a single level (e.g. restrictive AES requirements and power asymmetries from lobbying networks at the macro level, or farmers' risk aversion and community pressure at the micro level) while others cut across levels. This cover for example coordination and administrative-burden issues concentrate at the macro–meso interface, knowledge gaps on ecological and administrative processes concentrate at the meso–micro interface, and institutional constraints linked to AES design (e.g., restrictive eligibility criteria) together with the cultural narrative placing responsibility for environmental outcomes on farmers connect the micro and macro levels. Actors facing a barrier's consequences do not always hold the agency to resolve it: financial barriers, for instance, surface across funding, advisory, and service-provision roles, yet decision-making authority remains

concentrated among EU institutions, national ministries, and regional agencies. The study further identifies four additional roles (i.e. advocacy, value chain integration, lobbying, investment) and seven additional actor types (i.e. value chain actors, consumers, NGOs, farmers' unions, research, education, investors) that, while outside the formal AECMs' governance process, still shape its environmental performance, underlining that market forces and consumer behaviour also condition outcomes.

4.1. Introduction

The environmental performance of Agri-Environmental Schemes (AES), defined as the extent to which the environmental aim of an AES can be achieved, (Schomers & Matzdorf, 2013) has often been questioned. Such limitation has been grounded in a systematic lack of achievement of their long-term environmental objectives, such as biodiversity protection, habitat preservation, and climate change mitigation (Primdahl et al., 2003; Kleijn et al., 2006; Matzdorf & Lorenz, 2010; Pe'er et al., 2014; Galler et al., 2015; Leventon et al., 2017; Guyomard et al., 2023). Under the EU Common Agricultural Policy (CAP); AES serve as a key policy instrument for biodiversity conservation and climate protection (European Environment Agency, 2019). These schemes entail a series of measures, each designed to target specific farming practices or landscape features. Examples include reducing environmental risks (e.g. reducing fertilizers or pesticides), protecting nature (e.g. leaving winter stubbles in intensive arable areas to provide food for birds, flower strips for pollinators), and preserving traditional farming practices (e.g. extensive grazing, traditional vineyard management, agropastoralism) (Bazzan et al., 2022). AES are implemented across all EU Member States (MS) under different contractual arrangements (e.g., action-based, result-based, collective, or value-chain contracts) that shape the payment mechanism of AES (Bazzan et al., 2022; Sattler et al., 2023)).

The scientific literature has extensively debated the underlying factors of AES environmental shortfalls such as the lack of clear and quantifiable AES objectives (Kleijn et al., 2006), spatial mismatches (Toderi et al., 2017; Früh-Müller et al., 2019; Rotchés-Ribalta et al., 2021), the simplistic conceptualisation of farmer behaviour in the design AES (Hasler et al., 2019; Brown et al., 2021), high transaction costs (Falconer, 2000; Weber, 2015), opportunity costs and low payment levels (Bartkowski et al., 2023). Those critiques have been formulated under either ecological or economic perspectives – mainly focusing on environmental impact assessment or cost-benefit analysis – as pointed out by Uthes & Matzdorf (2013) and more recently by Bazzan, Candel, et al. (2023). Some scholars have focused on aspects related to their governance, exploring the interconnection between policy and farm scales (hereinafter referred to as AES governance literature) (Lowe et al., 2002; Beckmann et al., 2009; Matzdorf et al., 2013; Mettepenningen et al., 2013; Meyer et al., 2015, 2018; Bazzan, Candel, et al., 2023; Sattler et al., 2023). The AES governance literature, even if only recently targeted as a research topic, presents an extensive body of research focusing on linking AES governance and AES environmental outcomes (Fairbrass & Jordan, 2001; Smits et al., 2008; Meyer et al., 2015; Bazzan, Candel, et al., 2023). Their findings confirm previous evidence on AES environmental shortfalls, yet based on different underlying factors, such as stakeholder involvement (Beckmann et al., 2009; Leventon et al., 2017; Sattler et al., 2023), knowledge exchange (Bazzan, Candel, et al., 2023), flexibility in implementation, institutional design, institutional arrangements, and specific design rules employed (Mettepenningen et al., 2013; Schomers et al., 2015; Westerink et al., 2017; Lien et al., 2018; Bazzan et al., 2022; Toderi et al., 2017; de Vries et al., 2019), power dynamics across stakeholders (Beckmann et al., 2009; Benoit & Patsias, 2017).

Other studies have emphasized the role of decentralization of governance and subsidiarity of decision-making (Lowe et al., 2002; Beckmann et al., 2009). However, such literature struggles to provide a systematic analytical framework to describe how AES environmental shortfalls and the related underlying factors affecting AES environmental performance are linked to the governance framework.

Against this background, the study addresses the following research question: Which factors linked to AES governance hamper the environmental performance of AES?

To address this question, we develop a theoretical and analytical framework to examine AES governance structures and identify the factors that hinder their environmental performance, hereinafter referred to as barriers. The paper is structured as follows: Section 2 provides the theoretical foundation, identifies the research gap, and introduces the theoretical framework and the research design steps, along with the case study selected for empirical analysis. Section 3 outlines the analytical framework, which consists of two components, one focusing on the governance structure of AES and the other on the barriers that influence the link between governance and environmental performance. Section 4 presents the key findings related to governance structures and barriers. Section 5 discusses the implications for AES governance within the case study and in the broader context of EU regions. Finally, Section 6 offers the main conclusions of the study.

4.2. Theoretical background

4.2.1. A research gap in the AES governance literature

Defining governance is often complex and does not stop to one meaning and usage (Hill & Varone, 2016). The AES governance literature is no exception and, even if not providing a definition, converges on several common elements defining the concept of governance: a clear goal or priority to be achieved, a plurality of actors from both public and private entities, dynamic interactions among these actors (Beckmann et al., 2009; Westerink et al., 2017; Bazzan, Candel, et al., 2023; Sattler et al., 2023), and the presence of institutions, rules, and institutional arrangements that shape these interactions (Meyer et al., 2015; Lien et al., 2018; Bazzan, Candel, et al., 2023). Consistent with the multi-level governance framework prevalent in EU public policy studies (Hooghe & Marks, 2001; Jordan, 2001; Hooghe & Marks, 2003; Bache et al., 2016), AES governance research also underlines that decision-making occurs at various levels, affecting both the design features (e.g. spatial targeting, payment structure, duration of contracts) (Bazzan, Daugbjerg, et al., 2023) and the overall governance structure (Beckmann, 2009).

Multi-level governance means interactions between actors encompassing cooperation, negotiation, and potential conflict and institutional arrangements, including rules, procedures, and funding mechanisms, take place across levels and are key in shaping AES policy outcomes (Mettepenningen et al., 2013). Some studies employ the term "multi-level governance", for example McCarthy et al. (2018), directly, whereas others explore multi-level dynamics indirectly Beckmann et al. (2009).

The AES governance literature employs geographical and actor-based definitions of 'levels' to outline the AES governance. However, these definitions lack standardization, as the specific administrative levels vary

across sources and geographical contexts and the categorization of actors (public, private, civil society) can be fluid, with hybrid forms existing. This lack of standardization mainly relates to the EU subsidiarity principle governing the AES design, under which the governance structures overseeing the schemes vary significantly across MS. The subsidiarity principle, introduced in the early 90s during a change in the EU political *zeitgeist* and targeting political areas such as the environment (Jordan & Jeppesen, 2000), states that decision-making should take place at the lowest administrative level consistent with effective actions (Van Kersbergen & Verbeek, 1994). This shapes the governance under which the CAP policy framework is implemented within each MS, and consequently AES. Some MS have opted for a centralized governance model, while others have embraced a regionalized approach, defining the general approach to AES governance (Beckmann et al., 2009). Additionally, different AES contract types could define the mandates given to various actors, adding another layer of potential heterogeneity across contexts. Therefore, defining levels based on geographical or actor-based criteria would not ensure the external validity of such a framework across the diverse national contexts within the EU, failing to provide a common framework for the heterogeneous nature of AES implementation processes across EU regions and MS.

4.2.2. The proposed theoretical framework: AECM multi-level framework

The AES governance within the European Union, while resulting in diverse implementation across MS, still requires adherence to a common set of steps. This is due to three main factors: i) the shared objectives of AES (e.g. biodiversity protection) as a result of EU regulation (i.e. Regulation (EU) 2021/2115), ii) the fact that AES are part of public policy, which brings common institutional setting and institutional arrangements, and iii) AES across all MS – as voluntary-based subsidies – share a common goal of

influencing farmers' behaviour at the farm level, striving for broader impacts on ecosystems. Due to these commonalities, each MS is constrained by a predefined set of steps linking the public policy framework to the farm-level dynamics. From an institutional perspective, we argue that the decision-making processes defining the AES governance can be divided into three levels: i) a strategic level of AES, where the "rules of the game" are established, setting therefore the boundaries and defining the characteristics of the policy framework, ii) an implementation level, focusing on translating the broad policy objectives into tangible actions on the ground ensuring its implementation at both national and regional scales and iii) an operational level linked to the receiving end of AES policies – primarily farmers and land managers – whose decisions and actions ultimately affect the success or failure of these schemes at farm scale. **Table 12** gives an overview of AES institutional multi-level governance framework.

Table 12: The AES institutional multi-level governance framework

Governance level	Description
Macro level: Setting the boundaries	Delineates the overarching boundaries set by regulations governing AES policies framework
Meso level: Ensuring implementation	Ensures the implementation of AES coherent with the overarching public policy frameworks defined at macro level. This level interface with either the macro level or the micro level under distinct mechanisms
Micro level: Adopting parties	Focuses on the direct recipients of the policy framework. It refers to the AES adoption and related changes in farming practices and landscape features

The theoretical framework is designed to define the *structure* of AES governance, providing the necessary foundation to unravel its associated *process,* which is here defined as the complementary interactions among

various actors within a set of institutional arrangements aimed at a common goal. The AES governance process requires operationalizing the theoretical framework to identify the interactions linking the levels both horizontally (i.e., within levels) and vertically (i.e., across levels).

4.2.3. The research design steps

The theoretical framework serves as a basis for designing the research. Two steps are defined as i) the development of a multi-level governance framework for AES governance; and ii) the identification of barriers in the governance process.

The first research design step operationalizes the multi-level governance framework in the AES context; we define roles, assign them to mandated actors, and cluster them by governance level, aligning with common objectives.

It draws on the concept of roles as proposed by Sattler et al. (2023). In their research on innovative AES contracts, the authors utilize the concept of "roles" to analyse the distribution of responsibilities among the actors involved in AES governance. They define roles as "a set of recognizable activities used by an actor to address recurring situations," (Sattler et al. 2023) building on the work of Westerink et al., (2017). Within the AES framework, these roles clarify how various actors—such as farmers, government agencies, NGOs, and private companies—contribute to AES governance. The roles encompass activities such as contract design, implementation coordination, funding provision, outcome monitoring, and policy advocacy. Their application of roles is rooted in the broader context of institutional analysis, particularly the Institutional Analysis and Development (IAD) framework developed by Elinor Ostrom (Ostrom, 2009).

For the second research design step, the study mobilizes the concept of barriers to describe the underlying factors affecting AES environmental

performance. Scholars have approached a wide array of topics through the lens of barriers, including pesticide usage (Cowan & Gunby, 1996; Hofmann et al., 2023), cooperative dynamics (De Herde et al., 2022), technological innovations and genetic engineering (Vanloqueren & Baret, 2009), crop diversification (Meynard et al., 2018; Morel et al., 2020; Weituschat et al., 2022) , and value chain dynamics (Williams et al., 2024). This study builds upon the methodological insights derived from this literature and provides an analytical framework to link barriers to AES governance. To achieve this, the study applies a multi-level framework to AES governance, identifying where barriers arise in the governance process and which actors, across different levels, have agency over them.

4.2.4. The case study

This study adopts a case study approach focused on the AES governance in the Hauts-de-France region. The case study was selected for three reasons. Firstly, a regional approach enables engagement with a diverse set of actors operating at this scale, most of whom are included in the meso level – i.e. the level of implementation of the AES policy framework. These actors often have an in-depth understanding of the institutional mechanisms characterizing the AES governance, and they interact with both macro and micro levels, thereby providing a comprehensive view of the AES governance process.

Secondly, the Hauts-de-France is a predominantly agricultural region with high production levels and significant environmental challenges. Despite efforts to support a sustainable environmental transition through regional and national initiatives, the agri-food production system generates substantial negative environmental impacts, greatly affecting the local social-ecological systems (Martin et al., 2021). In 2022, the AES subsidies allocated to the region amount to roughly 14 million euros, against 255

million euros for direct payments and 31 million euros coupled income support (for livestock) (Agreste, 2024).

Thirdly, from a national perspective, France presents an interesting governance structure. Historically, the French governance is largely centralized but recent efforts, particularly during François Hollande's presidency (from May 2012 to May 2017), support a process of decentralization. This combination of centralized governance tradition and emerging decentralization makes Hauts-de-France an interesting case for studying the AES governance, which is inherently driven by the principle of subsidiarity.

4.3. Materials and methods

4.3.1. The analytical framework

The analytical framework includes two successive steps, summarized in **Figure 10**. The first step aims to highlight the key components of AES governance by identifying actors and their roles and eventually delineating the AES governance process linking them. The second step involves identifying and characterizing barriers hindering AES environmental performance and their linkage to AES governance. For this purpose, barriers are classified into categories and linked to roles and actors. Those links are eventually analysed.

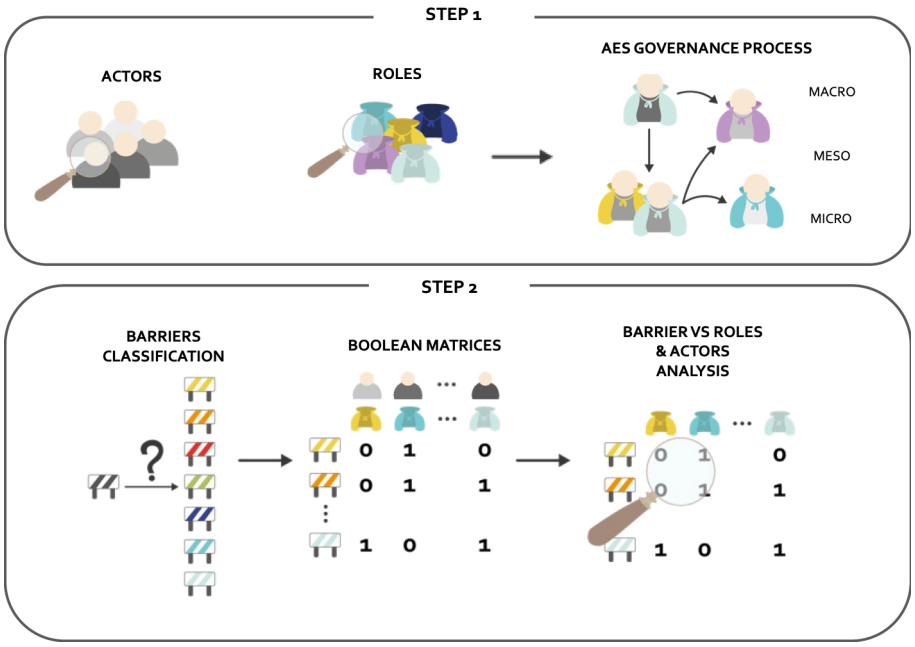


Figure 10: Analytical framework tackling AES governance and the barrier analysis

4.3.1.1. Step 1: The AECM governance process

This step strongly relies on the methodology developed by Sattler et al. (2023). For this, the AES governance is defined through the same dimensions: types of actors and their roles. The authors' categorization

provides a comprehensive list of roles within AES contract governance that was adapted for this study (see Table S2.1 in Appendix S2). The authors developed a list of roles for innovative AES contracts (i.e., result-based, collective, land tenure, and value chain AES contracts) in the EU, encompassing a wide range of actors from the private, public and third sectors, involved in the AES institutional governance process. We adapted the scope of this list as this research focuses exclusively on action-based mainstream AES (Sattler et al., 2023). An iterative process across the research team and participants of both interviews and focus group, which will be outlined in section 3.2, allowed for the identification and description of i) each role, ii) the actors performing them, and iii) the nature of the interactions occurring across these actors and roles. These three elements build the AES governance process described in the result section 4.1.

4.3.1.2. The barrier analysis

This step develops a barriers analysis to target the link between underlying factors hindering AES environmental performance and the AES governance. It entails the development of two Boolean matrices mapping the links between barriers and AES governance roles and actors.

During this phase we compiled the list of barriers collected during the interview phase, described in the section 3.2; barriers were grouped into categories (i.e. technical, power dynamics, organizational, knowledge, institutional, financial, cultural). To link the list to the AES governance, two Boolean matrices are built linking each barrier to i) the actor(s) it involves and ii) the role(s) it touches. Barriers are linked to roles and actors answering two distinct questions: i) across which role(s) does the barrier unfold ii) which actor(s) has direct agency over the barrier.

4.3.2. Data collection and analysis

4.3.2.1. Data collection

Primary data were collected from four complementary sources: desktop research, expert consultations, semi-directive interviews, a seminar and a focus group.

Desktop research was conducted as a first step to collect background information on the AES implementation process at the EU and MS levels and on the case study regional context. We consulted: five scientific publications, three policy documents, six policy reports and one methodological guideline (full list provided in Table S1.1 in Appendix S1). This preliminary step was also used to identify and select experts for the expert consultation.

The expert consultations were conducted in March 2023 with three experts (i.e., individuals with extensive knowledge and understanding of regional socio-political and environmental dynamics) who were asked to provide i) a brief description of the regional context, along with reports and literature references, and ii) relevant contacts to be used for the interviews. The experts were selected based on their knowledge of regional networks, their experience in the research area, and their availability.

This allowed us to complete the desktop research and yield the first list of key actors for interviews. Actors were selected based on their active (or past) role in the AES governance in the region. Snowball sampling technique (Naderifar et al., 2017) was adopted to complete this list. A total of 17 participants were interviewed (overview in Table S1.2 in Appendix S1).

Throughout the interview process (March 2023 to August 2023), participants were asked to: i) introduce themselves, their organizational affiliation, and geographical competence (e.g., national, regional); ii) outline the role of their

respective organizations; iii) list and describe the nature of interactions with other relevant actors and iv) provide their understanding on the barriers hindering AES environmental performance (full interview protocol is provided in Table S1.3 in Appendix S1).

Data collection allowed the drafting of two outputs:

1. AES governance insights: providing information on the actor's types, their roles and the interconnections across actors
2. Barriers' list: providing information on the barriers hindering AES environmental performance

Data validation for the AES governance process, including actors, roles, and interactions, was conducted during an online seminar where all participants of the interview phase were invited and could provide feedback.

Data validation for the barriers list was ensured through a two-step approach. The first interviews were analysed chronologically, and the lists were expanded until no further data acquisition on the specified parameters emerged, according to the principle of data saturation (Saunders et al., 2018). Second, the two lists were validated through a focus group where all participants were asked to review the completeness of both lists. Some of the participants could not join, and for those an email was sent to collect their feedback.

4.3.2.2. Data analysis

Data analysis was conducted differently for the two methodological steps, which are summarized in **Figure 11**.

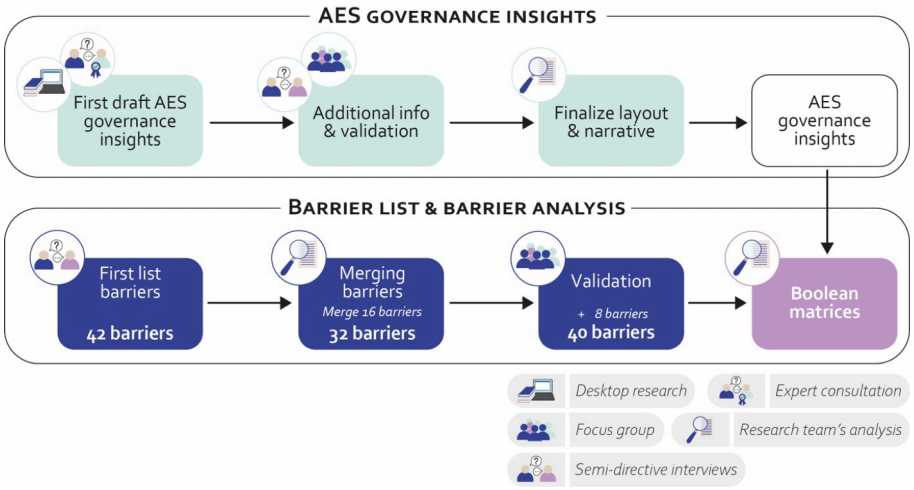


Figure 11: Data collection design and data analysis conducted in the regional case study

Step 1 aimed to develop a descriptive representation of the AES governance process. Initially, a preliminary version of the AES governance insights was drafted based on information retrieved through the desktop research. Subsequently, insights retrieved during the interviews provided complementary information to refine the draft. This revised draft was then discussed and validated during a seminar. The research team developed a table summarizing the main information retrieved in the draft (Table S2.2 in Appendix S2) that was used, along with the narrative built throughout the interviews and the seminar, to finalize the layout of the final version, presented **Figure 12** in the result section.

Step 2 required a more elaborate analytical approach. Barriers collected through each interview have been listed, allowing us to retrieve 42 unique barriers. Following this, a merging phase consolidated barriers addressing similar issues, reducing the list to 32 barriers and assigning new names to

the merged barriers. The focus group conducted with a sub-sample of the interview's participants allowed us to validate the 32 barriers and add 8 more barriers. We opted for conventional qualitative content analysis (Hsieh & Shannon, 2005) to group the barriers under specific categories. The research team organized the 40 identified barriers into seven categories based on thematic similarity, ensuring that the clustering reflected underlying patterns across the barriers.

Eventually, the research team built two Boolean matrices (a matrix consisting only of 0s and 1s, representing binary values) to link each barrier to roles and actors. The value "1" was assigned where the link occurred, and the value "0" otherwise. Two researchers conducted the analysis independently, following a common guideline. Later, three working sessions at the research team level were organized to discuss the differences and finalize the matrices. All data analysis steps can be found in Appendix S3.

4.4. Results

4.4.1. The AES governance structure and process

4.4.1.1. The roles and actors behind the AES governance

Nine roles and twelve actor types are identified as participating in the AES governance in the Hauts-the-France region **(Table 13)**.

The roles range from designing and funding the AES, coordinating related activities, organizing control and payment, monitoring and assessing progress, advising on farming practices, reporting on actual implementation, and providing services for which the AES payments were originally designed. A description of each actor type is provided in Table S2.3 in Appendix S2.

Table 13: The roles and actor types of the AES governance in the case study Hauts-de-France

Roles in the AES governance	Actor types in the AES governance
1. Design	1. EU Institutions
2. Fund	2. National Ministries
3. Coordinate	3. Regional Administrations
4. Control & payment	4. Regional Council
5. Monitoring & evaluation	5. Regional Agencies
6. Advise	6. Control & payment Agencies
7. Report	7. Agricultural Chambers
8. Transfer knowledge	8. Intermunicipal cooperation
9. Provision of services	9. Regional Natural Park
	10. Cooperatives
	11. Local associations
	12. Farmers

4.4.1.2. The AECM governance process linking actors and roles

This section presents the AES governance process in the regional case study. **Figure 12** showcases the interconnection of roles, actors and geographical scale at stake between the policy and the farm scales. The roles and the implication of actors within each role are explained below.

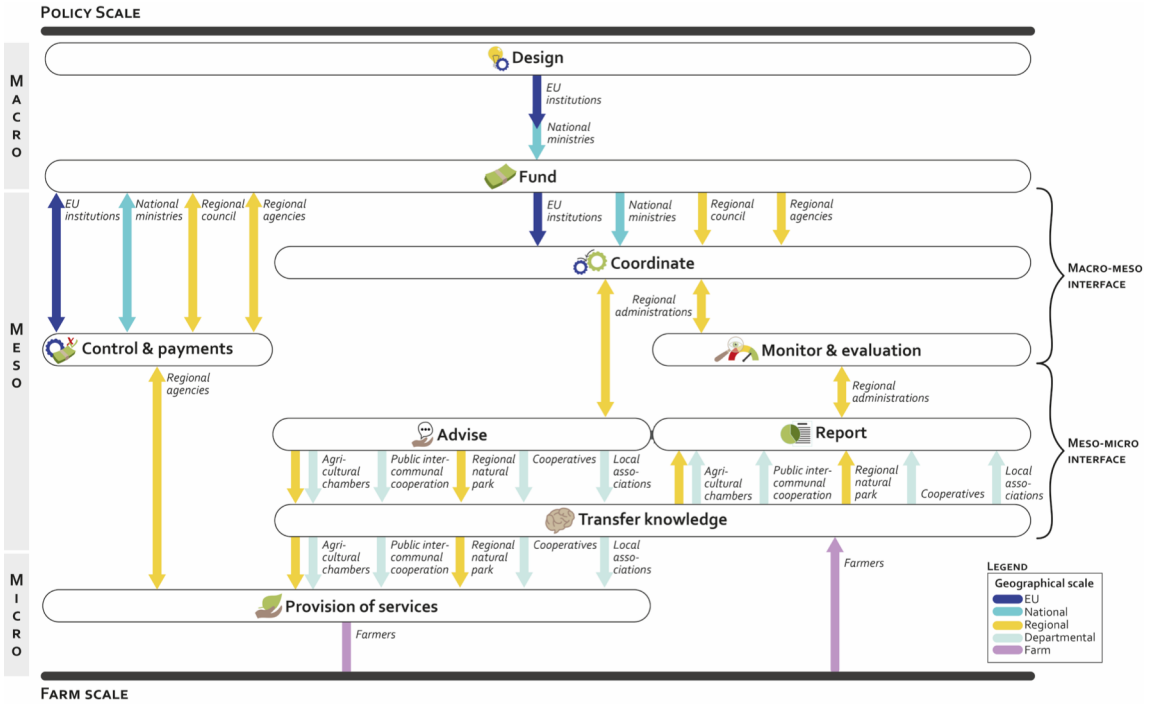


Figure 12: AECMs' roles, actors, and multilevel governance framework in Hauts-de-France region[20]

[20] Roles are represented by circled boxes, arrows represent actor types, and their associated colours the geographical scale they operate in

Under the AES public policy framework, the overarching legislative framework is designed firstly by EU institutions that set requirements and constraints to be implemented across all MS, as procured in Article 70 (EU Regulation, 2021/2115). Under the green architecture, the regulation establishes that AES payments should commit to farming measures that go beyond what is included in the Good Agricultural and Environmental Conditions (GAEC) and the Statutory Management Requirements (SMR). It also mentions that MS may promote and support collective schemes and result-based payments schemes to encourage farmers or other beneficiaries to deliver a significant enhancement of the quality of the environment at a larger scale.

