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Designing successful agri-environmental schemes: A mechanistic analysis of a collective scheme for eco-system services in the Netherlands



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ABSTRACT

In response to the challenges posed by the fragmentation of habitats and loss of native biodiversity, climate change adaptation and mitigation, diverse agri-environmental measures have been initiated across the European Union (EU) with the aim of fostering agricultural ecosystem service delivery. Previous studies adopting a governance perspective have identified various determinants of successful agri-environmental measures. However, the explanatory value of these studies is limited as the causal processes through which context and scheme design affect implementation success remain grey -boxed. This article uses a mechanism-based approach to uncover the causal processes that underlie actions and interactions within agri-environmental governance arrangements and provides insights into the role the interplay between context and scheme design plays in the successful implementation of agri-environmental measures. The empirical focus is the governance of a successful collective agri-environmental scheme in the Netherlands. In opening the grey box of the causal mechanisms that link contextual and scheme design with their results, the paper applies theory building process tracing methods. Results show that implementation success in the case is explained by the interplay between social learning and trust-building mechanisms. We argue that EU and domestic decision-makers aiming to improve the contribution of agri-environmental measures to climate change adaptation and mitigation must consider the contextual conditions that facilitate increased cooperation between stakeholders and, ultimately, successful implementation of measures.

1. Introduction

Addressing the trend of declining biodiversity and increasing water, air, and soil pollution caused by intensive farming poses serious governance challenges as remedying such environmental damage requires extensification of farming practices, particularly in environmentally sensitive areas. It is now widely acknowledged that extensive farming can deliver a range of high-quality ecosystem services such as increased biodiversity, cleaner water, improved soils and possibly climate mitigation. Links between the richness of the environment and farming practices are complex and, therefore, the provision of ecosystem services involves governance challenges in the form of engaging farmers (Polman and Slangen, 2008; Runhaar et al., 2018).

In response to the challenges posed by - inter alia - fragmentation of habitats and loss of native biodiversity, climate change adaptation and mitigation, diverse agri-environmental measures have been initiated in the EU with the aim of fostering agricultural ecosystem service delivery (European Environment Agency, 2015, 2019). Agri-environmental measures provide payments for farmers in return for implementing agri-environmental measures that go beyond legal requirements or the application of usual good farming practices (Bazzan et al., 2022a). Agri-environmental measures are designed at EU, national, regional, or local level so that they can be adapted to the local farming systems and environmental conditions, which vary greatly across the EU (Bazzan et al., 2022b). Examples of diverse measures 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), and preserving traditional farming practices (Bazzan et al., 2022a).

Reflecting the diversity of environmental needs they address, agrienvironmental measures are characterized by a wide variety of governance arrangements. Here, we draw on the definition of a governance

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arrangement as, "the ensemble of rules, processes, and instruments that structure the interactions between public and/or private entities to realize collective goals for a specific domain or issue" (Termeer et al., 2011, p. 161). Agri-environmental measures have attracted considerable scholarly attention from different perspectives (for a review, see, e.g., Derissen and Latacz-Lohmann, 2013; Hasler et al., 2022; Latacz-Lohmann and Hodge, 2003; Moxey and White, 2014; Uthes and Matzdorf, 2013). Previous research on agri-environmental measures has mainly adopted an environmental economics approach to develop and apply economic models to identify optimal interventions to meet environmental targets (e.g., Ansell et al., 2016; Arata and Sckokai, 2016; Balana et al., 2011; Batáry et al., 2011; Bertoni et al., 2020; Brady et al., 2009; Chabé-Ferret and Subervie, 2013; Christensen et al., 2011; Hanley, 2014; Hasler et al., 2019; Wunder et al., 2020). Moreover, several ecological studies have focused on the environmental performance of agri-environmental measures, providing insights into measures initiated by non-state actors (such as businesses in the food chain or NGOs promoting nature conservation) (Runge et al., 2022), voluntary standards for promoting biodiversity (Critchley et al., 2004; Granlund et al., 2005; Hanley et al., 1999; Jones et al., 2017; Walker et al., 2007), agri-environmental cooperatives and farmers' partnerships for nature conservation (Hodge and McNally, 2000; Kleijn et al., 2004, 2011), and agri-environmental schemes initiated under the rural development pillar of the EU's Common Agricultural Policy (CAP) (Hasler et al., 2022; Kleijn et al., 2006; Kleijn and Sutherland, 2003; Peerlings and Polman, 2009; Scheper et al., 2013). Findings regarding the ecological performance of these measures are mixed, but some studies have identified positive effects on biodiversity (Albrecht et al., 2007; Batáry et al., 2011, 2015; Brereton et al., 2008; Bullock et al., 2007; Carey et al., 2005; Edwards et al., 2007; Kleijn et al., 2006; Kleijn and Sutherland, 2003; Sutherland, 2004; Whittingham, 2006). Finally, various studies adopting a governance perspective have identified several design features that contribute to the success of measures (Bazzan et al., 2022a; Meyer et al., 2015, 2018; Olivieri et al., 2021) - inter alia, inclusiveness of decision-making (Runhaar, 2017; Runhaar et al., 2017, 2018; Schomers et al., 2015), collaboration among farmers (Peerlings and Polman, 2009; Runhaar and Polman, 2018; Westerink et al., 2017), and flexible implementation (Mettepenningen et al., 2013; Schroeder et al., 2013; Smits et al., 2008).