The EU principle of subsidiarity (defined by Article 5 of the Consolidated Version of the Treaty on European Union, (2016)) plays a significant role in the AES design, granting MS substantial autonomy in defining various aspects of AES, including their objectives, concrete targets, and expected outcomes. Such principle aims to enable tailored solutions to regional agricultural challenges, leaving decisions to MS, regional, or smaller subunits (Van Kersbergen & Verbeek, 1994). In France, the Agricultural & Food Ministry is appointed the mandate to draft a proposal for AES, along with all other policy instruments of both pillar I and II of the CAP (e.g. direct payments, LEADER programs). The proposal is then discussed in stakeholders' dialogues, primarily involving unions and farmers' organizations, and with other Ministries, such as the Environment and Ecology Ministries. Once these negotiations are concluded, and with the approval of the Prime Minister, the proposal is finalized, and the policy document is then sent to the EU Commission, for EU-MS negotiations. The final draft of the policy document on AES (along with all other CAP policy instruments) is highly detailed and provides the list of all AES measures

authorized in the national territories, along with payments per ha or per farm (depending on the type of measure). For the programming period 2023-2027 the AES design is included in the CAP Strategic Plans (Ministry of Agriculture and Food Sovereignty, 2022).

The AES *funding* in France is structured across multiple tiers. It includes EU contributions channelled through the European Agricultural Fund for Rural Development (EAFRD). Additionally, as mandated by EU laws, the Ministry of Agriculture and Food provides complementary funding for AES implementation. Furthermore, regional entities like water agencies, which operate in all French regions, allocate portions of their financial resources to support the AES program, ensuring the achievement of some of their objectives.

Having established AES design and funding, MSs can appoint diverse actors at different geographical scales with the mandate to *coordinate* AES activities. In France, the AES are managed at regional level by the regional administrations through the Agri-Environmental and Climatic Projects (AECP). The Agricultural Ministry delegates the regional administration to draft public calls for AECPs across the region, for which local partners (e.g. agricultural chambers, natural parks, local NGOs, cooperatives) can apply as project leaders. If selected, the local partner provides a detailed plan of the AES measures to be implemented in the area through the AECP. The AES measures are chosen from a predefined list included in the CAP Strategic Plans for the 2023-2027 programming period. The selected AES measures should align with local environmental threats previously identified at local and regional levels (Ministry of Agriculture and Food Sovereignty, 2022).

Once granted the AECP mandate, local partners must develop a farming *advising* campaign strategy, ensuring a *knowledge transfer* to achieve expected changes at farm level. Local partners are also required to *report* frequently on the activities conducted under their AECP, ensuring a

monitoring & evaluation framework, for which the regional administrations are responsible for.

Once subsidies become available under the AES measures within AECPs, farmers become eligible to apply for funding. AES contracts span five years, providing annual payments for the implementation of specific farming practices (e.g., delayed mowing season) or the introduction of landscape features (e.g., hedges, flower strips) within designated areas of the farm.

Before applying for funding, farmers are required to compile a diagnostic to ensure that the AES measures planned on the farm align with the overarching requirements and priorities outlined in the related AECP. *Control* agencies conduct an initial screening to assess the completeness and compliance of the application form and the provided diagnostic. After compliance is approved, *payment* agencies oversee the processing of the farmer's application. Additional controls may be conducted to verify ongoing compliance throughout the five-year period. Farmers are required therefore to keep informed competent authorities (i.e. *knowledge transfer role*) on the various indicators to monitor the subsidies' use.

National authorities define payment rates for each AES measure. They are aligned across all regions and based on the foregone incomes associated with implementing AES measures EU Regulation (2021/2115).

4.4.1.3. The AECM governance process through the multi-level framework

The multi-level governance framework building upon three main levels (i.e. macro, meso and micro level) now can be mobilized to organize the roles that transform a policy framework in actions at farm scale through the AES governance process (**Figure 13**). The macro level, which sets the boundaries of the policy framework, accounts for both the design and funding roles, as they are the main responsible for shaping the policy framework. The meso-level ensures the implementation of the AES policy framework. It comprises

a vast array of roles, such as the coordination by regional public administrations, the monitoring and evaluation by control agencies, and the advising activities by various actors such as agricultural chambers. This level is characterized by two main interfaces, one with the macro-level, grouping roles such as coordination, monitoring & evaluation that interact with roles at the macro-level, and one with the micro-level, ensuring both advising activities and knowledge transfers. The micro level focuses on the direct recipients of the policy framework and relates to the provision of services and knowledge transfer expected within the public policy framework. It refers to the AES adoption and related changes in farming practices and landscape features.

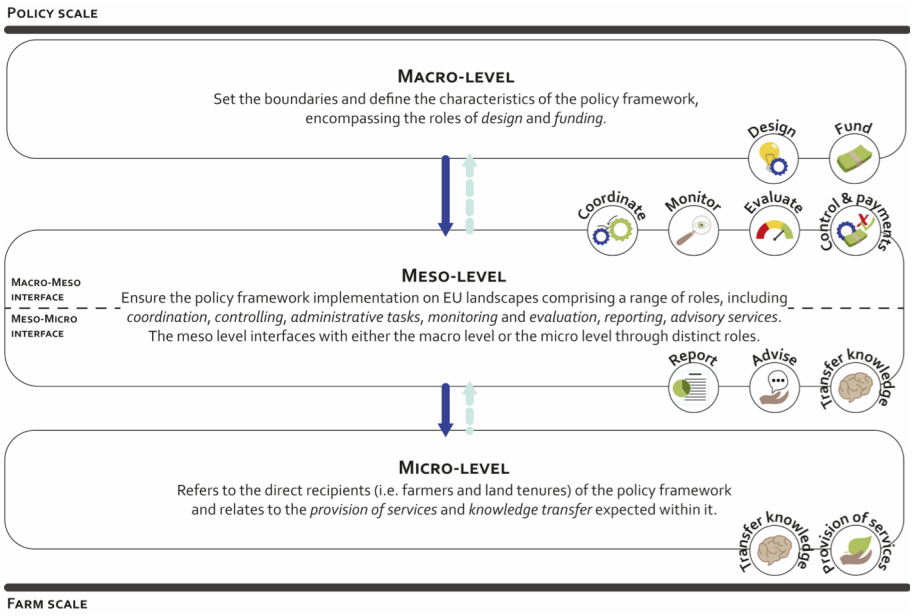


Figure 13: AECMs roles defining each level of the AECMs multi-level governance framework

4.4.2. The barrier analysis

4.4.2.1. Overview of the barriers

We identified 40 barriers hindering AES environmental performance. These barriers include issues such as the administrative burden associated with

AES design, limited budget allocation, insufficient coordination among entities managing AES funding, and the underappreciation of AES-related food production within value chains.

We identified seven categories under which we grouped the 40 barriers (**Table 14**).

Table 14: Categories of barriers, brief description and listing of specific barriers per category

Category of barriers	Specific barriers
Technical Barriers referring to technical aspects impeding the AECMs smooth and effective implementation. This category relates to both administrative and farming aspects of AECMs.	1. Complex and time-consuming administrative tasks for subsidies-related documents for both farmers and public administrations
	2. Non-realistic AECMs set of requirements to be implemented at farm level
	3. High specialization of value chain and high concentration of processing machineries and tools making difficult to find selling channels for crop diversification products
Power dynamics Barriers referring to power dynamics characterizing the AECMs' governance. This category relates to relations across actors within and outside the AECMs' implementation process.	4. Limited environmental advocacy representativeness at national level during policy negotiations
	5. Unbalanced representativeness of advocacy & lobbying groups in the decision-making process
Organizational Barriers referring to challenges in coordination, planning, and network interactions among actors involved in AECMs' implementation.	6. Delays in AECMs' subsidies disbursement to farmers
	7. Delayed provision to farmers of technical information on AECMs set of requirements
	8. Limited coordination across local and regional initiatives complementary to AECMs
	9. Lack of coherent environmental approach across local and regional initiatives
	10. Limited bottom-up feedback loops between policy implementation and policy design
	11. Limited coordination between administrative and budgetary responsibilities across public administration actors
Knowledge	12. Limited knowledge on environmental issues among policy makers and elected members

Barriers referring to knowledge gaps impeding AECMs' effectiveness. This category relates to knowledge gaps amongst various actor types.	13.	Limited knowledge of the effectiveness of AECMs, due to insufficient evaluation and science-based evidence
	14.	Lack of multi-disciplinary skills and knowledge to advise on (feasible) farming practices to protect biodiversity
	15.	Limited knowledge of available of public policy instruments & initiatives related to biodiversity protection
	16.	Limited knowledge of consumers concerning biodiversity protection
	17.	Limited networking across local and regional actors involved in biodiversity protection
	18.	Limited knowledge of farmers on biodiversity and natural dynamics
	19.	Limited knowledge of farming practices that are environmental and economically performing
Institutional Barriers arising from structural, regulatory, and procedural constraints embedded within institutions	20.	Lack of coherence of policy objectives versus long-term vision of local and regional development
	21.	Restrictions to funding allocations (e.g. quota to advisory funding per farmer)
	22.	Unstable and (often) changing political priorities
	23.	Limited flexibility of national strategies and policies to heterogeneous territorial needs
	24.	Lack of coherence between policy objectives and policy tools
	25.	Potential exclusion of farmers due to the AECMs' policy design
	26.	Low compatibility of some AECMs with current farming practices
	27.	Lack of environmental effectiveness of AECMs due to spatial mismatch
Financial Barriers referring to financial aspects impeding AECMs' effectiveness. This category relates to both financial constraints and financial allocation within the AECMs' implementation process.	28.	Limited (and unstable) financial resources for AECMs' implementation
	29.	Limited (and unstable) financial resources for advising and supporting activities
	30.	Limited added-value of sustainable farming practices within the value chain and final market prices
	31.	Limited impact of market tools (e.g. price premium, standards, labels)

Cultural Barriers referring to cultural aspects impeding adoption of AECMs, and their environmental effectiveness. This category relates to values, beliefs and relational aspects.	32.	Social pressure from (part of) neighbouring community discouraging AECMs' adoption
	33.	Limited communication between private and public actors of local and regional initiatives
	34.	Lack of bottom-up approach in policy design (e.g. farmers inclusion in policy decision-making)
	35.	Lack of trust by banks and other investments actors in environmentally friendly farming practices
	36.	High responsibilities given to farmers to maintain public goods (e.g. healthy ecosystems)
	37.	Productivity mindset as dominant mindset for farmers (and other actors of the agri-food system)
	38.	Reticence of farmers to additional risks linked to AECMs
	39.	Discouragement to adoption due to penalties in case of failure/irregularity of practice implementation
	40.	Conflicting timescale of action between policy level and farming level

During the interviews, participants found it challenging to directly connect AES governance barriers to environmental performance, instead emphasizing broader scheme effectiveness and adoption issues. The list of barriers reflects this bias yet still offers valuable insights into factors influencing uptake and operational performance, shaping environmental outcomes, as AES is inherently designed to deliver environmental outcomes.

The list of barriers compiled throughout the interviews extended beyond the institutional aspects of AES governance, identifying challenges associated with roles and actors not previously considered within the AES governance process. This analysis revealed four additional roles and seven additional actors that, while not directly involved in translating policy frameworks into on-farm actions, nonetheless, according to the participants, influence AES's environmental performance (**Table 15**). Such barriers touch upon a variety of issues from power dynamics of influence groups on policy making, market

value-added of AES and consumer knowledge of AES measures or banks' investment risk assessment practices.

Table 15: Additional roles and actor types linked to the barriers impeding AES in achieving environmental objectives

New role	New actor types
1. Advocacy	1. Value chain actors
2. Value chain integration	2. Consumers
3. Lobbying	3. NGOs
4. Investment	4. Farmers' Unions
	5. Research
	6. Education
	7. Investors

4.4.2.2. Linking barriers to the AECM governance

Barriers within the AES governance process are unevenly distributed across both roles and actors (**Figure 14**).

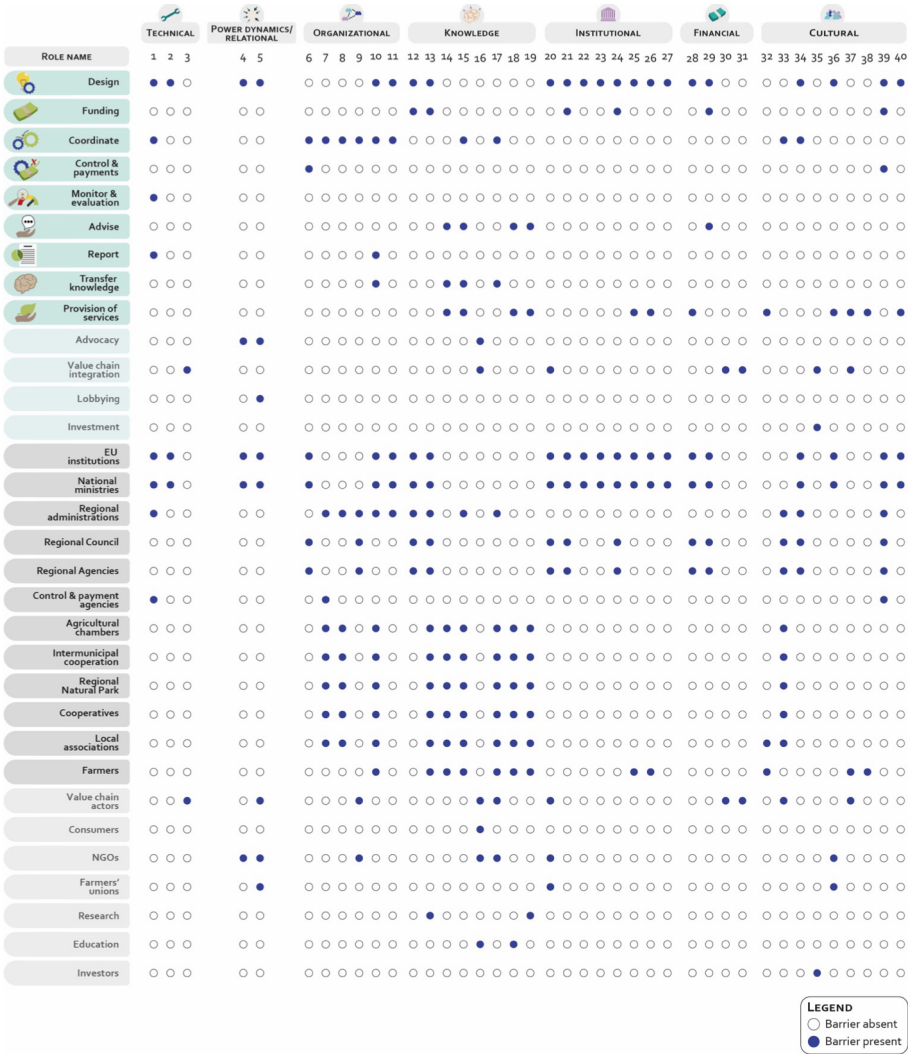


Figure 14: Boolean matrix[21]

Knowledge barriers vary considerably depending on the specific knowledge gaps they create. These include a lack of technical knowledge of the biophysical and ecological processes underpinning AES measures, insufficient understanding of administrative and institutional procedures,

[21] The Boolean matrix provides information on the link between barriers and i) AECMs roles and ii) AECMs actors in Hauts-de-France; blue dots for presence of the barrier, white dots for absence of the barrier

and gaps in network knowledge, referring to an awareness of the actor networks involved in AES governance. Cultural barriers are similarly widespread, primarily affecting trust and social norms. During the interviews, some participants highlighted the challenges of maintaining a balance between ensuring accountability in public budget spending through control measures and fostering trust, which is crucial in voluntary programs such as AES.

Power dynamics and institutional, financial, and organizational barriers are less widespread across roles and actors. Power dynamics barriers relate to governmental actors involved in AES design and funding with advocacy and lobbying groups, highlighting the interplay between formal institutional governance and external influence groups. Additionally, during the interviews, some participants pointed out that AECP calls might suffer from some power dynamics. Underrepresentation of some associations as AECP leaders could occur, factoring in some political agenda instead of others.

Institutional barriers primarily affect actors engaged in EU, national, and regional policymaking. These barriers vary in nature and implications, ranging from design and funding constraints to broader agenda-setting challenges, such as ensuring coherence between AES objectives and the wider CAP policy framework.

Financial barriers are closely related to budgetary constraints and primarily affect funders and beneficiaries. They are also linked to value chain dynamics, as current market conditions often fail to capture and valorise farm-level efforts undertaken through AES measures in final products.

During interviews, participants also reflected on the flexibility of AES governance. Some expressed concerns that predefined national listings of measures might limit the relevance of measures at the regional level, as AES

requirements are often fixed. Others, however, recognized a positive shift in the latest programming period, highlighting increased flexibility in AES measures to better align with regional needs and challenges.

Organizational barriers, in contrast, are more operational and predominantly affect administrative actors, particularly regional administrations. They involve challenges related to fund disbursement, coordination between administrations and local partners, and the lack of feedback mechanisms among actors engaged in AES governance.

From a multi-level governance perspective, barriers are closely intertwined with the multi-tiered nature of governance. Some barriers are specific to a single level, while others cut across multiple levels, underlying interdependency across levels (**Figure 15**). A more detailed analysis of the barriers within each category reveals distinct patterns of constraints.

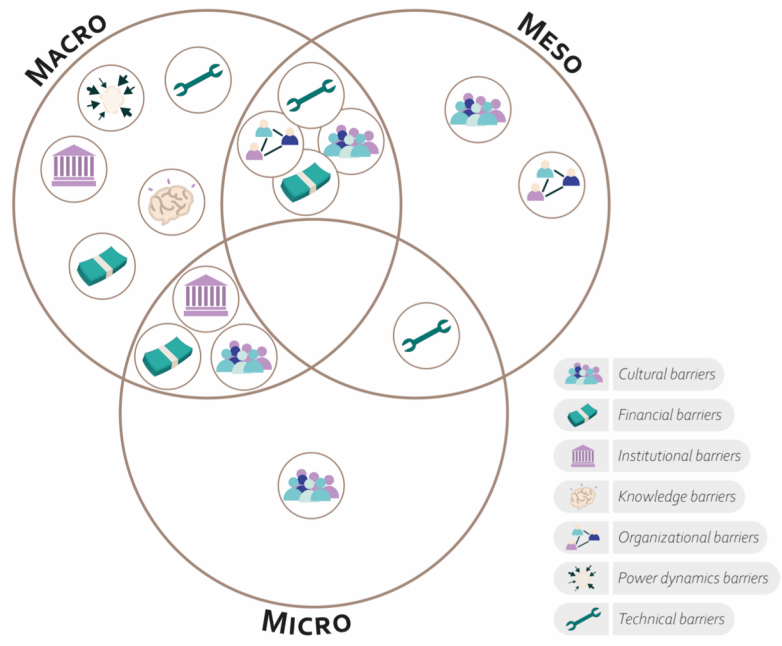


Figure 15: Barriers from a multi-level governance perspective, categories of barriers present per governance level in Hauts-de-France

Barriers between the macro and meso levels primarily derive from coordination issues. These include the limited involvement of meso-level actors (especially at the macro-meso interface) in decision-making and the administrative burden imposed on public authorities regarding fund accountability. At the meso (especially at the meso-micro interface) and micro levels, shared barriers largely relate to knowledge gaps, both in ecological and biophysical processes and in the skills required to implement AES in a way that balances environmental and economic objectives.

The micro and macro level share institutional barriers linked to AES design, such as restrictive eligibility criteria that may exclude certain farmers. Cultural barriers also emerged, regarding the dominant policy narrative that places primary responsibility for environmental issues on farmers, shaping both perceptions and policy approaches.

Some barriers remain within a single governance level, a pattern observed at all three levels. The macro level faces a broad spectrum of barriers, ranging from restrictive AES requirements and power asymmetries driven by lobbying and advocacy networks to policymakers' knowledge gaps on environmental issues and constraints in funding allocations. The meso level (especially at the macro-meso interface) is more affected by organizational barriers, such as delays in fund disbursement and coordination difficulties among regional initiatives, with the latter also reflecting cultural barriers that hinder communication among regional actors. At the micro level, barriers are primarily cultural, including farmers' risk aversion and the influence of local communities on individual decision-making.

From an actor-centered perspective, barriers do not always emerge within the roles where the mandated actors have the agency to address them. For instance, financial barriers related to AES budget allocation appear across

funding, advisory, and service provision roles. However, decision-making authority over these financial constraints remains concentrated at the macro level, particularly among EU institutions, national ministries, and regional agencies responsible for fund distribution.

4.5. Discussion

The analytical framework developed in this study helped move beyond simply listing factors that link governance and AES environmental performance. Instead, it allowed us to explore the interactions between actors, institutions, and processes within AES governance.

Our findings align with existing research. As Bazzan, Candel, et al., (2023) noted, knowledge exchange is a key issue at all governance levels. Our study adds to this by identifying different types of knowledge gaps depending on where they occur in the governance process. These range from knowledge gaps in administrative and institutional procedures occurring at meso level between public authorities and AES implementing actors to gaps in understanding biophysical and ecological processes at micro level across both advisors and farmers, highlighting the need for targeted knowledge-sharing strategies. Institutional design issues in AES governance were another key point, consistent with critiques from Mettepenningen et al., (2013); Schomers et al., (2015); Toderi et al., (2017); de Vries et al., (2019). Problems with spatial targeting and contract structures can exclude certain farmers or lead to ineffective environmental measures. Power dynamics, as discussed by Beckmann et al., (2009 and Benoit & Patsias, (2017), also emerged as a theme. However, unlike previous research which often focused on the unbalanced decision-making power between agricultural and environmental actors, our study highlights the influence of interest groups such as lobbying and advocacy networks. These groups often have

uneven representation in policy negotiations, raising concerns about fairness and balance.

Our results also confirm coordination and stakeholder engagement challenges in AES governance (Toderi et al., 2017; Bazzan, Candel, et al. 2023). We show that these challenges differ across governance levels and require different strategies. At the meso level, tackling coordination and stakeholders' challenges could involve building networks between regional agencies and local associations. At the macro level, adressing these challenges could involve feedback mechanisms between policymakers and administrations, reinforcing the macro-meso level interface.

A key takeaway from this study is that governance barriers are very diverse. Barriers of contrasted nature are found within each category (e.g., organizational, knowledge-based, and financial). Additionally, these barriers arise at different stages of AES governance process. Addressing them thus requires tailored strategies. For instance, solving a knowledge gap related to ecological processes differs from addressing gaps in administrative skills, even though both relate to knowledge. Additionally, some barriers remain within a single governance level while others span multiple levels. The latter entails that different actors and roles are involved, meaning that barriers at these intersections often require solutions that consider multiple perspectives. Recognizing this complexity is crucial when designing effective policy responses to those barriers.

Another important insight is that barriers affecting one group of actors cannot always be resolved at that level alone. For example, design and funding challenges affecting farmers' adoption of AES require decisions at higher governance levels involving funding actors. If the barrier falls within the regional administration's control, such as administrative burden in

disbursement mechanisms, administrative simplification measures can be effective. However, administrative simplification alone is insufficient for budget allocations, which lie beyond the authority of regional administration. In such cases, negotiation and collaboration across governance levels are needed.

Finally, actors outside the governance structure also influence AES environmental performance. For example, market forces and consumer behaviours affect production decisions, meaning improving AES effectiveness requires looking beyond governance. Production and consumption dynamics need to be considered together.

The analytical framework developed in this study clarifies the relationships between governance levels, actors, and roles and links barriers with governance process. However, our interview protocol had limitations in assessing the link between barriers and environmental mechanisms, focusing more broadly on performance issues. We encourage future scholars to tackle this issue by, e.g., designing the interview protocol, integrating a set of questions, further challenging the set of barriers and their link to environmental performance, and investigating the underlying mechanisms.

4.6. Conclusion

This paper developed an analytical and theoretical framework for systematically identifying and addressing governance factors hampering the AES environmental performance, validating it through a regional case study. Our findings explored the multi-level nature of AES governance and shed light on the complex web of barriers hampering the AES environmental performance. We identified six categories of barriers (i.e. technical, power dynamics & relational, knowledge, organizational, financial, cultural, and institutional) and emphasized their intertwined nature across the AES governance process. We found that some barriers are specific to a single governance level while others cut across multiple levels.

While some findings are region-specific, the study's framework offers broader insights applicable to AES governance across EU Member States. First, addressing AES governance barriers requires accounting for their specific characteristics, which depend on the stage of the governance process in which they emerge. Second, actors facing the consequences of governance barriers do not always have full agency to resolve them. Opting for a lever without considering the nature of the barrier and the agency of the implementing actor could lead to ineffective strategies. Third, actors outside the governance process influence AES performance, and coordinating these external influences is essential to enhance the effectiveness of AES.

5. Paper 3: Explaining differences in environmental policy integration: a comparative analysis of the European Union's Common Agricultural Policy

Status: Under review at Sustainability: Science, Practice and Policy (June 2026)

Authors: Diana Borniotto, Pascal Grohmann, Peter H. Feindt, Daniel Polman, Philippe V. Baret

Extended abstract

Scope: The paper explores the heterogeneity across EU Member States, investigating how they operationalise at national level environmental objectives. It focusses on the diverse governance and policy configurations under the current CAP Strategic Plans 2023–2027. To do so, the analysis is grounded in two theoretical foundations: Differentiated Policy Implementation (DPI), which focuses on the domestic factors shaping how EU policies are implemented across Member States, and Environmental Policy Integration (EPI), which focuses on the extent to which environmental objectives are embedded in sectoral policy (i.e. agriculture).

Link to hypothesis & research gap (Section 2.5 and 2.6): This paper relates to RG1, RG2, H1, and H2. By applying a comparative study across all 27 EU Member States, it directly addresses RG2, providing the systematic, cross-country assessment that the largely case-study-based literature has been missing (see Paper 1). The finding on the combinations of political, institutional, and sectoral conditions provides direct support for H2, while reinforcing H1 and, more broadly, RG1, by showing that governance-related conditions help explain variation in the environmental ambition embedded in AECM and eco-scheme design.

Methodology: Using Qualitative Comparative Analysis (QCA), the study asks under which conditions Member States pursue policy ambition (through stronger EPI in CAP implementation), and how these conditions combine into distinct pathways across countries. It focuses on the CAP's two central agri-environmental instruments (i.e. AECMs and Eco-schemes) examining both their budgetary weight and the stringency of their design across all 27 EU Member States (28 CAP Strategic Plans, as Belgium submits separate regional plans). The study tests five conditions drawn from the Differentiated Policy Implementation literature: i) green party presence in government, ii) the system of interest intermediation, iii) administrative capacity, iv) farming system intensity, and v) the prevailing agricultural policy paradigm. The analysis is conducted, first for AECMs, then for Eco-schemes, and finally for their joint implementation

Results: Environmental Policy Integration follows several distinct, partly overlapping pathways. Those pathways differ between the two instruments under scope, pointing to specific governance logics. For AECMs, strong EPI can follow a sectoral logic, combining extensive farming systems with a strong Pillar II orientation. Additionally, an administrative pathway, with strong administrative capacity paired with a green party in government and either Pillar II orientation or corporatist structures, is present mostly in wealthier Northern Member States. An European pathway, combining weaker corporatism and lower administrative capacity, sit against initial theoretical expectations (an would deserve further inquiry through in-depth case study analysis). For Eco-schemes, three pathways emerge. Firstly, an administrative pathway, second a political one in strongly corporatist, low-Pillar-II contexts. A third sectoral pathway tied to strong corporatist representation. None of the five conditions proves systematically necessary.

Comparing instruments, only a handful of Member States sustain strong EPI in both AECMs and Eco-schemes at once, and most MS instead concentrate their environmental ambition in one preferred instrument while remaining weaker in the other. This suggests that, through subsidiarity implementation, MS redistribute environmental ambition across instruments rather than its cumulative build-up.

Together, these findings show that the flexibility granted under the CAP Strategic Plans structures distinct, only partially overlapping routes to environmental ambition. This heterogeneity points out the challenges for the implementation of subsidiarity, given: i) the specific context of each Member State, ii) the diversity across Member States themselves (not least as shaped by successive rounds of EU enlargement), and iii) the nature of the EU–Member State relationship, including the institutional frictions that can emerge during implementation.

5.1. Introduction

The Common Agricultural Policy (CAP) has been a central pillar of the European Union (EU) since its establishment in 1957. Initially designed to increase agricultural productivity, stabilise markets, and ensure a fair standard of living for farmers through common market organisation (Treaty on the Functioning of the European Union, Articles 39-45), the CAP has undergone successive reforms that have progressively expanded its scope. Since the 1990s, and particularly following the Treaties of Amsterdam and Lisbon, environmental and sustainability objectives have been increasingly integrated into the policy framework. In parallel, these reforms have gradually reconfigured the balance of competences between the EU and its Member States (MS), granting greater discretion to national authorities in the implementation of CAP instruments. This shift has culminated in the 2023-2027 programming period, which introduces a New Delivery Model based on CAP Strategic Plans, designed by MS within a common EU framework Regulation (EU) 2021/2115. While this model aims to enhance policy relevance to local challenges, it also raises important questions regarding the implications of increased subsidiarity for policy coherence and effectiveness within the EU's multi-level governance system. It remains unclear how MS use this flexibility to pursue diverse policy objectives, and which combinations of factors account for variation in the integration of environmental objectives in EU policy.

To address this issue, this paper draws on two complementary strands of literature: environmental policy integration (EPI) and differentiated policy implementation (DPI). EPI refers to the extent to which environmental objectives are incorporated into sectoral policies, and has been widely studied in the context of EU governance(Persson et al., 2018; Lafferty & Hovden, 2003). Within the CAP, EPI has materialized through a progressively

developed set of policy instruments (commonly referred to as the “green architecture”) which includes i) conditionality requirements, ii) agri-environmental and climate measures (AECMs) and, more recently, iii) eco-schemes. Despite these developments, the literature consistently highlights persistent limitations in the strength of EPI in the CAP (Guyomard et al., 2023).

Recent studies have pointed to the role of MSs in shaping the level of environmental ambition achieved through CAP implementation (Borniotto et al., 2026; Isbasoiu, Ancuta & Fellmann, Thomas, 2024; Röder et al., 2024). This growing emphasis on national discretion aligns with the scope of DPI literature, which examines how EU policies are implemented differently across Member States (Zhelyazkova et al., 2024). DPI scholarship identifies a range of factors influencing implementation outcomes, including institutional characteristics (e.g. administrative capacity or governance structures), political dynamics (e.g. party composition in government), and structural or material conditions (e.g. the organisation and intensity of the agricultural sector) (Bazzan & Vogeler, 2025). While the conceptual link between DPI factors and EPI in the CAP has been acknowledged in the literature, empirical analyses explicitly connecting these two dimensions are, to our knowledge, absent.

Against this background, this paper addresses the following research questions: under which conditions do MS achieve strong EPI in the implementation of the EU CAP framework? How do these conditions combine into distinct pathways across countries?

To answer these questions, the paper focuses on the implementation of the two main policy instruments within the CAP’s green architecture, namely AECMs and eco-schemes. Using Qualitative Comparative Analysis (QCA),

the study examines cross-country variation across all EU 27 Member States in both the design and budgetary allocation of these instruments.

5.2. Conceptual framework: Differences in environmental policy integration in the implementation of EU's Common Agricultural Policy

5.2.1. Conceptualising EPI

EPI denotes the integration of environmental concerns into policy areas that address sectors where environmental problems originate(Persson & Runhaar, 2018). EPI requires that environmental objectives are considered alongside sectoral objectives(H. Runhaar et al., 2020), and that sectoral policy instruments support pro-environmental choices and behaviors in the target sector. Depending on the relative priority of environmental objectives and on instrument choices, EPI can be strong or weak. Weak EPI means that sector-specific objectives, e.g. enhancing agricultural productivity, are prioritized in policy design and implementation (Oberthür, 2009), whereas strong EPI denotes a "clear emphasis on, and bias towards, environmental objectives" (Lafferty & Hovden, 2003).

To analyse the strength of EPI in a policy area, it is useful to distinguish between policy output and policy outcome (Persson et al., 2018). Output-oriented analyses focus on the decisions taken in policy processes, set down in policies and programs adopted (H. Runhaar, 2016). Outcomes refer to changes in behavior or natural conditions that directly result from an output (Biesbroek, 2021). Output-oriented EPI studies struggle with challenges of causal attribution and measurement of the effects of specific policy output on behavior or natural conditions. However, policy outputs are generally a good indicator of EPI strength. Therefore, this paper adopts a policy output perspective.

Integrating environmental concerns in other policy areas result in policy mix. Each policy mix consists of three integral elements: *objectives* as

manifestations of the cognitive assumptions and normative beliefs of a policies' purposes, *instruments* as the tools and techniques to address the objectives and *calibrations* of the instruments as the concrete adjustment of the policy settings. EPI leads to tensions between sectoral and environmental objectives. The strength to which selected instruments support rather the sector-specific or the environmental objectives is determined by their calibrations (Grohmann & Feindt, 2023). Therefore, EPI assessment must not only analyse the integration of environmental objectives and instruments in sectoral policies but also consider their calibration, representing the contextual decisions through which policy makers adjust the actual setting of policy instruments(Grohmann & Feindt, 2023).

5.2.2. EPI in the policy mix of the CAP (2023-2027)

The CAP 2023-2027 explicitly target environmental and climate, and Art. 5 of Regulation (EU), 2021/2115 sets out the three overarching objectives of the CAP, one of which explicitly addresses environmental concerns, alongside income support and rural development. Therefore, EPI is evident at the level of overarching objectives. The same regulation includes provisions for the NSPs, in which MS select the instruments to address these objectives. This New Delivery Model is expected to "give more flexibility and subsidiarity for MS" (Recital 86, Regulation (EU), 2021/2115).

At the level of instruments, Eco-Schemes (Article 31, Regulation EU, 2021/2115) and AECMs (Article 70, Regulation EU, 2021/2115) are the two central instruments for addressing agri-environmental issues, alongside enhanced conditionality (Articles 12-14, Regulation EU, 2021/2115) linking income support to requirements in the areas of consumer protection, animal health, and environment. Eco-Schemes are included as a new instrument in the CAP 2023-2027 and entail payments for voluntary one-year measures considered beneficial for the environment, climate and animal welfare. Under AECMs, which have been part of the CAP's instrument portfolio since 1992(Daugbjerg, 2003), farmers voluntarily commit to implementing environmentally beneficial measures for a period of five to seven years.

The calibration and national implementation of Eco-schemes and AECMs is a complex task. MS are required to programme at least 25 % of their national financial envelope for pillar I[22] as eco-schemes, though this limit can be

[22] CAP's Pillar I and Pillar II rely on distinct financing mechanisms. Pillar I is funded through the European Agricultural Guarantee Fund (EAGF) and primarily covers direct payments to farmers as well as market support measures. It is fully financed by the EU budget. Pillar II, by contrast, is financed through the European Agricultural Fund for Rural Development (EAFRD) and supports rural development and agri-

reduced to 23 % for MS that use at least 30 % of pillar II for agri-environmental objectives. Eco-schemes must differ from the AECM to avoid double funding, but they can be combined on the same area. In their NSPs, MS set out the specific measures to be implemented and the premiums to be paid to farmers.

To analyze whether MS use their discretion to "realize the environmental potential or [...] meet the formal requirements" (Röder et al., 2024), we operationalize strong EPI as a combination of budgetary prioritization and high stringency of Eco-schemes and AECMs. Budgetary prioritization refers to the share of total CAP expenditure allocated to Eco-Schemes and AECM. Stringency describes the relative depth of intervention embedded in the concrete design of the measures implemented. A high share of budget for stringent measures indicates strong EPI. The flexibility provided by the CAP's legal framework on decisions for the instrument calibration results in a wide variation in the implementation across MS.

5.2.3. Explaining variation: Differentiated Policy Implementation

DPI refers to the "variation in implementation practices of EU policies among (and within) MSs in response to heterogeneity in domestic conditions"(Princen et al., 2022). While the issue of difference among MS in the implementation of EU laws and policies has long been of interest to policy scholars, recent research has shifted the focus from mere legal compliance to the existence and use of discretion during legal and practical policy implementation(Zhelyazkova et al., 2024). Analyzing the variation within and between the domestic policy actions in response to an EU

environmental measures; it operates under a co-financing principle, requiring contributions from Member States (and, in some cases, regional authorities).

regulation allows for more systematic assessments of EU policies (Bondarouk & Mastenbroek, 2018).

DPI literature recognizes that MS is often intentionally given the discretion to "customize" policies during implementation (Thomann, 2015; Zbiral et al., 2023) identify two underlying rationales for the provided flexibility. Firstly, discretion can be granted substantively, i.e., because of the better outcomes that can be expected when a policy can be adapted to domestic conditions (Zhelyazkova & Thomann, 2022). However, MS may also use discretion to avoid making changes and protect the status quo(Hoppe et al., 2025). Secondly, discretion can be used strategically to make EU level decisions acceptable for MS. DPI literature shows that MS make different decisions, resulting in varying implementation patterns (Princen et al., 2022).

A growing number of empirical analyses have identified a variety of supranational and domestic factors that influence these implementation patterns(Zhelyazkova et al., 2024; Zhelyazkova & Thomann, 2022). These conditions include political factors such as the influence of domestic political parties (Pollex & Ruffing, 2024) or interest groups (Bondarouk et al., 2019), administrative capacities (Bondarouk et al., 2019) and the sectoral context (Princen et al., 2022) such as the structural characteristics of the sector (e.g. farming intensity) and path-dependent patterns in pre-existing domestic policies. Before presenting our empirical analysis of the differentiated implementation of the CAP, we elaborate on the theoretical considerations regarding the factors contributing to strong EPI.

5.3. Theoretical assumptions for strong EPI in the CAP

Differences in the implementation of Eco-Schemes and AECMs across MSs can be attributed to a range of domestic conditions. Based on previous

findings from DPI research, we selected five factors – including political, administrative, and sectoral aspects – for our empirical analysis: i) political parties, ii) interest groups, iii) administrative capacity, iv) farming system intensity and v) policy paradigm. We will now develop assumptions regarding their effect on budgetary prioritization and stringency of the AECM and Eco-schemes, i.e. strong EPI.

Political parties

A1: Participation of environmentally oriented parties in government contributes to strong EPI in national CAP implementation

Political parties play a crucial role in environmental policymaking, aggregating interests that need to be translated into political agendas (Knill et al., 2010). The influence of parties on EPI can be explained by the fundamental conflict between environmental and economic concerns (Töller, 2022). This line of conflict is reflected in empirical analyses of party positioning in agricultural policy, in which green parties are identified as the strongest advocates of agri-environmental concerns, while conservative parties focus on productivity and food security (Bazzan & Vogeler, 2025). Consequently, we expect that participation of environmentally oriented parties as part of the government contributes to strong EPI in national CAP implementation.

Interest groups

A2: Pluralist systems of interest intermediation contribute to strong EPI in national CAP implementation

Interest groups affect implementation processes by articulating their interests to the public and strategically influencing policy processes (Zhelyazkova & Thomann, 2022). Research on interest intermediation established the differentiation between neo-corporatist and pluralist systems(Beyers & Maloney, 2024). Neo-corporatist systems are

characterized by a limited number of peak interest groups which are formally recognized and granted privileged, institutionalized access to policymaking, favoring the status quo. In pluralist systems, multiple, competing groups have more open but less structured access. In agricultural policy, MS differ in their systems of interest intermediation. MS with strong centralized farm unions display corporatist features and producer-oriented implementation decisions, whereas countries with fragmented farming structures and more competitive interest intermediation show more pluralist patterns. We hypothesize pluralist systems of interest intermediation to contribute to strong EPI in national CAP implementation.

Administrative capacities

A3: High administrative capacities contribute to strong EPI in national CAP implementation

Administrative capacities encompass the sets of skills, competences, resources, institutional arrangements and capabilities to develop and implement a policy (Howlett & Ramesh, 2016). Administrative capacity is a key factor in explaining variation in implementation decisions (Zhelyazkova et al., 2024). High administrative capacity can facilitate the effective implementation of environmental policies (Bondarouk et al., 2019). Existing policies create feedback effects so that administrations build specific capacities geared toward the implementation of established and new instruments (Pierson, 1993). In the case of the CAP 2023-2027, the preparation of the NSPs represented a very extensive process with which the MS had no previous experience and in many cases the personnel and organizational capacities for handling this process had to be created first (Röder et al., 2024). We therefore expect high administrative capacities in MS contributing to strong EPI in national CAP implementation.

Farming system

A4: A large share of extensive farming systems increases the likelihood of strong EPI in national CAP implementation

In addition to political and institutional factors, the sectoral context could provide explanations for variation in implementation decisions regarding agri-environmental policy instruments. Analyses of CAP negotiations from a political economy perspective show that the characteristics of national farming systems influence the policy preferences of MS (Greer, 2017). MS with high production-oriented farming systems give priority to income supporting policy instruments in pillar I, while agri-environmental practices are mainly implemented in regions with smaller-scale farming structures and more extensive farming systems. This can be explained by both the distributive effects of area-based income support measures and the higher opportunity costs of implementing agri-environmental instruments in more productive areas. We hypothesize that a large share of extensive farming contributes to strong EPI in national CAP implementation.

5: Agricultural policy paradigms

A5: The prevalence of multifunctional agricultural policy paradigm contributes to strong EPI in national CAP implementation

"Ideas matter" (Schmidt, 2008) in public policy, as they affect not only the development and design of policy solutions but also their implementation(Swinkels, 2020). A policy paradigm denotes the ideational framework of an enacted policy (Feindt, 2018). Research on the ideational dimensions of EU agricultural policy has established a distinction of three distinct agricultural policy paradigms: i) a productivist paradigm that emphasizes income support for agricultural producers, ii) a market-liberal paradigm characterised by reduced levels of state interventions, and iii) a multifunctional paradigm that focuses on the support for the provision of public goods(Feindt, 2018). The prevalence of these paradigms varies at

national level (Alons & Zwaan, 2016). MS's decisions in the CAP implementation (e.g. shifting budget across pillars, set high or low stringency of requirements) can be understood as manifestations of the dominant agricultural policy paradigm. Consequently, we hypothesize that the prevalence of a multifunctional policy paradigm contributes to strong EPI in national CAP implementation.

Overall, we were able to formulate assumptions regarding the effect of these five factors on MS's decisions in the implementation of the CAP and its general contribution to EPI. However, these considerations point to two gaps in theorizing domestic factors and their contribution to the EPI within the CAP. On the one hand, it is not expected that these domestic factors do have an isolated effect on implementation. Therefore, empirical analysis is needed to explore the combinations of factors. On the other hand, when analysing differences in EPI among MS, the effects of the (combined) factors are not expected to have an isolated effect on either Eco-Schemes or AECM but for their combined implementation. Consequently, our empirical analysis proceeds in three steps, exploring the (combination of) factors explaining strong EPI in i) the national implementation of AECMs, ii) national implementation of Eco-Schemes and iii) combined implementation of AECM and Eco-Schemes.

5.4. Materials and methods

5.4.1. QCA as methodological framework

QCA is a case-oriented comparative method grounded in set theory that examines how combinations of conditions are associated with a given outcome. It is structured around three core elements: i) cases (the units of analysis), ii) conditions (the explanatory factors), and iii) the outcome (the phenomenon to be explained). By analysing how these elements interact, QCA identifies pathways (i.e. configurations of conditions) associated with the presence or absence of the outcome, making it particularly suitable for complex, context-dependent phenomena.

The method follows five main steps. First, cases are selected to capture sufficient variation in both conditions and outcomes. Second, data are collected for all conditions and the outcome across cases. Third, calibration assigns set-membership scores to each case, reflecting the degree to which they belong to a given condition. Fourth, necessity analysis assesses whether any single condition (or its absence, denoted by ~) is required for the outcome to occur. Fifth, a truth table is constructed to represent all observed combinations of conditions, allowing the identification of configurations consistently associated with the outcome.

In this study, we rely on the intermediate solution using the Enhanced Standard Analysis approach, which incorporates directional expectations based on theory to address unobserved configurations. Analyses are conducted using the QCA and SetMethods packages in R.

The empirical relevance of the results is assessed through consistency and coverage. Consistency measures the extent to which a configuration is associated with the outcome across cases, while coverage indicates the

proportion of outcome cases explained by a given configuration. To ensure robustness, we follow the protocol proposed by Oana & Schneider (2024) testing the sensitivity of results to variations in calibration and consistency thresholds. Further methodological details are provided in Supplementary Materials (Annex 2).

5.4.2. Methodological steps

5.4.2.1. Case selection & data collection

The cases are the 28 CAP Strategic Plans (CSPs) submitted by the 27 EU Member States for the 2023–2027 programming period (with Belgium having separate regional plans for Wallonia and Flanders), focusing on both AECMs and Eco-schemes.

The primary data source for the outcome is the EU Catalogue of CAP Interventions, which is the official database of the European Commission compiling the full list of measures programmed under each CAP Strategic Plan. It provides harmonized information across all 27 Member States. The catalogue reports detailed data on budgetary allocations at measure level for the period 2023-2027, and the specifications associated with each intervention, such as eligibility criteria, targeted practices, or compliance requirements.

For data collection for the conditions in the analysis, multiple potential data sources and indicators were considered. The final selection followed a two-stage exclusion process aligned with the structure of the empirical analysis. A first screening was conducted prior to the QCA, based on two criteria: i) data availability across cases and over time, and ii) the robustness of the indicator with respect to the research design and conceptualization of the condition. Indicators that did not meet these requirements were excluded at this stage. A second screening was performed after the data analysis,

focusing on the explanatory contribution of the conditions to the model. Indicators associated with configurations showing limited or no explanatory power (more information in Supplementary Materials, Annex 1) were excluded. Based on this procedure, a final set of five indicators was retained for the analysis of conditions (**Table 16**).

Table 16: List of conditions, with related indicators, data source and value ranges across cases

ID	Condition	Indicator(s)	Database/source	Value range (raw data)
1	*Influence political parties*	Presence of green party in government (%)	ParlGov	0/1 Presence or absence
2	*Interest groups*	Density of employers' organizations	OECD/AIAS ICTWSS dataset	33-100
		Degree of corporatism in EU Member States	Harvard Dataverse – corpEUplusindex (Jahn, 2016)	-0.94 - +1.06
3	*Administrative capacity*	Recovery rate (%)	DG AGRI - Annual Activity Report 2024	20-96%
4	*Farming system*	Utilized agricultural area (UAA) managed by low-input farms (%)	FADN	18.2-57.7%
5	*Policy paradigms*	Pillar II share (%)	EC (DG AGRI) - CAP Catalogue of intervention	14-73%

Pro-environmental political influence was operationalized through the presence of Green parties in government during the NSP formulation period (2020-2022), based on association with the European Greens. The role of interest groups was captured through an indicator of corporatist interest representation combining i) employers' organization density (OECD/AIAS ICTWSS), used as a proxy for the influence of peak organizations in

policymaking, and ii) the corpEUplus score, reflecting the degree of corporatist coordination in EU Member States. Administrative capacity was measured through the recovery rate of irregular CAP payments, indicating the proportion of detected non-compliance successfully recovered by authorities. The farming system condition is operationalized using the share of utilized agricultural area managed under low-input systems, capturing structural differences in production intensity, both in livestock and crop production systems. Finally, policy paradigms are represented by the share of CAP funding allocated to Pillar II, which signals the strategic orientation of national agricultural policy towards rural development and agri-environmental interventions relative to income support instruments under Pillar I. Information on raw data across all cases is available in the Supplementary materials, Annex 1.

5.4.2.2. Calibration

The outcome has been calibrated following European Commission practice on budget tagging. We use a budget-share benchmark of 40% of budget allocation as financial floor for major commitment based on the Rio markers[23] (Nesbit et al., 2020). We distribute such share across the two policy instruments. To define the financial floor of minor commitment, as the Rio markers do not provide reference for this, budget allocation is defined as moderate-weak at the level of 10% allocation. We operationalize three stringency classes (low = 0.25; moderate = 0.5; high = 0.75). The threshold values for classification are the products of the budget-share benchmark and the stringency classes (**Table 17**). Further information on the calibration strategy for stringency is provided in the Supplementary materials, Annex 2.

[23] Rio markers are a policy-tracking methodology developed within the OECD to quantify the extent to which public expenditures contribute to environmental objectives, notably biodiversity and climate mitigation. Each budget item is qualitatively scored (0 = not targeted; 1 = significant objective; 2 = principal objective), and translated into indicative financial shares, commonly 0%, 40%, and 100% respectively in EU budgetary practice.