Despite this burgeoning literature and the identification of key variables in the design of agri-environmental governance arrangements, the precise causal processes that link these variables to eventual outcomes largely remain unexplored. In other words, the mechanisms that link the design features of arrangements with their results remain grey boxed (Ayambire and Pittman, 2022).¹ Against this background, this paper demonstrates how a mechanism-based approach can be used to uncover the causal processes that underlie actions and interactions within agri-environmental governance arrangements and provide insights into the role the interplay between contexts and scheme design plays in enabling the successful implementation of measures. We do this by drawing on the growing literature on causality by tracing the causal mechanisms that link causal conditions to certain outcomes (Beach, 2016; R. Biesbroek et al., 2017; Falleti and Lynch, 2009; Hedström and Ylikoski, 2010; Machamer et al., 2000; Mayntz, 2004). In this paper, we understand implementation success as the extent to which policy measures (outputs) are translated into outcomes, i.e., the extent to which they bring about the behavioral change deemed necessary to address the environmental problem at stake (Bazzan et al., 2022a). The choice of specific policy measures is based on assumptions about the causal relationship between such measures and behavioral responses (Bazzan et al., 2022b). Going beyond such assumptions and identifying the mechanisms that transmit policy measures into actual outcomes can inform policy design processes as knowledge on causality can be used to shape design in a way that increases the likelihood that the assumed behavioral change actually happens (Capano and Howlett, 2020, 2021). Empirically, we focus on the governance of a successful collective agri-environmental scheme in the Netherlands. In opening the grey box of the causal mechanisms that link scheme design with its results, we apply theory building process tracing methods.

Firstly, we present the conceptual framework and explain why a mechanism-based approach is suitable for investigating agrienvironmental governance processes. Then, we introduce theorybuilding process-tracing, which is subsequently applied to trace the mechanisms underlying the governance of a collective practice-based scheme for enhancing biodiversity in the Netherlands. The paper ends with a discussion of the results and the implications for future research.

2. Opening the grey box of agri-environmental governance processes: a mechanistic approach

Addressing the question of success and failure of agri-environmental measures first entails the conceptualization of such success. Agrienvironmental governance studies have distinguished between agrienvironmental outputs, outcomes, and impacts (Koontz et al., 2020; Newig et al., 2013). Outputs are the decisions, typically in writing, in the form of regulations, plans, or contracts. Outcomes are behavioral or procedural changes that directly result from an output such as implementation (the degree to which agri-environmental outputs are implemented) or compliance with a new rule. Finally, impacts are actual changes in the environment resulting from the outcome (Koontz et al., 2020). As implementation moves from outputs to impacts, it becomes increasingly difficult to establish a direct causal relationship (Knill and Tosun, 2020; Thomann, 2015, 2018). Despite advances in the literature on impact evaluation, identifying causal processes remains a major hurdle in studies of agri-environmental measures and schemes (Hasler et al., 2022; Zimmermann and Britz, 2016). Previous studies have mainly assessed agri-environmental outcomes in terms of whether expected outputs are implemented and, if so, to what extent, and then operationalized them into specific success/failure indicators such as farmers' uptake of measures, and participants' capacity to meet the requirements and overcome potential barriers to compliance (see, e.g., Bartkowski and Bartke, 2018; Dessart et al., 2019; Finn et al., 2009; Lastra-Bravo et al., 2015; Runhaar et al., 2017; Zimmermann and Britz, 2016).