Table 17: Thresholds calculation for the outcome

EPI Level	Budget	Stringency	QCA Outcome threshold
Strong	20%	0.75	20% × 0.75 = 0.15
Moderate-strong	15%	0.5	15% × 0.5 = 0.075
Moderate-weak	10%	0.25	10% × 0.25 = 0.025

Calibration anchor points for the conditions are summarized in

Table 18, further info on calibrated data is provided in the Supplementary Materials, Annex 1.

Table 18: Data calibration of conditions

Condition	Code	Inclusion threshold	Membership
Domestic political preferences	GRP	0.33 for each year that a green party was in govt during NSP formulation	7/28
Interest groups	VETO	>0.5 based on average set membership in two indicators (see Supplementary materials, Annex 2)	13/28
Administrative capacity	ADM	0.72	16/28
Farming system	FARM	31.7	15/28
Policy paradigm	PII	0.41	13/28

5.4.2.3. Necessity and sufficiency analysis

The analysis was conducted through three distinct analytical settings. First, QCA models were developed for AECMs to identify the configurations associated with higher levels of environmental ambition within this instrument (Section 3.1). Second, an analogous analysis was conducted for Eco-schemes, enabling a parallel assessment of how ambition is shaped under the second policy instruments (Section 3.2) . Third, the analysis shifted to the joint implementation of both instruments (Section 3.3).

Truth tables were constructed for the presence of the outcome for each of the three analytical models. Truth tables for outcome absence were not included in the main analysis to maintain analytical parsimony. Necessity[24] and sufficiency analyses were conducted following established QCA procedures. Tests were performed at both the level of single conditions and combinations of conditions. Necessity analyses were implemented using standard thresholds (i.e., consistency threshold incl.cut = 0.90, coverage threshold cov.cut = 0.60, and relevance of necessity ron.cut = 0.50).

5.5. Results

5.5.1. First step of analysis: focus on agri-environmental and climatic measures

The first analysis aims to explain which cases display strong EPI in AECMs, revealing several distinct but partially overlapping pathways (**Table 19**). The analysis is able to identify pathways that consistently (inclS = 0.880) explain most of the cases (covS = 0.864). Moreover, these results are robust to changes in calibration and inclusion thresholds (RFcons: 0.918, RFcov: 0.862).

[24] The necessity analysis conducted no necessary condition (or combination) was identified, hence they are not discussed in the result section; additional information on i) thresholds, and ii) all tables resulting from the analysis are provided in Supplementary materials, Annex 2

Table 19: Sufficient solution pathways for the EPI outcome presence for AECMs[25]

ID	Pathway	Minimized solution	inclS	PRI	covS	covU	cases
1	Sectoral pathway	FARM * PII	0.962	0.909	0.613	0.173	MT; CY,PT; IT; SI; FI,LU,SE
2	Political pathway	~VETO * GRP * ~FARM	0.996	0.987	0.114	0.015	IE
3	Eastern pathway	~VETO *~ ADM *~FARM	0.836	0.614	0.422	0.119	HU,RO; BG,CZ,HR,SK
4	Administrative pathway	GRP * ADM * PII	0.998	0.996	0.256	0.042	AT; FI,LU,SE
5	Administrative pathway	VETO * GRP* ADM* FARM	0.929	0.881	0.251	0.052	BE-WA,DE; FI,LU,SE
		Solution	*0.880*	*0.784*	*0.864*		

In the first pathway (Solution 1), a high share of low-input farming, combined with a relatively strong second-pillar allocation, enables ambitious strong EPI in AECMs implementation. This indicates driving sectoral dynamics of the farming system (expressed in terms of farming systems and pillar II fund allocation) across Member States with otherwise diverse political and administrative contexts (MT, CY, PT, IT, SI, FI, LU, SE).

A second configuration reflects a political-opportunity pathway (Solution 2), which appears in more high-input farming contexts, where strong EPI in AECMs becomes possible in the combination of weak corporatist structures

[25] Each row corresponds to a configuration of conditions leading to the outcome. The third column reports the combination of conditions using standard QCA notation: "*" indicates a logical AND (joint presence of conditions), while "~" denotes the absence of a condition Columns 4-7 report the following metrics: inclS (solution consistency), indicating the degree to which cases sharing a configuration also display the outcome; PRI (proportional reduction in inconsistency), assessing the extent to which a configuration is uniquely associated with the outcome rather than its absence; covS (solution coverage), capturing the proportion of outcome cases explained by each configuration; and covU (unique coverage), indicating the share of cases explained exclusively by a given pathway. The cases column lists the empirical cases corresponding to each configuration

with a green party in government. This configuration is observed in only one case (i.e., IE).

The distribution of cases also reveals regional clustering patterns. An Eastern European cluster groups countries (i.e. HU,RO; BG,CZ,HR,SK) characterized by weaker corporatist intermediation and lower administrative capacity (Solution 3). This pathway is somewhat surprising given the conceptual framing of assumption in Section 3, but also cluster relatively new MS, for which specific in-depth case study analysis could help further interpretations (C. Q. Schneider, 2024).

We also identify an administrative pathway (Solution 4), where strong outcomes emerge from the joint presence of strong administrative capacity, political support from green parties in government, and a dedicated Pillar II orientation. This pathway is primarily associated with wealthy Northern European countries (AT; FI, LU, SE).

A similar configuration is observed in Solution 5, which also combines strong administrative capacity and green political support, but differs as associated with the presence of strong corporatist structures and a dominance of low-input farming system, rather than a Pillar II focus (BE-WA, DE; FI, LU, SE). Some countries, such as FI, LU, SE appear across multiple configurations, indicating the presence of equifinality.

5.5.2. Second step of analysis: focus on eco-schemes

The second analysis aims to explain which cases display strong EPI in Eco-schemes, identifying three distinct pathways (**Table 20**). The analysis explains a substantial share of the cases (inclS = 0.780; covS = 0.703), although with lower consistency compared to AECMs, and remains stable across alternative calibration and inclusion thresholds.

Table 20: Sufficient solution pathways for the EPI outcome presence for Eco-schemes

ID	Pathway	Minimized solutions	inclS	PRI	covS	covU	Cases
1	Administrative pathway	~VETO * ~GRP * ADM	0.760	0.546	0.453	0.122	EE,LT,LV; CY,PT
2	Political pathway	VETO * ~ADM * ~PII	0.857	0.696	0.382	0.087	NL; FR
3	Sectoral pathway	VETO * ~GRP * FARM * ~PII	0.847	0.675	0.396	0.005	FR; BE-FL,DK
		Solution	*0.780*	*0.627*	*0.703*		

An administrative pathway (Solution 1) shows a combination of weak corporatist system, lack of green party support in government and strong administrative capacity (EE, LT, LV, CY, PT). A second configuration displays a political pathway (Solution 2), where in highly negotiated political arenas with strong corporatist systems and low budgetary orientation for Pillar II, strong EPI is achieved through Eco-schemes. This pathway is observed only in France and the Netherlands, Finally, a sectoral pathway (Solution 3) also emerges in corporatist contexts characterized by strong sectoral representation (FR, BE-FL, DK). France illustrates a case of equifinality, appearing across multiple configurations.

5.5.3. Third step of analysis: focus on combination of policy instruments

5.5.3.1. Strong and weak EPI in combined policy instrument

A preliminary descriptive analysis of the QCA outcome (i.e., strength of EPI) shows that MS make strong use of their granted flexibility, resulting in different patterns of strong and weak EPI within their policy mix (**Figure 16**).

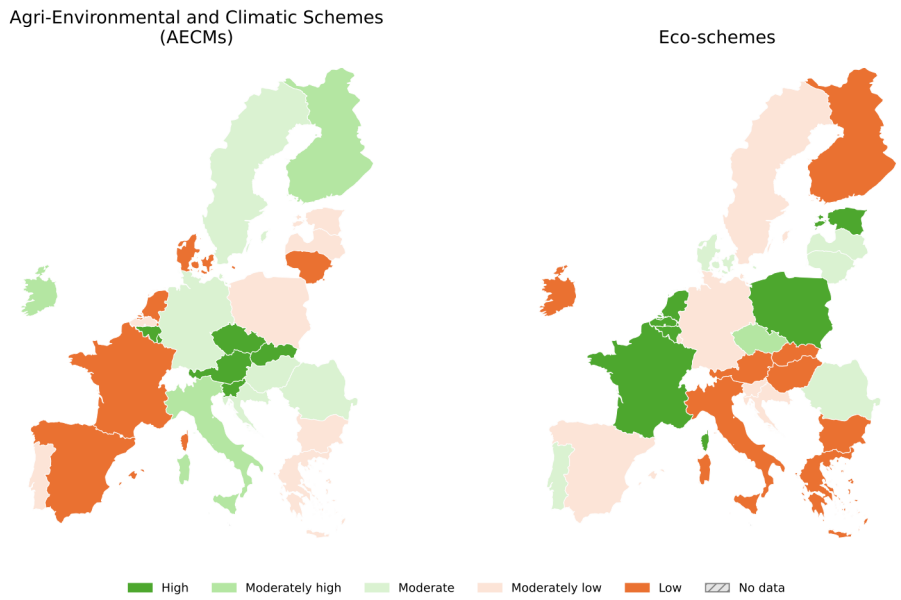


Figure 16 Cluster of EPI outcome across all EU Member States for Agri-environmental and Climatic Measures (AECMs) and Eco-schemes

The two maps presented in **Figure 16** indicates that the subsample of MSs displaying strong EPI differs across the two instruments. For AECMs it shows a relatively heterogeneous distribution, with several Central and Eastern European MS (e.g. Austria, Czechia, Slovakia) displaying strong or very strong EPI, while a cluster of Western and Southern MS (notably France, Spain and Portugal) fall into weak or very weak categories. Northern MS tend to exhibit moderate to strong EPI. For eco-schemes it reveals a different configuration. Strong and very strong EPI are more concentrated in a smaller group of MS, including France and parts of Central and Eastern Europe, while a broader set of Southern and some Northern MS fall into weak or very weak categories (e.g. Italy, Greece, Finland).

Comparing the two figures highlights that only a small number of MS (notably in Central and Eastern Europe, such as Austria and Czechia) maintain relatively strong EPI across both instruments. In contrast, several MS exhibit clear policy instrument prioritizations, and this pattern is also confirmed by

looking at budgetary distribution choice across the two policy instruments (**Figure 17**).

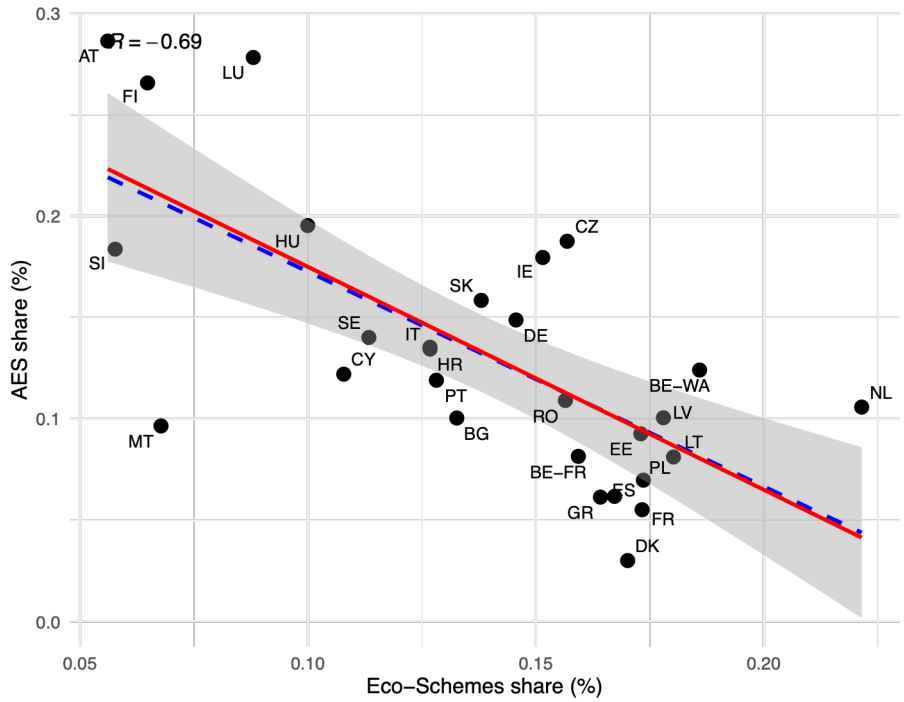


Figure 17: Scatterplot of budgetary share across AECMs and eco-schemes across EU Member States[26]

This suggests that CAP environmental objectives are typically addressed through a preferred policy instrument, rather than pursued through policy mix, meaning simultaneously across both AECMs and Eco-schemes. Although these choices vary geographically, some regional tendencies are visible. Eastern and Northern MSs more frequently display strong outcomes in AECMs, indicating a reliance on rural development measures for environmental integration. In contrast, several Central and Western MSs

[26] Blue dashed line: ordinary regression; red line robust regression; R=-0.69

tend to rely more on Eco-schemes, allocating relatively more ambition to Pillar I instrument.

5.5.3.2. Analysis on the implementation of combined policy instruments

Table 21 and **Table 22** show analyses investigate the combination between policy instruments across MS. The analysis is conducted respectively for AECMs and Eco-schemes, replacing the condition capturing the share of Pillar II expenditure with strong EPI in the alternative policy instrument. Specifically, in **Table 21** (AECMs outcome) the eco-schemes outcome is included as a condition, while in **Table 22** (Eco-schemes outcome) the AECMs outcome is included instead. This specification aims to assess how one instrument relates to the configuration leading to strong outcomes in the other, assessing policy instruments under a policy mix lens.

For AECMs (**Table 21**) the results indicate that the inclusion of Eco-scheme ambition does not substantially alter the main explanatory configurations, which continue to explain a large share of cases (inclS = 0.827; covS = 0.771) and remains robust to changes in calibration thresholds.

Table 21: Sufficient solution pathways for the outcome presence for AECMs, including the Eco-schemes as condition

ID	Pathway	Minimized solutions	inclS	PRI	covS	covU	cases
1	Eastern pathway	~ VETO* ~ ADM* ~ FARM	0.836	0.614	0.422	0.069	BG,HR,HU,SK; CZ,RO
2	Trade-off pathway	VETO* FARM* ~ ECS	0.909	0.810	0.438	0.040	IT; SI; DE,FI,LU,SE
3	Administrative pathway	VETO* GRP* ADM* FARM	0.929	0.881	0.251	0.030	DE,FI,LU,SE; BE-WA
4	Trade-off pathway	~GRP* ~ADM* FARM* ~ECS	0.918	0.702	0.330	0.000	GR,MT; IT
5	Trade-off pathway	GRP* ADM* ~ FARM* ~ ECS	0.998	0.995	0.195	0.052	IE; AT
		Solution	*0.827*	*0.708*	*0.771*		

The Eastern European cluster remains stable (Solution 1) as well as the administrative pathway (Solution 3). Though, three pathways including trade-off elements appear (Solutions 2, 4 and 5). These trade-off pathways are consistently associated with low-input farming systems and weak EPI for eco-schemes. Solution 2 is the most empirically relevant among these (covS = 0.438), with a relatively high consistency (inclS = 0.909; PRI = 0.810). It combines the low-input farming structures within high corporatism system and weak EPI for eco-scheme. The cases covered (IT; SI; DE, FI, LU, SE) indicate that this configuration spans a diverse set of MS across Southern, Central, and Northern Europe. Solution 4 presents a configuration characterized by the absence of green party in government, low administrative capacity, together with low-input farming systems, and weak EPI for eco-schemes. It shows a moderate empirical coverage (covS = 0.330) and high consistency (inclS = 0.918), and cluster Southern countries (GR, MT, IT). Solution 5 is more limited in scope (covS = 0.195) but displays very high consistency (inclS = 0.998; PRI = 0.995), and presents present of green

party in government, high administrative capacity, low-input farming systems and again weak EPI for eco-schemes.

For Eco-schemes (**Table 22**), the results indicate that the inclusion of AECMs outcome as a condition identifies two main pathways explaining a moderate share of cases (inclS = 0.813; covS = 0.610). Both pathways display trade-off dynamics, as they are consistently associated with weak EPI for AECM.

Table 22: Sufficient solution pathways for the EPI outcome presence for Eco-schemes, including the AECMs as condition

ID	Pathway	Minimized solutions	inclS	PRI	covS	covU	cases
1	Trade-off & political pathway	VETO * ~GRP* ~AECMs	0.873	0.746	0.44	0.085	NL; FR; ES; BE-FL,DK
2	Trade-off & administrative pathway	~GRP * ADM * ~AECMs	0.810	0.631	0.525	0.170	EE,LT,LV; PT; ES; BE-FR,DK
		Solution	*0.813*	*0.669*	*0.610*		

Solution 1 combines the high corporatism with the absence of green party participation in government. It shows relatively high consistency (inclS = 0.873; PRI = 0.746) and moderate coverage (covS = 0.440). The cases covered (NL; FR; ES; BE-FL, DK) indicate a concentration in Western and Northern MS, with some representation from Southern Europe. Solution 2 presents a configuration characterized by the absence of green party participation and high administrative capacity. It has slightly lower consistency (inclS = 0.810; PRI = 0.631) but higher empirical coverage (covS = 0.525) and the largest unique coverage among the two pathways (covU = 0.170). The cases associated with this solution (EE, LT, LV; PT; ES; BE-FR, DK) meaning broader geographical spread.

The robustness analyses conducted across all models(**Table 19-22**) indicate that the identified solutions remain stable under variations in

calibration and inclusion thresholds. Across all models, robustness scores for consistency exceed 0.918, demonstrating that the degree to which cases conform to the identified configurations is largely preserved when analytical parameters are modified. Similarly, coverage robustness remains above 0.825 for the first three analyses, meaning that at least 82.5% of the empirically explained cases continue to be accounted for despite changes in model specifications. This suggests a high level of stability in the explanatory relevance of the solutions. Only the fourth analysis (**Table *22***) shows comparatively lower robustness in terms of coverage, with 66.9% of cases remaining covered after adjustments to calibration and inclusion thresholds, indicating a more limited stability of case coverage in this specific model. Further information can be found in Supplementary materials, Annex 2.

5.6. Discussion

This paper contributes to bridging the DPI and EPI literature, by empirically examining national implementation of the CAP as case of EU policy. While previous research has acknowledged that increased subsidiarity may influence the level of environmental ambition achieved across Member States (Bazzan & Vogeler, 2025; Bondarouk & Mastenbroek, 2018), the CAP case in general, and its agri-environmental policy mix in particular, lacked empirical analysis. By adopting a configurational approach through a QCA, this study shades light on how variation in EPI relates to national context on institutional, political, and sectoral conditions. In doing so, it provides evidence that increased flexibility under the CAP does not simply generate heterogeneity but produces distinct pathways through which environmental objectives are pursued. The findings show that no single condition, nor combination of condition is necessary for explaining strong EPI, but there exist multiple sufficient pathways leading to strong EPI. The discussion develops five key insights, at the level of each condition, and examines their

role within the configurational nature of the results. The section goes back to the theoretical expectations from the EPI and DPI literatures developed in section 2 and 3, highlighting how these are either confirmed, nuanced, or challenged by the empirical findings of the paper. The strength of these insights varies: some support more robust explanatory interpretations, while others remain exploratory and point to the need for further, more fine-grained analysis.

First, our findings partly confirm our expectations about the role of environmentally-oriented political parties in contributing strong EPI (Bazzan & Vogeler, 2025; Tosun et al., 2024; Vogeler, 2021). For AECMs, their presence contributes to strong EPI when combined with enabling institutional conditions, particularly administrative capacity or favorable sectoral structures, suggesting that political commitment requires implementation capacity to be effective. For eco-schemes, however, strong EPI can emerge in the absence of green party participation, indicating that this instrument may compensate for limited environmental political leadership through alternative governance.

Second, the analysis provided a differentiated picture of the influence of agricultural interest groups. The results show that both strong and weak corporatist systems can support strong EPI, challenging the initial assumption that pluralist system would systematically favor stronger EPI (i.e. A2). For AECMs, strong corporatism can enable strong EPI when interacting with interaction with administrative capacity and sectoral conditions, suggesting that coordinated governance may, under certain conditions, facilitate rather than constrain environmental ambition. Similarly for Eco-schemes, corporatist systems can also support strong EPI. However, the direction of this effect remains unclear, as alternative pathways achieve similar outcomes in the absence of corporatism. This

points to the value added of potential within-case analyses, using this study for its exploratory power to better understand how different forms of interest representation shape implementation processes.

Thirdly, administrative capacity partly confirms it importance driving strong EPI, yet the analysis point to a context-dependent enabling condition. In AECMs, strong administrative capacity reinforces EPI when combined with political support or coordinated governance structures, confirming its role in translating policy ambition into implementation(Bondarouk et al., 2019). However, the identification of an Eastern pathway that does not fully align with these expectations suggests that additional contextual dynamics may be at play, warranting further investigation. In Eco-schemes, its role is less clear, as strong EPI can operate effectively in both high and low efficient administrative system. Context-specific dynamics for both the Netherlands and France emerge, yet the pathways would further require in-depth case study investigation. For the implementation of combined policy instruments, administrative capacity therefore contributes to differentiation rather than convergence, reinforcing strong performance in specific configurations without ensuring consistency across the implementation of the two policy instruments.

Fourthly, the role of farming systems challenges more deterministic interpretations of structural conditions. In AECMs, both low- and high-input systems are associated with strong EPI, depending on how they interact with policy orientation and political support. Low-input systems are linked to strong outcomes when combined with higher Pillar II investment, reflecting alignment with rural development objectives, while high-input systems can also achieve strong EPI under supportive political conditions. In eco-schemes, low-input farming systems are more consistently associated with strong EPI, suggesting a closer fit between production systems and

environmental requirements. Across the policy mix, this translates into a pattern of instrument differentiation, where low-input systems tend to favour AECM-based delivery and are largely absent from eco-scheme configurations.

Finally, concerning agricultural policy paradigms, the interaction between policy preferences guiding CAP pillar allocation and related policy instruments reveals a systematic substitution dynamic. While the association between Pillar II orientation and AECMs performance may appear expected, the analysis shows that this is mirrored by Eco-schemes operating independently of such orientation. More importantly, MS tend to concentrate environmental ambition in one instrument rather than pursuing strong EPI across both simultaneously. This indicates that increased flexibility under the CAP Strategic Plans could reinforce strategic allocation across instruments rather than cumulative integration. From an EPI perspective, this finding challenges assumptions about the additive effect of policy mixes and instead highlights that, at national level, instruments are rather prioritized.

5.7. Conclusions

This study has examined how political, institutional, and sectoral conditions shape the level of EPI across Member States, using the CAP 2023-2027 as case study. By empirically examining how environmental objectives are integrated into a key EU policy, the analysis extends existing discussions on DPI beyond questions of compliance and formal transposition, towards the ways in which discretion is exercised in shaping policy ambition on environment. It highlights that variation in implementation is not merely a domestic heterogeneity, but a structuring feature of EU governance, with substantive implications for policy outcomes.

By adopting a comparative perspective and systematically analyzing all national CAP Strategic Plans, the study identifies combinations of conditions associated with strong EPI, thereby engaging with the configurational and context-dependent nature of policy processes rather than isolating individual explanatory variables. The results show that strong EPI emerges through multiple configurations, confirming that no single condition is either necessary or sufficient on its own. These configurations differ between AECMs and Eco-schemes, reflecting distinct governance logics across CAP pillars. For AECMs, strong EPI is observed across a range of administrative, political, and sectoral pathways. Both low- and high-input farming systems can support strong outcomes, depending on their interaction with policy orientation and governance structures. The presence of environmentally oriented political parties contributes to strong EPI in some configurations but is not a systematic condition. Similarly, both corporatist and pluralist systems of interest intermediation are compatible with strong EPI, contingent on their interaction with other factors. Across instruments, Member States tend to achieve strong EPI in one while displaying weaker ambition in the other, indicating that environmental objectives are generally pursued through a preferred policy tool rather than through a combined approach.

Several limitations should be acknowledged. The analysis focuses on strong EPI only; examining pathways leading to weak EPI would provide a more complete picture. The operationalization of EPI across MSs within QCA is based on relative budgetary allocation and stringency, does not assess performance against an independent benchmark of environmental effectiveness. Linking implementation choices to environmental outcomes would therefore be a necessary next step. Finally, in-depth case studies (particularly of identified clusters) would help unpack the mechanisms behind observed configurations. Overall, the findings suggest that CAP

policy processes remain only partially understood, and that further research is needed to capture how environmental ambition is both defined, shaped and pursued within the EU's multi-level governance system.

6. Learning from the result

This chapter provides both i) a reflection on the research gaps and hypotheses presented in Chapter 2, and ii) it engages with the limitations faced in the research articles.

On the former, Section 6.1 examine the extent to which hypothesis and research gaps are confirmed, nuanced, or only partially addressed by the empirical evidence gathered across the three empirical papers of this dissertation (Papers 1, 2, and 3). Section 6.1.1 revisits each of the three research gaps, while Section 6.1.2 turns to the three hypotheses.

Section 6.2 engages with the PhD limitations, driven by the analytical and empirical choices engaged throughout the PhD research journey. Its purpose is to both i) acknowledge and ii) engage with limitations, recognising that those limitations are inherent to academic inquiry (and doctoral research). Rather than treating limitations solely as methodological shortcomings, this section discusses what these choices imply for the interpretation of the results, identifies potential avenues for further research, and provides initial reflections that will inform the reflexive chapter, especially regarding research design decisions.

6.1. Reflections on research gaps & hypothesis

Table 23 indicates whether the PhD was able to address the research gaps, and if hypothesis were confirmed, partially confirmed, or not.

Table 23: Assessment on research gaps and hypothesis

	Paper 1	*Paper 2*	*Paper 3*	*Ex-post*
Research gaps				
RG 1: governance as marginal perspective	X	X	X	Partially addressed
RG 2: case study approach as dominant one	X		X	Addressed
RG 3: missing link multi-level governance & lock-ins		X		Partially addressed
Hypothesis				
H1: governance has an impact on AECM ambition & performance	X	X	X	Partially confirmed
H2: Different governance patterns can lead to different environmental outcomes	X		X	Partially confirmed
H3: Multi-level governance frames & explains lock-ins of AECMs		X		Confirmed

6.1.1. Research gaps

The first research gap, concerning the marginal position of governance within the wider AECM literature, stans out clearly the evidence gathered in Paper 1. The systematic review illustrates this marginality, as of an initial pool of more than 943 records identified through database screening, only 28 studies met the inclusion criteria for engaging substantively with AECM governance. At the same time, the evidence points to a growing interest in the topic, reinforced by the ongoing CAP post-2027 reform debate, which

has placed governance-related questions more visibly on the policy and research agenda. Within this still-marginal body of literature, some dimensions of governance remain particularly underexplored, notably stakeholder engagement, power dynamics, and path dependency. The research gap is therefore only partially addressed.

The second research gap, concerning the dominance of case study designs in AECM governance literature, is addressed. Papers 1 and 3 each contribute to addressing this gap, though in different ways: Paper 1 provides a systematic overview of the existing, largely case-based, literature, while Paper 3 constitutes, to our knowledge, the first academic study to conduct a comparative analysis covering all 27 EU Member States. Comparative analysis at this scale reveals both recurring patterns and meaningful differences across Member States. This contribution, however, comes with an important caveat as comparative analysis of this kind requires methodological compromises. The major challenge consists in establishing a common analytical basis across countries, in terms of both data and methods, which is still a major challenge for both academic and policy literature. Current comparative setting often suffers shallow and generalised claims relative to the depth achievable in single-case studies.

The third research gap, concerning the missing link between multi-level governance and lock-ins, is partially addressed. Paper 2 develops an analytical framework structured around macro, meso, and micro governance levels, bridging the AECM governance literature (e.g. Sattler et al., 2023) with the broader multi-level governance literature. This framework, however, has so far only been tested through a single regional case study. As such, this research gap is best considered as having been opened up rather than closed: further in-depth case studies, conducted in different

institutional and geographical contexts, would be needed to assess how the framework travels beyond its original setting.

6.1.2. Hypotheses

H1 (i.e. governance has an impact on AECM environmental ambition and performance), is partially confirmed. Across the three empirical papers, governance arrangements, and specifically the actors involved and their interactions structuringthe arrangements, are shown to shape how environmental objectives are defined and pursued. This confirmation is nonetheless bounded by a deliberate scope choice, outlined in Chapter 2 (Section 2.7), to adopt a policy process and policy output perspective rather than a policy outcome perspective. Testing H1 in its fullest sense, extending governance's role to actual policy change and its environmental consequences, would require complementing this research with a policy outcome perspective, which falls beyond the scope of this PhD.

H2 (i.e. different governance patterns can lead to different environmental outcomes), is only partially confirmed. Evidence from Papers 1 and 3 confirms that distinct governance models exist and are systematically observable across Member States. However, in line with the scope limitation already raised under H1, this dissertation does not extend to actual environmental outcomes. Its empirical scope in fact stops at the point of policy implementation and does not bridge to farm-level operationalisation, where environmental outcomes would ultimately materialise. In Paper 3, the outcome variable is accordingly framed in terms of policy output, targeting environmental ambition, rather than performance. This choice reflects both a methodological framing decision, concerning which indicators to select, and a data availability constraint, as harmonised environmental performance indicators are not systematically collected across Member States. At this stage, we reflect on whether is conceptually sound and

analytical feasible to develop an evaluative framework that is simultaneously applicable at EU and environmental scale. Depending on the environmental dimension touched by EU policies (e.g. biodiversity, water quality, climate), its effect can be observed only where they occur, whether at a micro level (e.g. biodiversity), ecosystem level, or, for issues such as climate, at a much broader level. EU-level accountability, on the other hand, requires evidence that is aggregated and comparable across Member States. Reconciling the granularity needed to detect these scale-specific effects with the robustness needed to support EU-level judgements is a key challenge. How far such heterogeneity can be accommodated within a common comparative framework before the exercise of comparison itself begins to flatten, or even distort, the diversity it seeks to capture?

H3, (i.e. multi-level governance frames and explains the lock-ins affecting AECMs), is confirmed. Paper 1 shows that several studies in the existing literature (e.g. McCarthy et al., Sattler et al., Beckmann et al., Alblas and van Zeben, Weber) already link the distribution of mandates across governance levels to constraints on AECM ambition and performance, even if most of the time implicitly. This is typically through debates on the appropriate degree of centralisation, even though this connection was not the explicit focus of that literature. Paper 2 extends this insight by empirically linking a comprehensive list of governance-related barriers to the multi-level governance structure in which they arise, thereby making explicit a link that, as noted under RG3, had not previously been treated as a research question in its own right. One additional key point on the fact that the actors who bear the consequences of a given barrier do not always hold the mandate to act on it. This observation, raised as an initial reflection in Paper 2, points for future research.

6.2. PhD limitations

A first limitation relates to actor representation in the empirical material. In **Paper 2**, interviews and consultation processes primarily involved public administration actors and, to a lesser extent, civil society organisations. Farmers and value-chain actors were not included as main entry points. As a result, interactions between public governance arrangements and private-sector dynamics remain only partially explored. The barrier analysis nevertheless revealed additional roles played by private and societal actors, suggesting that governance dynamics extend beyond those captured empirically and would merit further investigation.

A second limitation concerns geographical and temporal scope. **Paper 1** relies on a corpus of published studies whose distribution reflects existing research biases, notably an under-representation of Southern and parts of Eastern Member States. Similar imbalances appear in **Papers 1 and 2**, where the focus on specific regions and MS limits our ability to assess how far the findings extend to other contexts. This bias was partly addressed through the comparative design adopted in **Paper 3**, which systematically covers all Member States. Nevertheless, further in-depth case studies would be valuable to better allow for in-depth analysis capturing context-specific implementation dynamics, governance arrangements, and actor interactions that remain difficult to assess through broader comparative approaches alone.

A third limitation relates to conceptual ambiguity, particularly regarding key concepts for the PhD: environmental ambition, performance and AECMs governance. Across the literature reviewed in **Paper 1**, environmental ambition and performance are defined inconsistently, often overlapping with concepts such as effectiveness, impact or efficiency (**Table 3**). The PhD adopts an objective-oriented definition, i.e., the extent to which environmental objectives are pursued (i.e. ambition) and achieved (i.e.

performance), as a common denominator across studies. However, this operationalisation remains influenced by disciplinary traditions and available evidence. Similarly, governance constitutes a broad concept whose meaning varies across analytical traditions, potentially introducing interpretative variability. Throughout the review exercise in **Paper 1**, AECMs governance literature provided normative assessments of what constitutes "good" or "bad" governance for improving AECMs environmental ambition and performance often spanning beyond scientific robust arguments, grounding it to disciplinary traditions, experience, personal bias amongst others. The PhD, especially through **Paper 1**, avoid employing a definition, but chose to engage with recurring elements across the studies, as seems to be a general coherence across studies (i.e. centralization vs decentralization, multi-stakeholder engagement, decision-making across and within levels).

Finally, as the PhD focus is on AECMs, it adopts a restricted policy scope EU agri-environmental policies, hence within the CAP green architecture. The analysis focuses mainly on voluntary instruments, particularly AECMs and, in **Paper 3**, eco-schemes. As a result, conclusions relate primarily to voluntary agri-environmental instruments rather than to the broad CAP governance, including other agri-environmental policy instruments (and even beyond them). Extending the analysis to additional regulatory instruments would constitute a valuable perspective for further research, allowing a more comprehensive assessment of how different policy instruments interact in shaping environmental ambition and performance within EU agri-food governance.

Table 24: Summary of limitations across empirical Papers (1-3) and across category of limitations

		Paper 1	Paper 2	Paper 3
Actor representation bias		–	Interviews dominated by public administration; limited inclusion of farmers, value-chain actors and private	–
Geographical bias		Literature corpus under-represents Southern and some Eastern MSs	Sampling of barriers specific to regional context	–
Temporal scope bias		Dependent on timing and availability of published studies	Linked to timing of consultations and interviews	Limited to CAP 2023–2027 configuration
Conceptual ambiguity	*Environmental ambition and performance*	Heterogeneous definitions across reviewed studies; methodological frame required synthesis and streamlining	Limited inclusion of ecological measurements in the governance analysis	Limited to ambition assessed through policy design features, i.e., budget & stringency, and not policy outcome
	Governance	Positionality and normativity in defining 'good' governance	–	Governance reduced to measurable institutional and political conditions
Policy scope limitation		Only focus on AECMs	Only focus on AECMs	Includes eco-schemes but excludes other EU agri-environmental policy instruments

The discussion section

7. The Future Chapter

7.1. The future CAP reform after 2027

While this PhD has analysed AECMs within the 2023-2027 CAP Strategic Plans programming period, the policy cycle is already entering a new phase, with negotiations underway for the next programming period covering 2028-2034. These discussions are not occurring solely within agricultural policy arenas but are unfolding through broader negotiations on the Multiannual Financial Framework[27] (MFF), where budgetary arbitrage will shape both the financial allocation to agriculture and the future governance architecture of the CAP within the wider EU policy landscape.

Within this evolving context, three interrelated developments appear particularly relevant from a governance perspective for agri-environmental policies: changes in governance mechanisms, evolving budgetary dynamics, and transformations in CAP policy instruments.

First, governance mechanisms are increasingly shaped by the enhanced subsidiarity. Building on longer-term reforms initiated with the CAP New Delivery Model and the introduction of CAP Strategic Plans 2023-2027, recent political developments, including the farmers' protests of 2023–2024 (Finger et al., 2024; Läpple et al., 2026) have reinforced greater flexibility at MS level. The European Commission has framed this evolution within a broader simplification agenda of the Omnibus packages[28], arguing that

[27] The Multiannual Financial Framework (MFF) is the EU's seven-year budgetary planning instrument that sets binding ceilings for EU expenditure. It ensures financial discipline and aligns spending with policy priorities. The MFF is structured around broad headings (e.g. cohesion, agriculture, research and innovation, migration, external action), under which EU programmes are financed. MFF resources come primarily from the Member States', GNI-based contributions (dominant share), VAT-based contributions, and EU resources (e.g. customs duties)

[28] https://commission.europa.eu/law/law-making-process/better-regulation/simplification-and-implementation/simplification_en

future arrangements should allow "*more flexibility, simplicity and better value for money, while strategically addressing today's priorities*" (European Parliament, 2026). In practice, this orientation reinforces the assumption that MS are best positioned to determine how EU policy objectives should be achieved within agricultural systems. However, this shift has generated criticism from civil society organizations, which argue that simplification measures, i.e., lowering EU mandatory requirements, risks translating into deregulation, particularly through the weakening of environmental safeguards and ringfencing provisions previously embedded in EU environmental policy frameworks. These concerns have escalated to a complaint to the EU Ombudswoman, that was filed in July 2024 by BirdLife International and ClientEarth (BirdLife International, 2024).

Second, MFF negotiations prior to post-2028 CAP framework introduce uncertainty regarding CAP funding. The July 2025 EC proposals envisaged integrating CAP financing within a broader policy framework, often referred to as National Regional and Partnership Plans (NRPP)[29], thereby embedding agricultural spending within wider EU priorities. This 'bundling approach' has encountered resistance from diverse stakeholders for different reasons. Farming unions across the EU express concern over potential dilution of agricultural priorities, and risks for budgetary allocation to agriculture[30], while the European Parliament has broadly defended the distinct status of agricultural funding, under a long tradition of agricultural exceptionalism[31].

[29] National and Regional Partnership Plans (NRPP) are the proposed framework by the European Commission, aiming to streamlined delivery mechanism for EU funds under the 2028–2034 Multiannual Financial Framework (MFF). They combine 14 separate programs, covering cohesion, agriculture, and migration, into one strategic plan per Member State.

For further information:

https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2026)782606

[30] https://www.fnsea.fr/communiques-de-presse/pac2028-2034/

[31] https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2026)782606

Some environmental organisations, in turn, fear that the lack of earmarked CAP resources into agri-environmental and climatic actions would dismantle the environmental policy integration in the CAP[32]. The Commission arguments firmly claim that agricultural funding will not decrease and emphasises the increased flexibility for Member States and strengthened co-financing opportunities. Yet, critics argue that shifting geopolitical priorities (i.e. increased defence and security spending) and political dynamics (i.e. increase polarization) across Member States may indirectly reduce investment in environmental objectives within agricultural policy. The extent to which CAP funding will remain ringfenced therefore remains uncertain as negotiations between the European Parliament and the Council continue.

Third, important changes are emerging in the design of policy instruments themselves. Current discussions suggest a potential consolidation of AECMs and eco-schemes into a unified intervention framework for agri-environmental and climate actions (AECA) (Matthews, 2025). Additionally, signals of a broader policy trend favouring voluntary environmental actions as the primary mechanism for environmental delivery within the CAP. On this, conditionality requirements (already substantially revised during the 2024 simplification process) may undergo further adjustments, potentially altering the balance and reducing mandatory baseline standards while privileging voluntary incentive-based instruments.

Given the current (changing) context and the insights provided by the PhD empirical findings, the following sections outline three governance leverage pathways, as part of the analytical perspective exercise made in **Paper 4**.

[32] https://www.wwf.eu/?19553841/From-a-flawed-proposal-to-real-transition---Joint-briefing-on-the-CAP-proposal

7.2. Paper 4: The role of governance in improving agri-environmental policies

7.2.1. Introduction

Despite accounting for more than €34 billion of the EU's Common Agricultural Policy (CAP) budget 2023-2027 and often described as the jewel in the crown of EU agri-environmental policy, Agri-Environmental and Climate Measures (AECMs) have systematically underperformed in delivering substantial environmental outcomes (Guyomard et al., 2023; Pe'er et al., 2014; Kleijn et al., 2006; Primdahl et al., 2003; Galler et al., 2015). AECMs are voluntary schemes under the CAP's second pillar that incentivise farmers to adopt agri-environmental practices beyond statutory obligations and Good Agricultural and Environmental Conditions (GAEC). Implemented through multi-annual contracts (5-7 years), they compensate farmers for additional costs or income foregone. By supporting actions beyond baseline requirements, AECMs aim to generate additional environmental benefits and contribute to the CAP's environmental and climate objectives. Yet, after more than three decades of successive reforms, AECMs continue to fall short of expectations. Several explanations from different disciplinary perspectives have been advanced in the literature to explain this deficient outcome. Our contribution in this paper is to highlight the under-appreciated role of governance in contributing to the unsatisfactory outcome, and to outline possible governance levers to improve performance in the next iteration of the CAP post-2027.

7.2.2. Disciplinary perspectives on AECMs environmental shortcomings

The environmental performance of AECMs have been the focus of sustained scholarly attention across multiple disciplines, providing insights on a variety of factors that contribute to their environmental shortfalls.

Economics, for example, through cost-benefit analysis (Balana et al., 2011, 2015; Bertoni et al., 2020) and transaction costs analysis (Banerjee et al., 2017; Franks, 2010; Schomers et al., 2015; Weber, 2014), points out limitations at the level of resource allocation. It also highlights the role of adverse selection (i.e. farmers who already meet the requirements are more likely to participate, thereby limiting the potential to drive change (Bertoni et al., 2020; Falconer, 2000)). Behavioural sciences focus on farmers' uptake and the related challenges, focussing on cognitive and social factors beyond the economic ones (Hasler et al., 2019; Brown et al., 2021; Schaub et al., 2023). They stress the often simplistic conceptualization of farmer behaviour underlying AECMs design. Environmental sciences raise issues on spatial mismatches, where the farm-level adoption of AECMs often fails to align with landscape-scale environmental needs (Toderi et al., 2017; Früh-Müller et al., 2019; Rotchés-Ribalta et al., 2021), as environmental challenges often transcend individual farm boundaries. Political science highlights the challenges to integrate environmental objectives into broader EU agricultural policy, given its institutional and political framing, often producing symbolic commitments rather than substantive reform (Alons, 2017; Vogeler, 2021). It points out the challenges for the CAP to move beyond its exceptionalism framing to develop "post-exceptional" politics aiming for more environmental ambition at both policy design and implementation levels (Candel & Daugbjerg, 2025; Daugbjerg & Feindt, 2022; Greer, 2017; Lovec et al., 2024).

More recently, an interdisciplinary literature, spanning policy studies (e.g. Bazzan, Candel, et al., 2023), environmental and institutional economics (e.g. Mettepenningen et al., 2013; Weber, 2014), rural sociology and human geography (e.g. Benoit & Patsias, 2017; Lowe et al., 2002), and the ecosystem services and payments-for-ecosystem-services tradition (e.g. Sattler et al., 2023; Schomers & Matzdorf, 2013), has emphasised the role of

governance arrangements in reinforcing AECM environmental underperformance. The research focus is on the actors involved in the policy process and the power dynamics shaping their interactions. This literature links environmental shortfalls to whom has the power and agency at the design stage to shape which features were chosen, and why; while at the implementation stage, it asks who was responsible for delivering the measure, and how. Consequently, a governance perspective is interested in identifying where, within the policy process, the problem lies and can point to the actors responsible for enacting the change needed to address it. This rests on the premise that an AECM will not achieve its intended outcomes if the governance context does not provide the conditions for effective design and implementation.

7.2.3. Key governance challenges

7.2.3.1. Actors composing the AECM governance

As part of the CAP governance framework, AECMs rely on a multi-level governance structure (Schebesta & Candel, 2020), in which an interdependent set of actors with distinct mandates share agency over the design and implementation of AECMs. Member States (MS) have high discretion in design features resulting in substantial variation in the measures adopted, spanning different environmental objectives (e.g. biodiversity, land preservation, climate, water), supported farming practices (e.g. delayed mowing season), landscape features (e.g. hedges, flower strips), and design forms (i.e. means-based, result-based, or collective-based). MS discretion is mirrored at the implementation level, as regards eligibility conditions, application and selection procedures, monitoring and control mechanisms, and payment calculation methods.

Each MS chooses a specific division of mandates across actors within the CAP multi-level governance framework. Germany, for instance, is

comparatively decentralised in both design and implementation, with most decisions taken at Länder level (Hirsch et al., 2022; Weber, 2014). France, by contrast, mostly centralises design at ministerial level, with implementation delegated through an administrative chain to regional authorities (Benoit & Patsias, 2017). The type of actors involved, and the stage at which they intervene, also varies considerably across MS: in France, water agencies co-fund AECMs and consequently influence their design; in the Netherlands, farmer collectives through organisations such as BoerenNatuur work with provincial authorities to develop agri-environmental scheme plans under collective contracts (Alblas & Zeben, 2023).

MS authorities often rely on a set of actors that can provide situated knowledge and therefore are better placed to design and implement context-sensitive AECMs, driving their environmental performance. This aligns with the subsidiarity principle which, under Article 5(3) of the Treaty on European Union (TEU), states that decisions should be taken at the lowest level where an objective can be most effectively achieved, with EU-level action reserved for cases where it cannot. However, the scientific evidence on the link between environmental performance and the implementation of subsidiarity across MS remains mixed, and at times contradictory (Alblas & van Zeben, 2023; Beckmann et al., 2009; Borniotto et al., 2026). This is partly because the implementation of subsidiarity depends not only on the information at hand, but also on the actors who populate each level of governance. These actors are indeed often highly knowledgeable about local conditions, but they also operate with their own institutional agendas, which go beyond the set of CAP environmental objectives for which AECMs are designed. For example, farmers' unions, while well placed to understand local farming conditions and challenges, also represent a broad and heterogeneous set of farming interests, which do not always align with the environmental objectives of AECMs. Design and

implementation choices thus reflect political and capacity realities as much as environmental constraints (and needs). When deciding i) which measures to fund, ii) how stringent their requirements should be, and iii) where to apply them, responsible authorities (e.g. Ministry of Agriculture) may balance environmental relevance against feasibility, political acceptability, and cost considerations. These trade-offs are further shaped by the overarching CAP policy setting that, despite long-standing efforts toward environmental policy integration (Feindt, 2010), continues to prioritise agricultural competitiveness and income support over environmental protection.

7.2.3.2. Power dynamics shaping AECM governance

Although EU policy discourse increasingly emphasises stakeholder participation and inclusive governance, power dynamics shape which actors are consulted, with agricultural stakeholders dominating the scene (Candel & Daugbjerg, 2025). Such imbalance sits differently at the design and implementation phase as each phase involves different sets of actors, operating under different mandates and pursuing different stakes.

Power dynamics and AECM design

The design phase of AECM governance involves establishing the budgetary envelope for the measure, the broad parameters for the scheme, and the specific farming practices that will be supported and funded. It is largely undertaken at EU and national levels where agricultural constituencies have significant power (Benoit & Patsias, 2017). At EU level, the composition of the stakeholder groups regularly consulted by the European Commission's Agriculture Commissioner is dominated by the agricultural constituency, and more specifically European farm unions (Alons, 2017; Candel & Daugbjerg, 2025). This pattern is mirrored in the Council of Agriculture Ministers and the European Parliament's agriculture committee (COMAGRI), the bodies ultimately responsible for deciding on CAP legislation (Alons, 2017; Greer & Hind, 2012). At national level, most MS assign the role of managing authority (i.e. the body legally responsible for administering and overseeing the CAP Strategic Plan under the current CAP 2023-2027) to the Ministry of Agriculture. This influence does not imply a coherent agricultural position on environmental issues. Rather, it reflects the predominance of specific interests, actors and policy narratives that set the framing in which the integration of environmental objectives take place. The power dimension in the design phase hence resides in the (unbalanced) institutional positions of some actors which allow them to set the terms of debate.

Power dynamics and AECM implementation

The implementation phase, which tends to be the responsibility of lower governance levels (Borniotto & Baret, 2026), often includes a more diverse set of actors. Environmental agencies, farmers' associations, NGOs and public administrations for both agriculture and the environment, play active roles at this level. The roles involved in the implementation phase are themselves heterogeneous, spanning administrative tasks such as reporting

and disbursement, knowledge transfer through advisory services, and coordination and communication functions that connect farmers, administrations, and other intermediaries (Sattler et al., 2023; Borniotto et al., 2025). This diversity of roles corresponds to an equally varied range of competences. Although the implementation phase is generally more operational in character than the design phase, it is not exempt from power dynamics. Where power at the design phase operates through control over agenda-setting and the formal mandate, power at the implementation phase operates through discretion exercised by the authorities responsible for administering AECMs on the ground (e.g. interpreting eligibility criteria, verifying compliance, and applying sanctions). Actors such as public administration, advisory systems or coordinating organisations need to interpret rules that were necessarily framed in general terms at the design stage (Lipsky, 2010), and in doing so shape AECMs' potential performance. This means that who is involved in the implementation phase shapes how rules ultimately land at farm level. In France, communication and coordination of AECMs at farm level is frequently delegated to agricultural chambers (Wolff, 2019). In the Netherlands, such roles are mainly channelled through BoerenNatuur, giving AECMs' farmer-led collectives a central role in translating scheme requirements into practice (de Vries et al., 2019).

Power, stakeholder engagement and transparency

A further issue behind power imbalances concerns the legal framing behind stakeholder engagement. The CAP regulation formally mandates, under Article 106 of Regulation (EU) 2021/2115, that "the public competent authorities for the environment and climate are effectively involved in the preparation of the environmental and climate-related aspects of the CAP Strategic Plan", but the methods through which participation is

operationalised remain loosely specified. Plan adoption processes are largely opaque, characterised by limited traceability, restricted access to deliberative records, and little transparency regarding who effectively shapes final decisions (Erjavec & Rac, 2023). Often procedural compliance is prioritised, leaving it unclear how diverse interests are integrated into decision-making or whether participatory mechanisms meaningfully redistribute influence within AECM (and more broadly CAP) governance. This institutional ambiguity can ultimately constrain the assessment of inclusiveness and raises the possibility that participation serves more to legitimise existing power configurations than to rebalance them.