Against this background, scholars within the agri-environmental governance literature have formulated valuable propositions about various design determinants for (un)successful results (Bazzan et al., 2022a; Matzdorf et al., 2013; Mettepenningen et al., 2013; Meyer et al., 2015, 2018; Peerlings and Polman, 2009; Runhaar et al., 2017; Runhaar and Polman, 2018; Sattler et al., 2013; Schomers et al., 2015; Schroeder et al., 2013; Smits et al., 2008; Westerink et al., 2017). Nevertheless, the causal processes that link such factors to the success (or failure) of the agri-environmental measures have remained grey-boxed (Bunge, 1997), and, therefore, we have limited knowledge as to why some measures result in successful implementation while others fail. What limits the explanatory power of existing agri-environmental governance studies is the lack of theorizing about the role the interplay between the design features of agri-environmental governance arrangements plays in enabling the implementation success of measures. With a few exceptions (Bazzan et al., 2022a; Meyer et al., 2015, 2018), most agri-environmental governance studies have investigated the influence of single design elements on farmers' participation and adoption of agri-environmental measures. These include assistance in implementation (i.e., the level of advice and information provided by government or

¹ Black-boxed means that the causal processes linking design conditions and outcomes are completely ignored. In the context of agri-environmental governance, black boxing means no attempt is made to identify the causal processes linking the two. Grey-boxed implies a partial attempt to uncover these causal processes. Grey-boxing may result from perceiving mechanisms as intervening variables (Ayambire and Pittman, 2022; Beach, 2016).

experts and the cooperation between farmers and other actors) (Mettepenningen et al., 2013), flexible implementation (regarding the choice of land enrolled, the farm practices implemented, and the length of contract) (Schroeder et al., 2013; Smits et al., 2008), participation in design (whether the measure is designed by the nature protection sector and the agricultural sector in collaboration, or whether participation of farmers and other stakeholders occurs) (Peerlings and Polman, 2009; Runhaar and Polman, 2018; Westerink et al., 2017), the type of payment (i.e., result-based, or practice-based fixed rate) and the scope of the measure (single measures, schemes, whole farm approach) (Matzdorf et al., 2013; Sattler et al., 2013). Despite their acknowledged importance, the causal processes through which the scheme design shapes implementation success remain unclear as how the design of policy measures enables successful outcomes has not been substantiated. In other words, the explicit linkages, i.e., the mechanisms, between the design conditions and the outcomes they produce are unknown.

In the past two decades, there has been a turn towards mechanismbased explanations in the social sciences (Ayambire and Pittman, 2022; G. R. Biesbroek et al., 2014; R. Biesbroek et al., 2017; R. Biesbroek and Candel, 2020; Capano et al., 2019; Capano and Howlett, 2021; Hedström and Ylikoski, 2010; Mavntz, 2004; van der Heijden et al., 2021). The concept of causal mechanisms has been defined in many ways. The simplest understanding of causal mechanisms considers them as a series of events leading to a certain outcome (Mahoney, 2012, p. 571). Yet, following this understanding, the causal mechanisms remain black-boxed as only a descriptive narrative is provided, which does not shed light on why things happened (Beach, 2016). Other scholars treat mechanisms as intervening variables between X and Y (Falleti and Lynch, 2009; George and Bennett, 2005; Gerring, 2005; Morgan and Winship, 2007; Pearl, 2000), but this results in the actual causal process remaining grey-boxed (Ayambire and Pittman, 2022; Bunge, 1997; Hedström and Ylikoski, 2010; Mahoney, 2012; Mayntz, 2004). In fact, according to Bunge (1997, p. 428), "only translucent box (or mechanismic) theories describe mechanisms in any detail". Following this understanding, Beach and Pedersen defined mechanisms as theorized links between causes and outcomes (Beach and Pedersen, 2013, 2016) in which each part of the mechanism is described in terms of entities engaging in activities that transmit causal forces, i.e., a mechanism-based explanation consists of a causal story linking a cause (or a set of causes) X to an outcome Y, without logical holes (Beach and Pedersen, 2018; Machamer et al., 2000). Following this understanding, in the sequence $X \rightarrow Y$, the mechanism is triggered by X and results in Y occurring.