7.2.4. Looking forward to the CAP post-2027 reform

The Commission's CAP post-2027 proposal is shaped jointly by the sector-specific CAP legislative proposal (COM(2025) 560 final) and by the new National and Regional Partnership Plan (NRPP)33 architecture introduced for the 2028-2034 Multiannual Financial Framework (MFF) (COM(2025) 565 final). Together, they represent a decisive shift in CAP governance which can have important consequences for agri-environmental governance.

First, the proposal implies a further enhancement of subsidiarity, building on a longer-term trajectory initiated with the CAP New Delivery Model introduced with the CAP Strategic Plans framework for 2023-2027, already giving Member States substantial discretion to design their own mix of interventions to meet EU-defined objectives. The post-2027 proposal extends this logic further by folding the CAP into the broader NRPP

[33] National and Regional Partnership Plans (NRPP) are the proposed framework by the European Commission, aiming to streamlined delivery mechanism for EU funds under the 2028–2034 Multiannual Financial Framework (MFF). They combine 14 separate programs, covering cohesion, agriculture, and migration, into one strategic plan per Member State.

For further information:
https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2026)782606

framework, under which each Member State (and, where relevant, its regions) draws up a single seven-year partnership plan covering CAP support alongside other EU funds, including cohesion policy.

Second, under the Commission's proposals of July 2025, CAP financing would be integrated into this broader NRPP structure rather than kept as an independent CAP-specific budget line: MSs would draw on a partnership fund of which only a portion is explicitly ring-fenced for direct farmer income support. The remainder would be programmed within the wider NRPP alongside other EU spending priorities. While the outcome of the EU inter-institutional negotiations remains uncertain at the time of writing, the Commission's proposals could facilitate the involvement in planning of government ministries other than agriculture that have an interest in incentivizing behavioural change on farms (e.g. environment ministries that need to meet legally binding Nature Restoration Law targets, or climate ministries that have national emission reduction ceilings under the Effort Sharing Regulation). This could allow an opportunity to move the CAP beyond its traditional "exceptionalism" (i.e. its long-standing status as a self-contained policy silo insulated from other EU priorities). Yet, folding CAP spending into a single pot alongside other national and regional priorities could also expose agricultural spending as a whole to greater pressure. Given the existing power imbalance between agricultural and environmental interests, there is a risk that agri-environmental measures could be sacrificed (unless explicitly protected). This risk is enhanced in the Commission proposal as there is no longer any mandatory ring-fencing of a minimum expenditure on agri-environment-climate measures. Also, current proposals would raise the minimum co-financing requirement for spending on agri-environmental measures within the CAP ring-fenced amount to 30% (up from 20% today), while both area-based and coupled payments remain

exempt from national co-financing altogether, a bias that could reduce the willingness of MS to allocate funding to these schemes.

Third, within the CAP-specific proposal, the Commission suggests consolidating eco-schemes and AECMs into a single, unified intervention category for Agri-Environmental and Climate Actions (AECA). This voluntary layer would rest on a compulsory baseline of "farm stewardship" obligations applying to all payment beneficiaries. This consolidation could, in principle, lead to better coordinated and cross-cutting design for agri-environmental policy, if dedicated budgetary envelopes are preserved and a clear EU-level baseline for AECA scope and ambition is safeguarded, given the absence of ring-fencing noted above. However, the proposal to allow MS to compensate farmers for elements of the farm stewardship obligations could further limit the resources available to incentivise truly additional environmental obligations.

Fourth, the European Commission's proposal for a performance framework regulation (COM(2025) 545), as part of the 2028-2034 MFF package, aims to revise indicators, reporting, and accessibility through a "single gateway". Performance monitoring should inform scheme design by identifying which interventions are most likely to deliver the desired environmental outcomes, setting measurable targets, and providing the evidence needed to adjust the scheme when it is not achieving them. The focus of the proposed framework is on result indicators, which mainly measure progress in implementation rather than whether EU objectives have been achieved, although new indicators that attempt to measure actual outcomes, including greenhouse gas emissions and soil organic content, are proposed. The Single Gateway, intended to bring together information currently spread across numerous EU portals on financial implementation, beneficiaries and performance, will bring useful transparency benefits.

7.2.5. Governance levers to support agri-environmental strategy

Given the challenges on actors and power identified above, and taking account of the current CAP post-2027 reform and related proposals, the following section identifies governance levers that could help to improve AECM outcomes.

7.2.5.1. Diversify the actors who sit at the table

During the design phase, governance power over the conceptualisation of AECMs rests on a combination of expertise, influence, and institutional mandate. Decisions over AECM design (i.e. through specific requirements and budgetary allocations) depend on the set of actors composing the design arena, their agendas, their bargaining power once at the 'decision table', and how their mandates compare with others around the table. Whether environmental ambition will be pursued in the CAP post-2027 will depend, in part, on how influential the actors (or coalitions of actors) whose agendas align with that ambition will be, and how the body in charge of design will frame the consultation processes.

EU agri-environmental policies provide legal frameworks and obligations, but rarely direct funding, leaving environmental objectives highly reliant on allocations from the agricultural budget. Leverage for more ambitious policies could be encouraged if MS diversified funding across sectoral budgets (e.g. health, environment, climate or social policy), reducing reliance on agricultural budgets alone and broadening the coalition of actors backing agri-environmental action and increasing their influence over AECM design. Ireland offers an illustrative example as since 2023, a share of its national carbon tax revenue has been ring-fenced to help finance a national specific agri-environmental scheme, channelling climate-related fiscal

revenue into agri-environmental measures outside the CAP's own budget lines (Irish Department of Agriculture, Food and the Marine, 2021).

Similarly, actors such as nature conservation authorities or water agencies that hold environmental protection as a statutory mandate could be invited to become budgetary contributors and consequently be enabled to contribute to policy design. An example is provided by France, where water agencies actively co-finance AECMs. Their financial contribution translates into direct participation in decision-making at regional level, enabling them to influence both measures selection and their implementation rules (Wolff, 2019).

The CAP post-2027 proposal within the broader NRPP framing could represent a window of opportunity, as decisions on agricultural policy will in future be taken within the context of a broader NRP Plan (i.e. covering cohesion policy, the European Social Fund, and fisheries and maritime affairs, alongside agriculture). If successful, this could be a powerful governance lever, but it would require significant changes in administrative culture at government level in many MS, where government ministries tend to operate in silos. Additionally, we could expect transaction costs to increase, as coordinating policy design across a larger and more heterogeneous set of actors could entail higher costs of negotiation, coordination, and monitoring. EU institutions have long had to manage this same balance between inclusive, transparent decision-making and the efficiency costs it can generate. Emphasizing factors such as administrative capacity, the clarity of procedures, and the quality of coordination mechanisms in place could be key in balancing the trade-off behind it.

7.2.5.2. Strengthen coordination in AECM implementation

While the design phase sets the formal environmental ambition of AECMs through conceptualisation and funding, the institutional setting shaping the implementation phase also drives performance and is the responsibility of Managing Authorities at MS level. Although frequently under the authority of agricultural ministries and administrations, some arrangements could better integrate competences across agriculture, environment, and rural development, enhancing more coordinated governance. During the negotiations on the CAP post-2027 package, the European Parliament and the Council could amend the provision governing the designation of Managing Authorities (i.e. the successor to Article 123 of Regulation (EU) 2021/2115) to explicitly require broader institutional composition. This already exists in some MSs, as in Wallonia (Belgium) and in Denmark, where the Managing Authorities include broader institutional and sectoral interests. Additionally, closer co-ordination with local and regional authorities as well as strengthening formal arrangements with key environmental institutional actors such as water authorities and natural parks, could encourage implementation strategies that enhance effective spatial targeting (Beckmann et al., 2009). Experiences from France, Germany and Ireland for example show potential arrangements to improve coordination along these lines (Cullen et al., 2018; Zindler et al., 2024; Borniotto et al., 2025).

More broadly, AECMs are an element of the CAP green architecture (i.e. conditionality and eco-schemes under Pillar I and AECMs under Pillar II). Managing Authorities should use the opportunity to promote synergies by aligning disbursement procedures, advice and controls across these different elements. For example, in Wallonia, since 2012 the advisory system advising on AECMs and Natura 2000 is coordinated under the same organisation. Better co-ordinating these interventions would lower

transaction costs, avoid inconsistent incentives for farmers, and reduce administrative complexity, which are main drivers for weak participation. The post-2027 CAP proposal for Agri-Environmental and Climate Actions (AECAs) should be used as an opportunity to enable such coordination, and EU co-legislators could support this by attaching a single, ring-fenced budgetary envelope to the AECA category.

7.2.5.3. Improve monitoring transparency

Enhancing transparency on the design and implementation of the CAP chapters in the national NRP Plans in the next programming period could allow to better trace procedural and substantive outcomes across MS. We have identified the potential of the Single Gateway proposal to improve transparency on financial implementation and results performance. Under the current 2023-27 CAP, Member States submit an Annual Performance Report (APR) by 15 February each year, covering the previous financial year. The APR reports on expenditure, outputs, results and progress towards the milestones in the CAP Strategic Plan. The Commission then uses these reports for the biennial performance review. Where relevant result indicators fall substantially below their milestones, the Commission can require justification and potentially remedial action.

The Commission proposal for 2028-2034 retains annual performance reporting but integrates it into a more standardised, horizontal reporting framework based on far fewer indicators, While this approach can improve comparability across MS, since MS will in future report on the same indicators, it will also reduce the amount of CAP-specific environmental information in the reporting. Reporting is unpopular because it leads to administrative burden for managing authorities and MS but it is vital if outside observers should be enabled to follow developments. The co-legislature should therefore ensure that the indicator coverage provides

meaningful transparency on environmental outcomes. The European Commission also makes a distinction between monitoring and evaluation. The performance framework provides routine output and result data, whereas evaluation is supposed to establish whether interventions were effective and, importantly, whether they actually caused the observed effects. Here the proposal makes an important innovation by explicitly requiring impact evaluations using quantitative techniques, including counterfactual approaches and experimental designs where appropriate. These impact evaluations must be completed no later than two years after the end of the programming period. Monitoring committees should demand additional information where the reduced indicator set misses meaningful environmental information and ensure the new impact evaluations are actually used to assess environmental effectiveness.

7.2.5.4. Governance indicators in the monitoring framework

The transparency logic set out above for the performance monitoring framework could also be used to track how decisions on the design and implementation of policy were made. Information on who decides and how decisions are made could promote greater effectiveness in CAP's governance structures. This could be done by including a set of governance indicators within the monitoring framework. Power is exercised through opacity created by informal negotiations and closed consultations (McGee & Gaventa, 2011; Carriedo et al., 2022). In AECM governance, less powerful actors (e.g. nature conservation authorities) or those marginalised in governance processes (e.g. water management companies or health specialists) remain structurally disadvantaged (Beckmann et al., 2009), and often they have neither access nor visibility on key decision-making steps.

Several mechanisms already provide a foundation for enhancing transparency (e.g. CAP Catalogue of interventions[34]), allowing actors beyond the responsible institutions to observe and to hold these institutions responsible for their choices. Building on this effort, similar transparency should be applied to the governance dimension at design and implementation stages of the CAP chapters in the national NRP Plans in the next programming period, allowing to trace procedural and substantive outcomes across MS. The CAP legislation should require governance metrics (e.g. composition of monitoring committees, type of stakeholders consulted, type and frequency of consultations) to be systematically included in the new framework. Some of this information already exists in a fragmented form (e.g. Member States are already required to publish monitoring committee membership and rules of procedure online) but scattered across national CAP network websites and never aggregated or standardised at EU level, which a systematic indicator could aim for. This could help make visible not only what is spent and on what, but also who contributes to shaping these decisions, and which interests are represented in the process. While acting on transparency would not eliminate power asymmetries, it would allow to shift the informational balance, representing a crucial first step toward redistributing influence across actors, and providing increased governance accountability of EU policymaking.

7.2.6. Conclusion

Governance is not a new lever in agricultural, environmental, or agri-food policy (e.g. De Schutter et al., 2020; Patay et al., 2025; Runhaar et al., 2014; Schebesta & Candel, 2020). What remains comparatively under-explored is a governance-focused reading of AECM underperformance and specifically,

[34] https://agridata.ec.europa.eu/extensions/DashboardCapPlan/catalogue_interventions.html

how accounting for the governance dimension can translate into actionable and context-specific levers to improve AECM performance. This paper aims to fill that gap, adopting a forward-looking perspective given the likely continuation of voluntary agri-environmental schemes within the CAP post-2027, and their potential role as a central pillar of agri-environmental delivery within a broader EU budgetary framework.

The article proposes several governance levers to tackle the institutional lock-ins constraining AECM performance. First, diversifying the actors who hold a seat at the decision table to move the conceptualizing and funding of AECMs towards stronger environmental performance. Funding AECMs from sources other than the agricultural budget could allow actors that are currently marginal in AECM decision-making to exercise a greater role in their governance. Second, we highlight the role of the Managing Authority and recommend that MS reflect the full range of CAP objectives within its institutional composition, as already practised in some Member States that include actors beyond the Ministry of Agriculture. Related to this, we raised the issue of improving coordination across agri-environmental instruments within the CAP as a way to reduce transaction costs for farmers. The current CAP proposal facilitates this by combining eco-schemes and AECMs into a single AECA instrument. The main concern is whether MS will allocate sufficient budgetary resources to this instrument, given the absence of a ring-fencing requirement and the need for more substantial national co-financing. Thirdly, we recommend strengthening the role of monitoring framework to enhance transparency, both to better understand the outcomes of AECMs and to provide information on who decides and how decisions are made, both key steps toward addressing power imbalances through informational rebalancing.

The outcome of the ongoing inter-institutional debates surrounding the CAP post-2027 and the future EU budget could reshape actor configurations, negotiation dynamics, and institutional leverage points, potentially opening space for new coalitions and oversight mechanisms. It could also mean introducing new uncertainties regarding sectoral prioritisation and safeguarding of environmental ambition. This debate will ultimately be settled through the positions taken, and the balance of power negotiated, across the European Commission, Parliament, and Council in trilogue (Gravey & Buzogány, 2021). Nevertheless, EU co-legislators, national ministries and competent authorities would benefit from taking these governance dimensions on board. While national differences across Member States will inevitably shape how these arguments apply in practice, engaging with them could help establish a stronger governance playing field for pursuing environmental ambition within the CAP.

8. The reflexive chapter

This chapter adopts a more personal perspective and steps back from the empirical findings and policy implications, to critically reflect on the research process of my PhD and on the researcher's role in shaping it. It dives into the inter- and transdisciplinary approach that guided this PhD journey, discusses the science-for-policy interface (both as a research object and research process), considers the broader impact(s) of (agri-environmental) research.

Beginning a PhD on EU agri-environmental policy after having previously worked within EU institutions[35] created a peculiar sense of continuity and distance at the same time. It felt less like entering a new environment than moving across the street from a familiar building: the same structure remains visible, yet it is observed from a different point of view. This starting position, somewhat unusual, simultaneously enriched and unsettled my perspective. It allowed me to draw upon prior experience while requiring me to reconsider and, in many respects, reconstruct my understanding of the policy world I had previously inhabited.

A PhD is often described (by many in general and by my supervisor in particular) as a learning journey, a process of acquiring a craft. Yet learning a craft after already having practiced another fundamentally differs from learning it as a first formation or as a continuation of earlier academic training. Rather than learning entirely anew, this experience was largely one of relearning: writing follows different rules, analytical lenses are re-constructed, and new modes of reasoning must be developed. The process

[35] I hold a Bachelor's degree in Geography and a Master's degree in Agricultural Economics, both from the University of Milan. Prior to joining Sytra (UCLouvain) as a PhD candidate, I worked as a data analyst at True Price, focusing on the assessment of social and environmental externalities in agricultural value chains. I also worked two years at the Brussels office of the European Commission's Joint Research Centre, where I contributed to evaluation and impact assessment activities.

required not only acquiring tools but deconstructing and reshaping ways of thinking.

This journey has transformed me as a researcher, as a citizen and as an individual. If the metaphor of moving across the street captures the shift in position, the PhD also provided a new set of lenses through which to observe both sides: the policy world across the street, academia itself from within, and the broader landscape connecting them.

8.1. Inter- and transdisciplinary journey across research and public policy

Interdisciplinarity was not only a methodological choice but a defining feature of this PhD. As mentioned in the **Framework chapter,** I have decided to '*adopt a choral approach in which each discipline contributes where it has the strongest explanatory capacity*'. The central challenge was to maintain a balance between disciplinary rigor and interdisciplinary integration, preserving analytical depth while enabling dialogue across perspectives. This choice carried several implications.

First, interdisciplinarity raises questions of legitimacy. Engaging multiple disciplinary approaches means being evaluated according to the expectations of each, thereby multiplying the expected rigour. The (interdisciplinary) researcher must navigate the research journey without compromising any single disciplinary standard, raising quite substantially the (already demanding) challenge of a PhD.

Second, interdisciplinarity introduces ontological and epistemological issues (Boon & Van Baalen, 2018; Murphy, 2011). Different disciplines do not merely apply distinct methods, but conceptualize research objects (and, more fundamentally, research itself) in different ways (Boon & Van Baalen, 2018). Producing (interdisciplinary) knowledge across different perspectives

requires seeking complementarity while navigating the fragile boundary where integration risks becoming misunderstanding. For example, this was the case while drafting **Paper 3**, where epistemic traditions from both political science and agricultural system research had to find their way to find common grounding on i) how to define environmental ambition, ii) what counts as key drivers leading agri-environmental policies to higher ambition, iii) which arguments (and literature) supports it.

Third, interdisciplinarity reshapes one's relationship to academic communities (Salmela et al., 2025). Disciplines are organized around specific conferences, jargons, journals, and networks. Conducting an interdisciplinary PhD often means inhabiting an 'in-between space', belonging to several communities without fully fitting into any. Moreover, each interdisciplinary configuration generates its own distinct 'in-between space'. Two interdisciplinary PhDs (or projects) may both be labelled interdisciplinary yet occupy very different intersections between disciplines, rarely resulting in a cohesive community, leaving (interdisciplinary) researchers navigating spaces that are relationally similar but substantively separate.

Given these challenges, the question arises: why pursue interdisciplinarity at all? For this research, the answer lies in the nature of the research question itself. Addressing agri-environmental governance within EU policy frameworks would have required significant compromises in explanatory power had it remained confined within a single discipline. Interdisciplinarity, therefore, emerged less as a preference than as a necessity. In practice, this interdisciplinarity materialized through diverse methodological approaches, engagement with multiple scholarly communities, publication strategies across different journals, varied data sources, and the coexistence (and negotiations) of distinct epistemological and ontological perspectives. The

PhD navigated through perspectives inspired by system thinking, a agri-environmental perspective expanding the multi-level governance one, and a set-theoretic, configurational approach as grounding epistemic foundation of the comparative approach.

The transdisciplinary dimension of the research introduced a different set of challenges. A central one consisted of identifying the boundary between listening to (and learning from) stakeholders, on the one hand, and maintaining the analytical role of the researcher, on the other. Making sense of multiple voices while producing analysis required an effort of constant (intellectual) negotiation.

On this, two tensions became particularly relevant. First, the idea of an objective reality proved increasingly elusive (Funtowicz & Ravetz, 1990). Throughout the research process, it became evident that my own positionality shaped both interpretations and interactions. In many respects, I was not merely observing stakeholders but was myself part of the broader system under study. Second, engagement with stakeholders inevitably involved an emotional dimension (Kamkhaji & Radaelli, 2025). Agri-environmental issues concern potential futures, frustrations, fears, convictions and hopes. Maintaining analytical distance was, therefore, not only an intellectual challenge, but also an emotional one.

Two key (yet very personal) learning points emerged from these tensions. First, the boundary between perception and reality proved, as probably one could suspect, largely heuristic rather than real. It functioned as a guiding horizon rather than an attainable endpoint. Walking towards it nonetheless helped me structure reflexivity throughout the research journey. Second, I gradually adopted an approach of acceptance rather than avoidance of emotions. Research on societal challenges inevitably invites at the table

values, concerns and hopes into the research process. Acknowledging them allowed me to better understand my own position and the role emotions play in interviews, collaborations - and policy, see Kamkhaji & Radaelli (2025). Engagement, when reflexively examined, became for me a strong ally in navigating this (very human) journey.

All this brings me to reflect on the distance I made between myself and the research object. Learning to navigate this distance proved less about maintaining a fixed level of detachment and more about developing ownership of the research and, ultimately, of the dissertation itself (Radaelli, 2024).

Throughout the PhD, distance was continuously negotiated, with my supervisor, colleagues, co-authors, research partners, stakeholders, and inevitably with myself. Rather than arriving at a definitive (or wished) position, the most valuable learning outcome was understanding this process of (continuous) negotiation itself.

8.2. Science-for-Policy interface: some reflections

In the course of studying agri-environmental governance, I reached a moment of questioning whether research is solely about studying policy or also, in some way, about serving it. What role does research play beyond its investigative purpose? Does it carry a broader societal mission, and if so, how should this mission be understood and enacted? These questions made me bridge to another literature streams, i.e., the Science-for-Policy (S4P) interface one, and gradually became central to my journey.

The notion of the S4P interface has been defined (and questioned) by both policy and research practitioners in the past decades. From the policy side,

the European Union policymaking has been shaped by the principles of Better Regulation (Listorti et al., 2019), promoting evidence-based policymaking, systematic evaluation, and the "evaluate first" principle. Within such a framework, the emergence of spaces dedicated to science-policy interaction appeared almost inevitable. Considerable effort has been devoted to creating and institutionalizing these interfaces. For example, prior to starting my PhD, during my time at the Joint Research Centre (JRC) within the European Commission (EC), several initiatives were being developed to strengthen interactions between researchers and policymakers. These included efforts to facilitate exchange, and initiatives such as Knowledge4Policy[36] and the EU Policy Lab[37] illustrate this institutionalization of the S4P interface.

From a research perspective, scholars from various disciplines have been delving into the issue of S4P interface, for example in the context of food system studies (Benton, 2023; Turnhout et al., 2020), agriculture and environmental policies (El Benni et al., 2023; Ghirardelli & Tarolli, 2025; Pe'er et al., 2025), public health (Cairney & Oliver, 2017; Eichenberger et al., 2023) and biodiversity (Görg et al., 2016; Koetz et al., 2008; Sarkki et al., 2025; Watt et al., 2019). Their work addresses, among other issues, how to overcome communication gaps, the role of networks connecting researchers and policymakers, and the extent to which research can (or should) engage with policy processes.

While the existence of such spaces of interaction between research and policy is studied and acknowledged, less clarity exists regarding the nature of the interactions that take place within them, and amongst researchers

[36] https://knowledge4policy.ec.europa.eu/home_en

[37] https://policy-lab.ec.europa.eu/index_en

and policy makers. It is still unclear (to me) whether S4P is a space of co-production, characterized by reciprocal exchanges or is it primarily conceived as a unidirectional flow of knowledge, moving from science towards policy, focused on delivering usable outputs such as reports, indicators, models, or recommendations. Within both the initiatives I attended through the JRC, and the literature insights I could consult during the PhD, significant emphasis was placed on communication and methods: how to engage policymakers, how to translate scientific evidence into accessible formats, and how to produce concise and clear policy brief. However, even if such skills are essential, I feel that the underlying institutional arrangements shaping S4P interface (Sarkki et al., 2025) have been underexplored. For example, defining the engagement mechanisms (e.g., advisory bodies, consultations, informal networks) with policymakers are largely absent, little guidance is provided on where and how such engagement could take place in practice, and the roles and mandates of both researchers and policymakers in such engagements. The figure of the 'honest broker' (Pielke Jr, 2007) has been key in shaping the role of researchers, emphasizing one that is able to provide evidence, outline alternatives, and avoid positionality. While this perspective aligns with the principle that decision-making ultimately lies with elected bodies, it leaves unresolved the practical and normative boundaries between very different S4P interface actions, such as i) informing, ii) advising, and iii) engaging in policy processes. The absence of explicit reflection on the boundaries between them remains, in my view, a critical gap in the current understanding and practice of the S4P interface.

The linear model linking knowledge production to policy decision-making has been questioned (Hopkins et al., 2021; Sarkki et al., 2025) underlying the bounded rationality of both policy makers and researchers (Botterill & Hindmoor, 2012; Dente, 2014) in post-normal context where "facts are

uncertain, values in dispute, stakes high and decisions urgent" (Funtowicz & Ravetz, 1990, 1993). In such context, policy decisions are defined as evolving processes (Dente, 2014) within institutional trajectories, negotiated compromises, and are historically embedded in arrangements that shape present and future choices. Decision-making therefore unfolds through interconnected and time-lagged processes that escape sequential explanations (and imaginations). When drafting policy briefs, or supporting colleagues in doing so, I found that such complexity often remained only partially visible. We frequently work with limited insight into existing path dependencies and into the actual room for manoeuvre available to policymakers. A concrete example from before the PhD illustrates this, when I contributed to the drafting of the Walloon Pollinators Plan, commissioned by the Ministry on Environment. Although the engagement between research and policy was established, the mandate was clearly defined, and political interest appeared to be present, the plan was never implemented. We knew later on that disagreements over ministerial responsibilities (and the associated allocation of funding) led to a deadlock that prevented the initiative from moving forward. The institutional and political context in which S4P interactions take place is key, and without this situated knowledge (Haraway, 1988), it becomes difficult to fully grasp how decisions are shaped, or to anticipate where research input may effectively contribute (Hill & Varone, 2016). Greater attention to these contextual dimensions could support more targeted engagement, allowing research efforts to better align with the areas where policymakers have both the capacity and the authority to act.