The agri-environmental governance literature suffers from greyboxing in terms of identifying the mechanism(s) that provides the causal link between X and Y. Without adopting an explicit mechanismbased approach, the literature on agri-environmental governance has pinpointed some processes that resemble what we consider mechanisms, including trust-building (Newig et al., 2018; Siddiki et al., 2017; Westerink et al., 2020b), inclusion in decision-making (Newig et al., 2018; Polman and Slangen, 2008), social learning (Schusler et al., 2003; Westerink et al., 2020a), and knowledge exchange (Bazzan et al., 2022a; Newig et al., 2018). Mechanism-based explanations are a recent approach in environmental governance and management scholarship (Ayambire and Pittman, 2022; Baird et al., 2019; R. Biesbroek et al., 2017; Filbee-Dexter et al., 2018), which have the potential to study previously black-boxed or grey-boxed causal explanations, e.g., between design conditions and successful implementation of agri-environmental governance. Mechanistic approaches emerged as a criticism of correlational approaches, which failed to clarify the causal processes linking design conditions to implementation responses (Ayambire and Pittman, 2022; Mahoney, 2001; Namugumya et al., 2020). Ayambire and Pittman (2022) emphasize that a mechanism is, "a set of interacting parts [...] and no single part can generate the effect produced by the set" (p. 2093), and Biesbroek et al. (2014) argue that in governance processes, mechanisms involve entities and their activities, which produce an observed outcome. In identifying the way in which mechanisms causally link design

conditions and outcomes, it is crucial to consider how the context into which a measure is introduced influences the way in which the mechanisms transmit design into a particular observable outcome (Falleti and Lynch, 2009; Pattyn et al., 2020; Pawson and Tilley, 1997). From such a viewpoint, it is essential to distinguish between contexts and design features (Beach and Pedersen, 2013, 2016). Contexts are scope conditions: they do not produce the outcome, but they need to be present for the occurrence of the mechanism (Pattyn et al., 2020, p. 8) (see Fig. 1).

3. Methods

Process-tracing is a qualitative methodology that, "*attempts to identify the intervening causal process – the causal chain and mechanism*" (George and Bennett, 2005, pp. 206–207) that links a cause (or a set of causes) to an outcome (Beach, 2016). Three variants of process-tracing methods have been developed: theory-testing (deductive), theory-building (inductive), and explaining outcomes (Beach and Pedersen, 2013).

Here, we use theory-building or inductive process tracing to explore the types of mechanisms that play a role in agri-environmental governance schemes (Bennett & George 1997, p. 17). We first use the empirical material to shed light on potential mechanisms in the case. Subsequently, we iterate between the empirical observations and theoretical concepts that could potentially depict the mechanisms at work. The concepts were selected from the governance literature, including the agri-environmental governance and design literature. Our aim is to provide a *plausible* causal explanation of the role the interplay between agri-environmental designs and contexts plays in enabling (or hampering) successful implementation (Beach and Pedersen, 2013). To establish such plausible causality through theory-building process tracing, we employed what Beach (2016) calls minimalist understanding, which is particularly useful when some uncertainty about what mechanisms link X to Y remains. Following Beach (2016), we undertake a plausibility probe to assess the validity of the causality. Although this approach has its limitations, it provides new insights into the causal mechanisms.

We compared different sources of data to obtain an in-depth, verified understanding of the situated processes at play to reduce bias and uncover plausible causal mechanisms. Data collection comprised semistructured interviews with key stakeholders, analysis of policy documents, legal documents, evaluation reports, and secondary literature. Interviewees were selected in consultation with academic and project partners from the Horizon 2020 EFFECT research project on environmental performance in the agricultural sector. We gathered different perspectives on the design and implementation of the scheme from different stakeholders involved in the governance arrangement: an officer from Friesland province (interviewee #1), two officers from the Netherlands Enterprise Agency (RVO) (interviewees #2 and #7), which is responsible for payments, two farmers participating in the scheme (interviewees #3 and #5), a board member of the Noardlike Fryske Wâlden (NFW) collective (interviewee #4), a field coordinator volunteering for NFW (interviewee #6), an expert scholar collaborating with NFW (interviewee #8). Interview questions (provided in the Annex) were derived from an operationalization of agri-environmental design conditions and outcomes used in extant literature and agrienvironmental governance studies (Bazzan et al., 2022a; Hardy and Koontz, 2009; Koontz et al., 2020). We asked respondents about their role, engagement with the scheme and the processes that affected implementation of the measures. Interviews lasted between 45 and 90 min.