Recognizing that policy entails an act of will and relies on the existence of alternatives (Dente, 2014) becomes essential in this regard; hence, policy and politics are inherently intertwined, as the exercise of will and the selection among competing options is shaped by processes of contestation,

negotiation, and power. In the context of agri-environmental policies, this implies that treating instruments such as agri-environmental subsidies merely as technical allocations adjustable through 'better evidence' risks analytical reductionism. Acknowledging that politics is not an external disturbance to policy design and implementation reshapes the potential contribution (and role) of research. It implies reflecting on the choices researchers make regarding where to invest their time, which relationships they nurture, how research agendas (i.e., which research topics to pursue) and funding strategies are designed within research teams, and how dissemination is conceived (and with whom) both within and beyond academia. Engagement with policy is therefore not only methodological but also strategic. The impact of research thus extends beyond the production of recommendations to the cultivation of collective reflections, in the form of an intellectual (and political) agora where we can find our role in society.

Recently the narrative within European Commission shifted the emphasis from 'evidence-based' to 'evidence-informed' policymaking[38]. I feel this change is not merely semantic, but it reflects a repositioning of the role of evidence (and research) within policymaking processes. As such, the space for scientific knowledge in shaping policy is shifting (Eichenberger et al., 2023), raising further questions about both the institutional space given to research[39] and the strategic reflections the research community should focus on to effectively contribute to policies.

[38] https://knowledge4policy.ec.europa.eu/evidence-informed-policy-making_en

[39] https://www.ceps.eu/the-commissions-neglect-of-evidence-based-law-making/

8.3. The research impact on public policy (and on agricultural system transitions)

Yet is research expected to generate impact on the policy itself, and if so, what does this expectation truly entail? What counts as impact, and how should it be measured?

Institutional frameworks shaping research programs tend to provide operational answers through indicators: the number of policy documents influenced, citations in policy reports, stakeholder engagements, or scientific publications produced (European Commission, 2023). Such metrics are now embedded in research evaluation processes, particularly within large EU funding programs. Completing reporting templates often requires translating complex research trajectories into quantifiable outputs (Belcher et al., 2024). Yet, are these measurements becoming ends in themselves rather than means for reflecting on broader societal contributions? More importantly, do we sufficiently question the purposes towards which research impact is directed?

Within Sytra[40], discussions around impact are frequent and often unresolved. A plurality of understandings emerged not only regarding how impact should be defined, but also regarding how our research should position itself in relation to it. These conversations revealed how porous the boundary is between researchers as scholars and researchers as citizens or societal actors. Each of us implicitly carries different assumptions about what meaningful impact looks like and about the role we should personally (and professionally) play in achieving it. Decisions about what constitutes

[40] https://sytra.be

desirable change, whose perspectives matter, and which outcomes are valued cannot be entirely separated from underlying value systems.

In this context, the reflections presented here are necessarily personal. For me, impact increasingly appears less as an outcome and more as a process. Its significance lies not primarily in whether policy recommendations are cited verbatim, but in the relationships established and sustained with policymakers, practitioners, and broader communities. Influence often unfolds indirectly, through dialogue, trust-building, and shared learning rather than through visible policy uptake.

The PhD revealed itself as a key space where impact unfolded gradually, through dialogue and shared reflections. Through interviews, conferences, workshops, and informal exchanges, impact emerged both from producing recommendations but also from asking questions to the key stakeholders. This pushed me to create space for debate, and playing the role of both facilitator and analyst to foster mutual learning, while bringing analytical distance into discussions.

Impact also contains an unexpected (and largely uncontrollable) dimension. Research may resonate in unforeseen ways, travel across contexts, or shape discussions long after formal project timelines have ended. This unpredictability challenges linear conceptions of knowledge transfer and suggests that impact cannot be fully planned or engineered. For example, in my case, methodological developments from the PhD (especially from **Paper 2**) informed an initiative led by the Walloon public administration responsible for the CAP green architecture, which aimed to carry out an in-depth evaluation extending beyond the evaluation obligations required under the CAP regulatory framework. This opportunity emerged from the convergence of an existing relationship of trust built through long-term

collaboration between Sytra and the regional administration, the timely alignment between the PhD research focus and this policy needs, and the legitimacy gained combining scientific analysis with a transdisciplinary perspective at the meso level, linking farm practices and policy design.

Moreover, impact is relational and mutual. Researchers do not simply influence policy actors; they are themselves transformed through these interactions. Engagement reshapes research questions, analytical perspectives, and even normative positions. In this sense, alliances and relationships precede impact rather than resulting from it. They constitute the conditions under which meaningful influence may eventually emerge.

At the same time, I feel the research environment often encourages a narrower understanding of impact. For example, in many funding programs, research is increasingly organized through managerial frameworks resembling those of private-sector enterprises, with predefined deliverables, performance indicators, and impact pathways. While such structures provide accountability, to me it feels at odds with the exploratory (and very often iterative) nature of research processes. Yet researchers remain dependent on these funding schemes and therefore operate within frameworks they have limited capacity to reshape (or may feel unable to question).

Eventually, reflecting on impact returns to focusing on both what research produces, and how researchers choose to inhabit their role within society. Impact may therefore be understood less as a measurable endpoint than as an ongoing negotiation between knowledge production, engagement, and responsibility within processes of agricultural (and societal) transitions.

9. The conclusion chapter

This PhD examined the role of governance in shaping EU agri-environmental policies. It did so through three empirical studies: a literature review on AECM governance (**Paper 1**); the development of a theoretical governance framework for AECMs, tested through a regional case study, together with a barrier analysis linking governance factors to environmental performance (**Paper 2**); and a comparative analysis covering all EU Member States, investigating how MS pursue agri-environmental objectives and how these relate to structural, political and governance factors (**Paper 3**).

This empirical work made it possible to explore several aspects of AECM governance. It examined how multi-level governance and subsidiarity frame AECMs, showing how much the different levels of decision-making, and the connections between them, shape both the AECM ambition and the performance. It showed the diversity of governance models and governance arrangements across MS, and that aiming to find the 'best' governance framing is more of an idealistic ambition than a realistic or policy-relevant objective. It also focused on the actors involved and the dynamics between them, looking at both the tensions and the synergies occurring amongst them, and their involvement in both policy design and implementation.

At its final stages, the research developed a reflexive take on the topic as a whole that, through **Paper 4**, grew out into a perspective article targeting policymakers and experts, and drawing out the PhD lessons learnt. The aim was to feed the wider discussion on the future of the CAP, its governance and EU agri-environmental policy.

The present chapter follows the same spirit yet broadens the audience beyond policymakers and CAP scholars targeted in **Paper 4**. The target here is also the wider academic community, civil society, (future PhD) students

and any other interested reader. It also allows for more open-ended reflections, pointing to unresolved issues that could guide future research.

The chapter structures as following: it looks at the governance framework through subsidiarity (Section 9.1) and through the concept of levels (Section 9.2); it focusses on actors (Section 9.3), on governance arrangements through the lens of power (Section 9.4) and stakeholder engagement (Section 9.5). It then turns to policy output and outcome (Section 9.6), returning to the policy cycle and the theory of change and the question of impact discussed in Section 2.3. It closes with potential future research avenues (Section 9.7).

9.1. Subsidiarity as a structuring principle of AECM governance

This PhD did not set out to be a study of EU governance, as its starting point was agri-environmental governance. But as PhD goes (i.e. where the research journey is hardly known in advance), investigating the structure of AECM governance led to multi-level governance, and, through the interactions across levels, to the principle of subsidiarity, key in EU governance. This principle shapes policies and mandates between EU, national and regional institutions, and the research gathered three main findings linking subsidiarity and AECM governance.

First, EU policy developments, such as the New Delivery Model and the CAP post-2027 proposal, have pushed for enhanced subsidiarity, on the assumption that decentralisation improves environmental fit and effectiveness. Yet the scientific evidence on it is still lacking. This is partly because the implementation of subsidiarity depend not only on the information available at each governance level, but also on the actors who populate it. These actors, while very knowledgeable on local conditions, carry their own institutional agendas, which can go beyond the environmental objectives AECMs are designed to serve.

Second, Member States have implemented subsidiarity very differently, producing a wide spectrum of governance models. These range from highly centralised systems, to highly decentralised and between these two extremes sits a wide range of mixed models (see **Paper 1** for further information).

Third, the implementation of subsidiarity means delegateing discretion over to Member State (and often sub-national) authorities, and design and implementation choices reflect political and administrative capacity as

much as environmental needs. In exercising this discretion, the authorities in charge have to navigate trade-offs across environmental relevance, policy feasibility, political acceptability and cost. Even if there has been a long-standing efforts toward environmental policy integration in the last decades, the CAP still prioritises agricultural competitiveness and income support over environmental protection (Alons, 2017; Bordin & Daugbjerg, 2026; Candel & Daugbjerg, 2025; Feindt, 2010). When domestic trade-off preferences lean away from environment ambition, enhanced subsidiarity could grant MSs greater leeway in lower environmental ambition. Additionally, as enhanced subsidiarity means that the strength of EU-level prescriptive power is reduced, it no longer stands as factor weighing in on that domestic balance.

Yet we are short on answers when it comes to understand what drove enhanced subsidiarity, which policy and political drivers led to it, and what are its historical roots. Additionally, given the timeline of this PhD, it is not yet possible to fully grasp where this move toward enhanced subsidiarity will lead the CAP post-2027. The outcome of the ongoing trilogue negotiations will be decisive and will tell researchers (and any other involved stakeholder) much more about what is happening both at policy design and implementation levels.

9.2. Levels as part of governance in AECM design and implementation

Level is a key concept of this research, as multi-level governance quickly emerged as the main framing shaping AECM governance. Yet defining 'level' turned out to be quite the challenge.

A level is often understood geographically (i.e. EU, national, regional), but it can be as well a *level* of decision-making power[41]. The two can line up neatly, with one geographical level matching one specific decision-making power. But in the context of AECMs, this alignment does not hold across Member States, as subsidiarity translates in each Member State deciding its own match between the two. In other terms, this means that the same decision-making power, such as measure's design, may sit at national level in one country (e.g. France) and at regional level in another (e.g. Germany).

Roles were used as an intermediary concept to include both decision-making levels and geographical levels, and how the two interact. Roles, understood as recognisable sets of activities used by an actor to address a recurring situation (Sattler et al., 2023), do not depend on a fixed geographical or institutional position. The same role, such as designing measures or coordinating their implementation, can sit at a different level in different countries, which makes it possible to compare governance across very different national contexts.

Looking at roles also gave more granularity on how levels interact, since roles are connected through the policy process that turns a policy design into implementation, and eventually into action on the farm. In the Hauts-de-France case in **Paper 2**, for example, the Ministry of Agriculture designs AECM, and co-fund them along with the Water agencies; the regional administration then coordinates implementation through calls for Agri-Environmental and Climatic Projects; local partners (mainly chambers of agriculture) advise farmers and transfer the knowledge needed to apply for these projects; farmers then enrol in the projects, and adopt the set of

[41] Anton Riera's PhD dissertation similarly engages with the question of level as a matter of scale, examining how different spatial and organisational scales shape the analysis and governance of food system transitions, using the Belgian livestock sector as a case (Riera, 2026) https://hdl.handle.net/2078.5/273591

farming practices within them. The barrier analysis that followed showed that these interactions across levels, and the roles tied to them, matter directly for the factors that hold back performance (see the barrier analysis in **Paper 2** for more detail).

Yet, part of these findings is based on a single case study, which raises two issues. First, relying on one region does not make it possible to further investigate the link between geographical levels and decision-making levels. Second, the absence of a comparative design limits the extent to which the findings can help understanding which elements of this matching are context-specific, and derive some lessons learnt across cases.

Bridging levels requires bridging disciplines, as most academic fields are structured around a single level (either geographical or decision-making) of analysis. Agronomy, for instance, tends to concentrate on the operational level, closest to the farmer, whereas political science is more oriented toward the strategic level at which measures are designed, and economics toward the budgetary dimension. This PhD suggests that these levels can nonetheless be examined jointly, provided the research is explicitly designed to integrate these perspectives rather than treat them in isolation. Our conclusion is that underperformance can be (partly) explained through the disconnection between levels rather than only from a shortcoming confined to a single level. This remains, however, an initial step, and further theoretical and empirical work would be needed to consolidate the approach.

9.3. Actors and agency in AECM governance

Actors and agency are key elements of governance and have been one of the main research object of the PhD. We discovered that AECM governance involves a wide diversity of actors, with different competences, all

interlinked, and drawing on a broad range of knowledge and skills. **Paper 1** identified 15 main actor types, spanning both the public and private spheres and crossing across all geographical levels. We showed as well that some of these actors play a direct influence in steering AECM governance, such as agricultural ministries; others are more indirectly involved, such as environmental ministries or nature conservation bodies. This split cuts across both the public and private spheres. The balance between these actors also varies geographically, in line with the subsidiarity-driven diversity across MS we discussed in Section **3.3.2**.

Even though AECMs sit within an institutional setting, as a subsidy scheme under a public policy framework, actors from beyond that setting also play a role, mainly through value chain actors and advocacy groups (see **Paper 2** for more detail). These actors bring their own agendas and priorities, which often go beyond (and can sometimes sit in tension with) the scope of AECMs. Once these actors are included in AECM governance, their agendas and priorities feed directly into how measures are designed and implemented. Actors are also interdependent, and a constraint faced by one has ripple effects on others, which is why coordination resulted as a key factor.

A key aspect of actors' agency, as shown in **Paper 1**, is that it ranges from direct to indirect influence over AECM design and implementation. This depends on the actor's role: regulatory mandates, such as those typically given to Ministries of Agriculture to design and calibrate specific measures, carry much more direct influence, while roles such as payment agencies are more administrative and framed, with less influence over design and implementation choices. This is not to say that some roles matter more than others; rather whether, and how, each role shapes design and implementation. Looking at agency showed that official, institutional mandates are only part of the story: some actors hold real influence even

without a formal mandate, and some actors live with the consequences of design and implementation choices without having any influence over them.

9.4. Power dynamics in AECM design and implementation

Exploring agency meant unavoidably stare at the elephant in the room: power. We discussed at length power imbalances between agricultural and environmental interests when looking at the CAP, and what we discovered is that power unbalances take different forms, and trigger different effects, depending on whether policy design or policy implementation is considered.

At the design stage, some actors shape the policy by setting the budget envelope for each measure and deciding which farming practices will be supported and funded. These decisions are politically sensitive, and consequently a frequent target of lobbying and advocacy. Looking at who holds influence, agricultural constituencies and farming unions, tend to dominate (Candel & Daugbjerg, 2025). This does not mean agriculture speaks with one voice on environmental issues, but rather reflects the dominance of specific interests, actors and policy narratives that set the frame within which the debate takes place.

At the implementation stage power imbalances are more driven by the institutional setting itself, through the mandate almost exclusively given to the Ministry of Agriculture as managing authority. This means the Ministry effectively holds the pen on how Strategic Plans are drafted and implemented. This is not to say the Ministry has a completely free hand: path dependency constrains how things have been done before and how they can be done going forward, on both political and policy grounds. Nor does this suggest that environmental objectives are entirely off the table for Ministries of Agriculture, especially given the growing evidence on the impact of biodiversity loss and climate change on agriculture itself. But the argument stands that a Ministry of Agriculture's agenda, in line with what happens at

EU level, tends to place productivity first as an objective in its own right, leaving environmental aspects as secondary.

Yet, by the end of the PhD it feels like the connection between power and governance has only started to be unpacked. For example, it remains unclear what role informal arrangements play in all this, how much power is driven by path dependency, and how much personal connections are key in setting the decision and consultative framework.

Power is an intrinsic feature of any interaction, in the same way that some frictions are unavoidable whenever people with different interests engage with one another. Power is not inherently bad, as to some extent, it is simply a sign that interaction is taking place. It emerges from the diversity of actors and visions involved, and from the fact that actors are trying to achieve their own objectives.

This is where **Paper 4** begins to reflect on the role of transparency, proposing a governance monitoring framework. If evaluation and monitoring practices would systematically include governance-related indicators, such as the composition of monitoring committees, or the type and frequency of stakeholder consultations, it could make visible not just what is spent and on what, but also who shapes these decisions and whose interests are represented.

9.5. Stakeholder engagement and representativeness in CAP governance

As power sits at the table, so does the stakeholder engagement practices who, so to say, shape the table itself. In **Paper 4**, we highlighted the EU's stated intention to ensure fair and balanced stakeholder engagement in the design of CAP Strategic Plans. Further discussions amongst co-authors

made us question how in practice CAP's regulatory framework ensures it. On the design side, Article 106 of Regulation (EU) 2021/2115 requires Member States to *'organise a partnership including regional and local authorities, economic and social partners (including farming representatives), and civil society bodies'*, and to *'effectively involve'* them in preparing the CAP Strategic Plan. On the implementation side, Article 124 sets out the role of the *monitoring committee*, the body each Member State must establish to monitor how its Strategic Plan is being implemented.

Although both articles exist, the difference in the accountability strength is quite striking. Article 106 requirements on the design side are fairly loose, as Member States must set up a partnership and consult it, but there is no obligation to publish the list of partners, to explain how they were selected, nor to document how the consultation was actually carried out.

The monitoring committee under Article 124, by contrast, requires Member States to ensure *'a balanced representation of the relevant public authorities and intermediate bodies and of representatives of the partners'*, to publish the committee's rules of procedure and opinions, and to publish the list of its members online. It also sets out, in some detail, what the committee must examine (e.g. progress toward targets, and any issue affecting performance) and what it must formally give an opinion on (e.g. criteria used to select operations, or any proposed amendment to the Plan).

Even correcting for this imbalance (where transparency requirements at design becomes as strict as those at implementation stage), we could question if this will be enough. Would increase in transparency be able to show what is really happening, and expose potential bias or power imbalance in these processes? And once information is available, would it be possible to correct for it?

An issue on legal enforcement is underlying, as it is not clear whether the European Commission actually has the power to hold Member States accountable. Based on the regulation itself, the quality of a Member State's stakeholder engagement process is not part of what the Commission actually checks before approving a Plan. The Commission does have a biennial performance review mechanism (Article 135), which can require a Member State to submit an action plan, but this is triggered by underperformance against result indicators and targets, not by the quality or balance of stakeholder engagement.

9.6. From policy output to outcome: indicators, evaluation and EU auditing

Given its focus on governance, this PhD set its boundaries at policy design and implementation. It therefore does not touch upon i) later stages of the policy cycle (i.e. evaluation and the feedback loop back into agenda-setting), and ii) later stages of the theory of change, as outcome and long-term impacts.

The research boundary was set both for reasons of scoping and feasibility, and we are aware that AECMs' effects does not stop at implementation. Once a measure reaches the farm level, its environmental effects become the subject of other research fields (e.g. environmental science and ecology) which examine impact through parameters including biodiversity loss, greenhouse gas emissions, water quality and broader ecosystem services indicators. Additionally, policy evaluation literature and economics examines how monitoring and evaluation (M&E) frameworks are themselves designed, and how they interact with the rest of the policy process (Alons et al., 2019; Listorti et al., 2020; Patton, 2023; van Voorst & and Zwaan, 2019; Zwaan et al., 2023).

These fields fall outside this PhD (and the competences acquired through it). Yet, two reflections have been gathered on the potential links between the PhD's governance perspective and those fields.

First, on the role of indicators and data, as tracking progress toward policy objectives is key, and continuous efforts by research institutions working on the assessment of EU agricultural policies and practices (Bosco et al., 2024; Schievano et al., 2024) and their environmental effects are remarkable.

Yet there are some challenges which relate to, for example, collecting and sharing data, ensuring indicators are comparable across EU Member States, and the transaction costs data collection involves. For the CAP specifically, an additional challenge is linked to its focus on results and output indicators (i.e. tracking whether an implementation action took place), and less on indicators focused on environmental impact (i.e. outcome indicators), which lower its potential as evidence-based policymaking. Seen from a governance angle, these are not purely technical problems as administrative capacity and institutional habits shape how data-sharing and data-collection procedures are set up (De Olde et al., 2025). Some of these arrangements can lower transaction costs (e.g. data sharing platform) while others entrench them to the point of becoming unmanageable (e.g. fragmented reporting requirements).

Additionally, the actors responsible for policy design and implementation (on whom data collection depends) together with the institutional framing that feed this data into decision-making, may be more or less willing to adopt a given indicator or data-collection practice. This might depend on how the resulting information could affect their own position or serve their agenda.

Second, it exists an intrinsic time lag between CAP implementation and evaluation, that does not match the pace of the policy cycle with the impact

cycle, making it very difficult to gather information on the long-term effect of policy implementation within the timeline of policy evaluation processes. EU institutions have therefore adapted their policy learning practices, that tends to travel through other channels. Institutional actors often draw lessons from the interim reports, they organise inter-departmental meetings to share on-going assessments and gather insights from key actors. Yet we could question whether there is a role for those evaluation to eventually reach the stage of final outputs, if the actors that should benefit from their insights lack the institutional space (and time) to include them in their decision-making. Evaluation is currently mainly a compliance-driven exercise, which sits uneasily alongside the extremely political, actor-driven negotiations that shape CAP design. As a result, when negotiations are underway, evaluation risks being set aside as too technical or institutional to matter, rather than treated as a source of informative insight. Moreover, the ongoing simplification of Better Regulation requirements under the Omnibus packages further lowers the weight (and the prescriptiveness) of evaluation and evidence-driven recommendations in EU policymaking.

9.7. Future research avenues

The limited duration of a PhD inevitably constrains both the research questions that could be addressed and the depth at which they had been explored. Boundaries are defined not only by scientific relevance but also by what can realistically be achieved within a fixed timeframe. The end of a PhD is artificial and without temporal or practical limits, the learning process could likely continue indefinitely.

This results in what many doctoral researchers informally maintain alongside their main work: a collection of unresolved research questions that fall outside the dissertation's scope. In my case, these reflections were gathered in a document named the 'Pandora box', initially created during the

exploratory phase when searching for a research question. This document was deliberately left aside afterward, to avoid reopening an ever-expanding set of research questions that could easily escape the purpose of boundaries required to carry the research forward. Revisiting it at the closing stage of the PhD allows me to reflect on extensions that would stretch the coverage, scope, or disciplinary reach for future research. Building from the above sections, five broad avenues for future research are identified.

The first concerns subsidiarity, focussing on i) what actually drives enhanced subsidiarity, and ii) what its consequences in future reforms. On the former, further research could trace the link between the drivers of subsidiarity and the governance arrangements that result from it. On the second, the outcome of the ongoing trilogue negotiations for the CAP post-2027 will shape governance, policy design and implementation in ways this PhD's timeline could not capture. A temporal perspective could extend both questions further. While this PhD used contextual and historical elements to situate the analysis within successive CAP reform cycles, path dependency itself was not examined systematically, even though the analysis suggests that current policy configurations are partly shaped by earlier institutional choices and accumulated reform trajectories. Thie research avenue would build from a strong analytical foundations (Lowe & Baldock, 2000; Swinnen, 2008, 2015; Haigh, 2016; Daugbjerg & Feindt, 2019; Garcia Azcarate & Mili, 2020), and pursuing a systematic investigation on agri-environmental measures and how past policy decisions constrain or enable their current governance arrangements, pointing out how reform processes shape ambition and performance over time.

The second avenue concerns levels and roles, where developing studies across other national and regional cases, would allow for a comparative analysis this PhD's single case study could not provide. Additionally,

building research projects explicitly designed to connect levels would help develop a more systemic understanding of underperformance, rather than one confined to a single level or discipline.

The third avenue concerns actors, power and stakeholder engagement. This PhD's reflections on power came relatively late, and several questions remain open: the dynamics between actors, the role of informal arrangements, and the imbalances that can arise in consultation processes deserve deeper investigation. This would also mean examining the legal framing of stakeholder engagement more closely, including how accountable Member States can be held for it and how strong EU enforcement actually is in practice. An interdisciplinary effort in collaboration with agri-environmental law scholars could be an ideal setting.

The fourth avenue concerns evaluation and impact, connecting governance, design and implementation with the research questions raised by policy evaluation and impact assessment. This would help link the governance side of AECMs to the environmental outcomes they are meant to produce.

The fifth and final avenue concerns the scope of the policy dimension itself. This PhD focused primarily on voluntary agri-environmental subsidies directed at farmers, yet agri-environmental governance rests on a broader set of instruments, including regulatory obligations, national programs and other policy tools. Widening the analytical lens to include these elements would allow for a more complete understanding of how different policy instruments interact within the broader agri-environmental policy and governance framework.

Appendix

This appendix presents the supplementary materials for the research articles included in the Results section of this thesis.

Supplementary materials for Paper 1 and Paper 2 are not reproduced here, as both articles are published open access, and their supplementary materials are freely available online:

Paper 1: Borniotto, D., & Baret, P. V. (2026). *Diversity of agri-environmental governance and potential impacts on environmental performance – a systematic review*. Journal of Rural Studies, 121, 103924. https://doi.org/10.1016/j.jrurstud.2025.103924

Paper 2: Borniotto, D., Antier, C., & Baret, P. V. (2025). *A governance perspective on agri-environmental schemes: Actors, roles, and barriers*. Ambio. https://doi.org/10.1007/s13280-025-02182-0

This appendix therefore contains only the supplementary materials for Paper 3, which was under review at the time of writing:

Paper 3: Borniotto, D., Grohmann, P., Feindt, P., Polman, D., & Baret, P. V. (2026). *Explaining differences in environmental policy integration: a comparative analysis of the European Union's Common Agricultural Policy*. Under review, *Sustainability: Science, Practice, and Policy*.

A. Paper 3 - Supplementary material, Annex 1

The materials presented in this annex provides additional information on the data selection criteria and data calibration for both outcome and conditions

Table 25: Data selection criteria for conditions

Condition	Indicator	Database/source	Exclusion criteria	Reason of exclusion	Final inclusion in the study
Domestic policy preferences	Presence of green party in government and in parliament	ParlGov	/		Yes
Domestic policy preferences	Public opinion on environmental issues	Eurobarometer	After analysis	High quality data, yet low explanatory power due to high indirect link	No
Domestic political dynamics & power structures	Time-Variant Corporatism Index	Harvard Dataverse	/		Yes
Administrative capacity	Recovery rate	DG AGRI - Annual Activity Report 2024	/		Yes
Administrative capacity	Monitoring & evaluation	EU CAP Network – Learning portal on ex-post evaluations	Before analysis: data quality	Low granularity of the data, as provides only frequency of evaluation and monitoring report, yet no information of FTE invested in conducting it, that would have been the proxy to understand the strength of the administration capacity in MSs	No

Policy paradigm	Accession year	EU Treaties Archive	After analysis		No
Policy paradigm	Pillar I/Pillar II	EC (DG AGRI) - CAP Catalogue of intervention	/		Yes
Farming system	Gross value added and income for agriculture, forestry and fishing	Eurostat	Before analysis: indicator type	High quality data, yet indicator not fitting as proxy for the type of the farming system (more on the weight of agriulture in the economy, yet only partial as disregarding the 'food' industry component, that would have provided a bigger picture on the sector weight in the MSs)	No
Farming system	Livestock density index	FADN	Before analysis: indicator type	High quality data, yet only focused on livestock (not on crop) therefore partial understanding of the farming system	No
Farming system	Share of grassland types in utilised agricultural area (UAA) by NUTS 2 region	FADN	Before analysis: indicator type	High quality data, yet only focused on livestock (not on crop) therefore partial understanding of the farming system	No

Farming system	Utilised agricultural area (UAA) managed by low-, medium- and high-input farms	FADN	/		Yes
Farming system	Gross nutrient balance per hectare	FADN	Before analysis: indicator type	High quality data, yet only focused on crop therefore partial understanding of the farming system	No

Table 26: Data calibration (outcome and conditions)

COUNTRY	OUT AES	OUT ES	VETO	GRP	ADM	FARM	PII
AT	0,99	0,05	1,00	1,00	0,89	0,30	0,88
BE-FL	0,33	0,91	1,00	0,00	0,60	0,91	0,34
BE-WA	0,83	0,86	1,00	1,00	0,60	1,00	0,15
BG	0,37	0,07	0,20	0,33	0,12	0,18	0,61
CY	0,65	0,68	0,40	0,00	0,74	0,94	0,60
CZ	0,93	0,83	0,20	0,00	0,23	0,46	0,66
DE	0,60	0,23	0,70	0,67	0,78	0,60	0,29
DK	0,08	0,61	0,70	0,33	0,93	0,91	0,02
EE	0,36	0,97	0,20	0,00	0,86	0,39	0,38
ES	0,16	0,35	0,60	0,00	0,78	0,46	0,10
FI	0,85	0,01	0,70	1,00	0,86	0,85	0,88
FR	0,09	0,90	0,60	0,00	0,24	0,53	0,16
GR	0,20	0,03	0,20	0,00	0,07	0,58	0,26
HR	0,64	0,29	0,20	0,00	0,39	0,34	0,68
HU	0,56	0,08	0,00	0,00	0,44	0,45	0,23
IE	0,70	0,19	0,30	1,00	0,86	0,32	0,44
IT	0,81	0,20	0,80	0,00	0,35	0,67	0,64
LT	0,12	0,65	0,00	0,00	0,90	0,31	0,14
LU	0,97	0,26	0,80	1,00	0,60	0,55	0,92
LV	0,38	0,68	0,00	0,00	0,74	0,33	0,18
MT	0,62	0,06	0,00	0,00	0,17	0,61	0,96
NL	0,16	0,98	1,00	0,00	0,42	0,32	0,25
PL	0,23	0,88	0,20	0,00	0,05	0,62	0,19
PT	0,48	0,63	0,30	0,00	0,76	0,67	0,58

RO	0,72	0,75	0,20	0,00	0,12	0,06	0,35
SE	0,57	0,38	1,00	0,67	0,81	0,61	0,54
SI	0,87	0,11	0,60	0,00	0,87	0,60	0,89
SK	0,91	0,01	0,20	0,00	0,36	0,36	0,71

B. Paper 3 – Supplementary material, Annex 2

The materials presented in this annex provides additional information on coding for stringency, necessity analysis, negated outcomes analysis, enhanced analysis, robustness checks and sufficiency plots; each section provides information across all four models

Coding strategy for stringency

The variable 'stringency' captures the degree of prescriptiveness and specificity embedded in the design of agri-environmental measures and eco-schemes under the CAP across all Member States. It reflects the extent to which measures impose clearly defined conditions and requirements on beneficiaries, beyond broad policy objectives. Coding was performed through qualitative content analysis of official measure descriptions. Each measure was assessed against five analytical criteria reflecting distinct dimensions of design specificity:

1. *Value chain specification*: whether the measure identifies a specific stage or segment of the agri-food chain;
2. *Farming practices*: whether the measure prescribes or constrains specific production practices;
3. *Surface type*: whether it targets particular land uses or biophysical areas;
4. *Implementation processes*: whether it defines procedures for decision-making, monitoring, or stakeholder consultation
5. *Legal obligations*: whether the measure introduces enforceable requirements or links to existing regulatory standards

The overall stringency score (0 to 1) was assigned based on the cumulative presence, clarity, and prescriptiveness of these criteria, following the four-level scale detailed below.

Table 27: Stringency scores, operational definition and coding criteria

Stringency level	Score	Operational definition	Coding criteria and interpretation
Low	0	The description provides none or very limited information on the specific requirements	None or very few criteria identifiable. The measure remains generic (e.g., "support for sustainable practices") without indicating specific practices, surfaces, or processes
Rather low	0.33	The description provides limited but identifiable information on the requirements	One to two criteria identifiable, but with limited detail or clarity. Requirements are loosely defined or voluntary, with broad room for interpretation
Rather high	0.67	The description provides a medium to high level of detail on the requirements	Three to four criteria clearly identifiable, specifying aspects such as target surfaces, prescribed practices, or procedural obligations. Moderate degree of prescriptiveness
High	1	The description provides comprehensive and explicit information on the full set of requirements	Four or more criteria explicitly defined. The measure includes clear obligations, targeted practices, and procedural or legal specifications, indicating high prescriptiveness

Necessity analysis

Necessity analysis was conducted both at the level of single conditions and at the level of multiple conditions, the latter assessed through the identification of INUS conditions (i.e. factors that are Insufficient but Necessary parts of configurations that are themselves Unnecessary but Sufficient for the outcome). The analysis was performed using the following thresholds: incl.cut = 0.9, indicating the minimum consistency required for a condition to be considered necessary; cov.cut = 0.6, setting the minimum empirical relevance (coverage); and ron.cut = 0.5, ensuring robustness against trivial or contradictory relations. Under these parameters, no necessary condition (or combination) was identified. This result implies that the outcome does not systematically depend on the presence of any single condition or recurring combination of conditions, suggesting that multiple

alternative pathways may lead to the observed outcome, substantiating further in-depth analysis on sufficiency.

Table 28: Necessity analysis of AECM model (model 1)

Condition	Cons.Nec	Cov.Nec	RoN
VET	0.614	0.712	0.798
GRP	0.391	0.847	0.952
ADM	0.712	0.696	0.725
FARM	0.722	0.734	0.767
PII	0.79	0.92	0.935
~VET	0.612	0.624	0.701
~GRP	0.68	0.492	0.396
~ADM	0.586	0.714	0.814
~FARM	0.633	0.736	0.813
~PII	0.574	0.583	0.676

Table 29: Necessity analysis of Eco-schemes (model 2)

Condition	Cons.Nec	Cov.Nec	RoN
VET	0.598	0.577	0.729
GRP	0.189	0.341	0.82
ADM	0.688	0.559	0.645
FARM	0.714	0.604	0.688
PII	0.481	0.466	0.682
~VET	0.651	0.552	0.662
~GRP	0.887	0.534	0.417
~ADM	0.596	0.605	0.759
~FARM	0.605	0.585	0.734
~PII	0.822	0.694	0.741

Table 30: Necessity analysis of AECM model, trade-off with Eco-schemes (model 3)

Condition	Cons.Nec	Cov.Nec	RoN
ESS	0.487	0.585	0.746
VET	0.614	0.712	0.798
GRP	0.391	0.847	0.952
ADM	0.712	0.696	0.725
FARM	0.722	0.734	0.767
PII	0.79	0.92	0.935
ESS	0.768	0.759	0.774
~VET	0.612	0.624	0.701
~GRP	0.68	0.492	0.396
~ADM	0.586	0.714	0.814
~FARM	0.633	0.736	0.813
~PII	0.574	0.583	0.676

Table 31: Necessity analysis of Eco-schemes model , trade-off with AECM (model 4)

Condition	Cons.Nec	Cov.Nec	RoN
AES	0.585	0.487	0.622
VET	0.598	0.577	0.729
GRP	0.189	0.341	0.82
ADM	0.688	0.559	0.645
FARM	0.714	0.604	0.688
PII	0.481	0.466	0.682
~AES	0.722	0.712	0.804
~VET	0.651	0.552	0.662
~GRP	0.887	0.534	0.417

~ADM	0.596	0.605	0.759
~FARM	0.605	0.585	0.734

Negated outcomes

Table 32: sufficient solutions for negated outcome for AECM mofel (model 1)

	inclS	PRI	covS	covU	cases
VET ~ GRP2* ~ PII*	0.933	0.845	0.487	0.116	NL; FR; ES; BE-FR,DK
~ GRP2 ~ ADM* FARM* ~ PII*	0.899	0.702	0.441	0.062	GR,PL; FR
~ GRP2 ADM* ~ FARM* ~ PII*	0.917	0.774	0.466	0.109	EE,LT,LV; ES
Solution	0.927	0.854	0.734		

Table 33: Sufficient solutions for negated outcome for Eco-schemes model (model 2)

	inclS	PRI	covS	covU	cases
VET GRP2*	0.82	0.744	0.303	0.043	AT; BE-WA,DE; FI,LU,SE
VET PII*	0.882	0.797	0.462	0.017	IT; SI; AT; FI,LU,SE
VET ADM* ~ FARM*	0.876	0.742	0.343	0.028	ES; AT
~ GRP2 ~ ADM* PII*	0.821	0.702	0.393	0.168	BG,CZ,HR,SK; MT; IT
GRP2 ~ FARM* ~ PII*	1	1	0.136	0.017	IE
Solution	0.806	0.716	0.738		

Table 34: Sufficient solutions for negated outcome for AECM model, trade-off Eco-schemes (model 3)

	inclS	PRI	covS	covU	cases
~ GRP2 FARM* OUT4*	0.858	0.681	0.509	0.056	PL; CY,PT; FR; BE-FR,DK
~ VET ~ GRP2* ~ ADM* FARM*	0.847	0.559	0.391	0.118	GR,MT; PL
~ VET ~ GRP2* ADM* OUT4*	0.869	0.688	0.388	0.069	EE,LT,LV; CY,PT
VET ~ GRP2* ~ ADM* OUT4*	0.968	0.888	0.313	0.032	NL; FR
Solution	0.838	0.68	0.732		

Table 35: Sufficient solutions for negated outcome for Eco-schemes, trade-off with AECM (model 4)

	inclS	PRI	covS	covU	cases
VET OUT2*	0.835	0.737	0.507	0.145	IT; SI; AT; BE-WA,DE,FI,LU,SE
GRP2 ~ FARM* OUT2*	1	1	0.207	0.025	IE; AT
~ GRP2 ~ ADM* FARM* OUT2*	0.849	0.701	0.326	0.026	MT; IT
~ VET ~ GRP2* ~ ADM* ~ FARM* ~ OUT2*	0.864	0.723	0.287	0.038	BG
~ VET ~ GRP2* ADM* FARM* ~ OUT2*	0.858	0.548	0.272	0.048	PT
Solution	0.811	0.712	0.743		

Enhanced analysis

Table 36: Enhanced analysis for AECM model (model 1)

	inclS	PRI	covS	covU	cases
~ VET GRP2* ADM*	0.885	0.766	0.112	0.025	IE
~ VET FARM* PII*	0.995	0.981	0.354	0.059	MT
GRP2 ADM* FARM*	0.931	0.887	0.263	0.07	BE-WA,DE,SE; FI,LU
GRP2 ADM* PII*	1	1	0.215	0.038	AT; FI,LU
ADM FARM* PII*	0.996	0.989	0.448	0.047	SI; FI,LU
Solution	0.968	0.937	0.656		

Table 37: Enhanced analysis for Eco-schemes (model 2)

	inclS	PRI	covS	covU	cases
VET ~ GRP2*	0.745	0.577	0.485	0.115	NL; FR; IT; ES; BE-FR,DK; SI
~ GRP2 ADM*	0.714	0.533	0.595	0.226	EE,LT,LV; CY,PT; ES; BE-FR,DK; SI
Solution	0.703	0.556	0.711		

Table 38: Enhanced analysis for AECM model, trade-off with Eco-schemes (model 3)

	inclS	PRI	covS	covU	cases
ADM ~ OUT4*	0.868	0.753	0.597	0.086	IE; ES; SI; AT; DE,FI,LU,SE
FARM ~ OUT4*	0.875	0.734	0.573	0.035	GR,MT; IT; SI; DE,FI,LU,SE
~ VET ~ ADM* ~ FARM*	0.836	0.614	0.422	0.129	BG,HR,HU,SK; CZ,RO
GRP2 ADM* FARM*	0.931	0.887	0.263	0.03	DE,FI,LU,SE; BE-WA
Solution	0.822	0.708	0.825		

Table 39: Enhanced analysis for Eco-schemes, trade-off with AECM (model 4)

	inclS	PRI	covS	covU	cases
VET OUT2*	0.835	0.737	0.507	0.145	IT; SI; AT; BE-WA,DE,FI,LU,SE
GRP2 ~ FARM* OUT2*	1	1	0.207	0.025	IE; AT
~ GRP2 ~ ADM* FARM* OUT2*	0.849	0.701	0.326	0.026	MT; IT
~ VET ~ GRP2* ~ ADM* ~ FARM* ~ OUT2*	0.864	0.723	0.287	0.038	BG
~ VET ~ GRP2* ADM* FARM* ~ OUT2*	0.858	0.548	0.272	0.048	PT
Solution	0.811	0.712	0.743		

Robustness checks

Table 40: Robustness check for AECM model (model 1)

Sensitivity ranges				
		Lower	Threshold	Upper
Parameters	Raw consistency:	0.84	0.85	0.85
	Frequency:	1	1	1
	ADM Exclusion	NA	0.2	NA
	ADM Threshold	0.63	0.72	0.75
	ADM Inclusion	0.96	1	1.03
	FARM Exclusion	NA	5	33
	FARM Threshold	25.7	31.7	31.7
	FARM Inclusion	27	60	77
	PII Exclusion	0.15	0.2	0.45
	PII Threshold	0.41	0.41	0.46
	PII Inclusion	0.55	0.7	NA
Robustness parameters for both recalibrated conditions and higher raw consistency threshold (0.86)				
Fit-oriented	RFcons: 0.918	RFcov: 0.862	RFscminTS: 0.782	RFscmaxTS: 0.846

Table 41: Robustness check for Eco-schemes model (model 2)

		Sensitivity ranges		
		Lower	Threshold	Upper
Parameters	Raw consistency:	0.78	0.8	0.82
	Frequency:	1	1	1
	ADM Exclusion	NA	0.2	0.28
	ADM Threshold	0.68	0.72	0.8
	ADM Inclusion	0.68	1	NA
	FARM Exclusion	NA	5	18
	FARM Threshold	25.7	31.7	33.7
	FARM Inclusion	31	60	84
	PII Exclusion	NA	0.2	0.4
	PII Threshold	0.41	0.41	0.41
	PII Inclusion	0.65	0.7	0.75
Robustness parameters for both recalibrated conditions and higher raw consistency threshold (0.82)				
Fit-oriented	RFcons: 0. 933	RFcov: 0.825	RFscminTS: 0.778	RFscmaxTS: 0.842

Table 42: Robustness checks for AECM model, trade-off with Eco-schemes (model 3)

		Sensitivity ranges		
		Lower	Threshold	Upper
Parameters	Raw consistency:	0.81	0.84	0.84
	Frequency:	1	1	1
	ADM Exclusion	NA	0.2	0.34
	ADM Threshold	0.7	0.72	0.74
	ADM Inclusion	0.86	1	1.08
	FARM Exclusion	NA	5	27

	FARM Threshold	30.7	31.7	32.7
	FARM Inclusion	40	60	91
	PII Exclusion	0.15	0.2	0.45
	PII Threshold	0.41	0.41	0.46
	PII Inclusion	0.55	0.7	NA
Robustness parameters for both recalibrated conditions and higher raw consistency threshold				
Fit-oriented	RFcons: 0.944	RFcov: 0.912	RFscminTS: 0.875	RFscmaxTS: 0.867

Table 43: Robustness checks for Eco-schemes model, trade-off with AECM (model 4)

		Sensitivity ranges		
		Lower	Threshold	Upper
Parameters	Raw consistency:	0.78	0.8	0.82
	Frequency:	1	1	1
	ADM Exclusion	0.14	0.2	NA
	ADM Threshold	0.68	0.72	0.88
	ADM Inclusion	0.68	1	NA
	FARM Exclusion	NA	5	29
	FARM Threshold	25.7	31.7	37.7
	FARM Inclusion	25	60	NA
	PII Exclusion	NA	0.2	NA
	PII Threshold	0.16	0.41	0.71
	PII Inclusion	NA	0.7	NA
Robustness parameters for both recalibrated conditions and higher raw consistency threshold (0.82)				
Fit-oriented	RFcons: 0.939	RFcov: 0.669	RFscminTS: 0.617	RFscmaxTS: 0.899

Sufficiency plots

Figure 18: Sufficiency plot for AECM model (model 1)

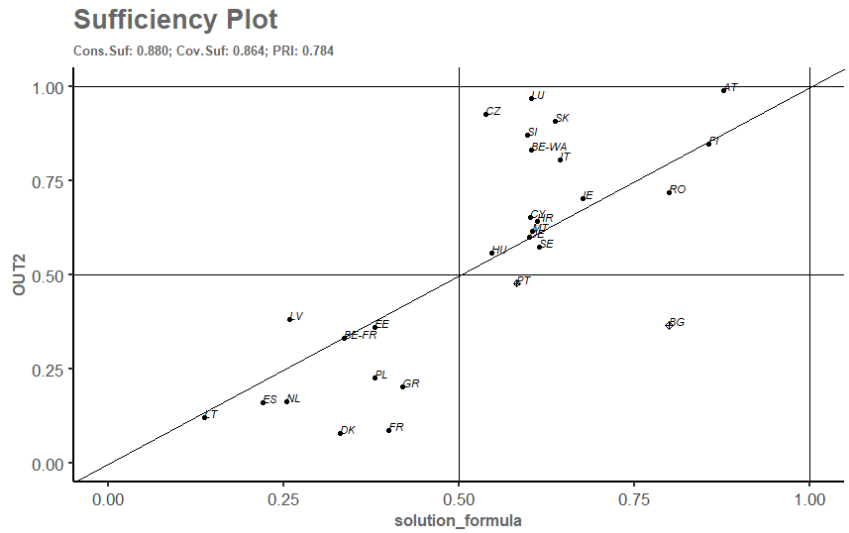


Figure 19: Sufficiency plot for Eco-schemes model (model 2)

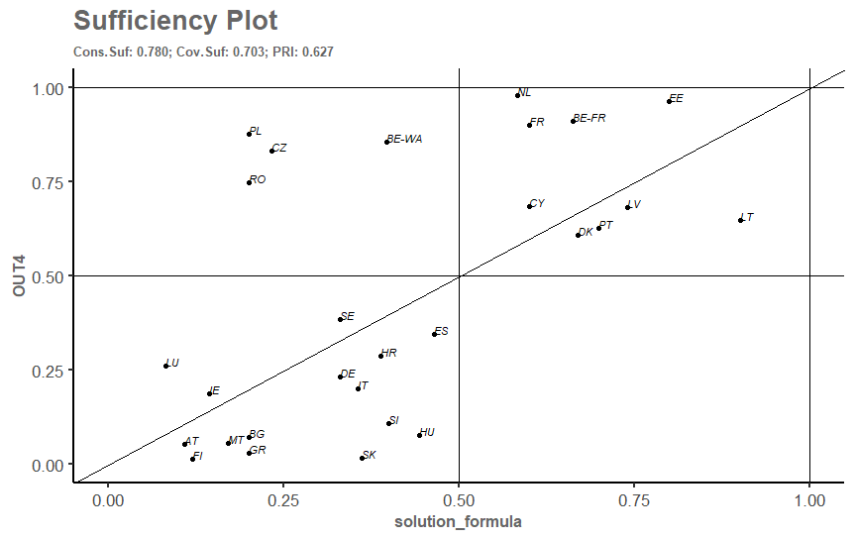


Figure 20: Sufficiency plot for AECM model, trade-off with AECM (model 3)

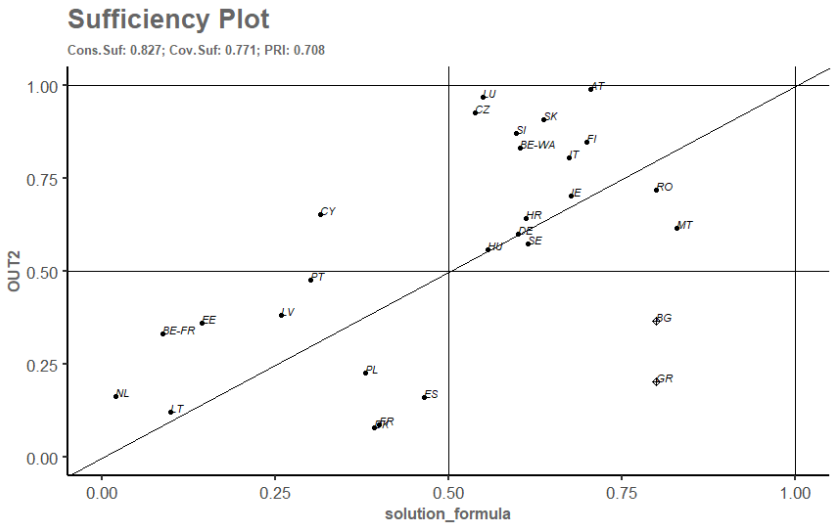
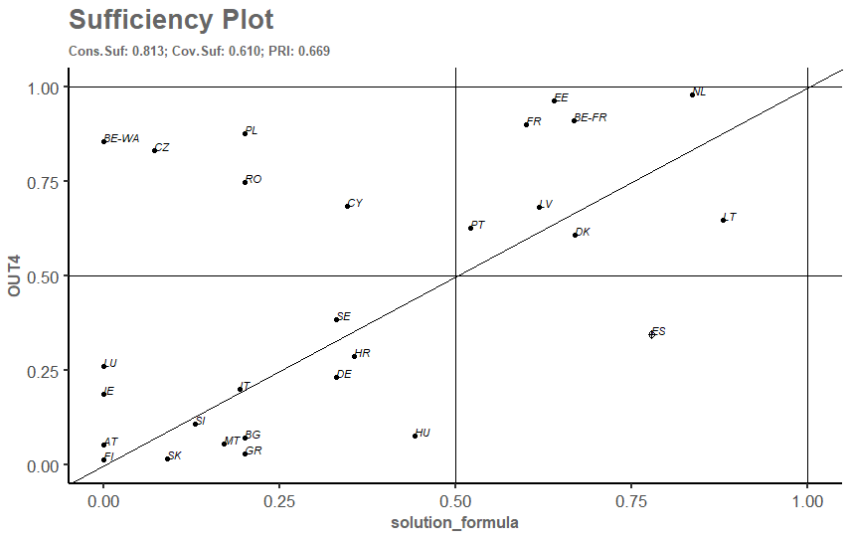


Figure 21: Sufficiency model for Eco-schemes model, trade-off with AECM (model 4)



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