To analyze our data qualitatively, we first developed a codebook (provided in the Annex), drawing on the conditions and outcomes identified by existing agri-environmental governance literature. In the second step, we inductively identified the interactions between the design conditions, the contextual conditions, and the underlying mechanisms. Two authors independently coded data from each interview highlighting the *observable manifestations* of the *plausible* causal



Fig. 1. Context-design-mechanisms-outcome linkages.

mechanisms identified. Causal processes emerging from the empirical data were compared with the existing social science literature on mechanisms to determine appropriate labels.

4. Agri-environmental schemes design for enhancing nature conservation in the Netherlands

Larger scale and intensification of farming in the Netherlands have gone hand in hand with increased pressure on the environment and climate. Primary agriculture and horticulture are responsible for 13% of greenhouse gas (GHG) emissions, while in farming areas, the population of birds has fallen by 70% in the past 30 years (Terwan et al., 2016). The number of farmland and grassland birds strongly depends on how farmers manage the land. Moreover, although water quality and the condition of Dutch waterways is improving, more work is necessary to meet Water Framework Directive goals (Terwan et al., 2016). To meet these challenges, the Dutch Rural Development Programme (RDP) finances a wide variety of measures to restore, conserve, and enhance ecosystems related to agriculture.

The Dutch agricultural landscape management scheme evolved under the 2014 EU Rural Development Regulation, which introduced group applications for agri-environment-climate measures (Regulation EU 1305/2013, Art. 28). In 2016, the Dutch government introduced a new scheme for joint applications only. Between 2011 and 2014, the new collective approach was tested in four pilot regions, and in 2014 and 2015 a vast reorganization of the agrarian collectives occurred, which resulted in a reduction from 160 to 40 certified farmer collectives, which involve over 9000 farmers and approximately 100,000 ha of farmland. The new collective approach responds to the need to adopt a cross-farm territorial approach to reverse the decline in farmland biodiversity, introduce greater flexibility in conservation activities (i.e., their content, exact location, and financial compensation), simplify administration, and improve scheme compliance.

In this paper, we focus on a collective practice-based agri-environmental scheme in the northern province of Friesland, where the Noardlike Fryske Wâlden (NFW) agrarian collective manages 25,000 ha of rural area with landscape elements, meadow bird areas, tolerance areas for geese, water areas, and arable land. NFW, comprising around 800 members, is the oldest of the seven professional Frisian agrarian collectives, which coordinate agri-environmental activities of their farmer-members. The NFW collective is considered one of the most successful in the Netherlands (Gerritsen et al., 2013; Termeer et al., 2013).

5. Agri-environmental scheme design features

The new Dutch collective scheme requires that agrarian collectives submit an application, which specifies which conservation activities will be performed and how they will contribute to achieving the national and provincial nature conservation targets, to the province. Subsidies are only granted to a collective once the application has been approved by the province. Contracts between the government and collectives run for six years and set the agri-environmental targets and describe the conservation activities to be implemented to achieve those targets. Agrarian collectives then offer a diversity of management packages from which eligible farmers choose in consultation with their field coordinator. Each management package remunerates the farmer and a bonus is often awarded if results from the agri-environmental management activity are observed (e.g., a meadow bird nest on the farmer's land). Contracts between the collective and the farmers outline the specific activities and payments needed at the field level to achieve conservation targets. Field monitoring and controls are conducted by the paying agency and the collective (by field coordinators). Sanctions (e.g., late payment or penalty) are possible based on these controls [interviewees #4, #6].

The NFW agricultural landscape management scheme is a collective practice-based scheme, which originated from a bottom-up approach open to participation of various stakeholders, including farmers, field coordinators, and specialists [interviewees #1, #2, #4, #7, #8]. Since the introduction of the scheme in 2016, collectives are regularly consulted by the national government through Boerennatuur, the Dutch national association that represents all farmer collectives in the Netherlands [interviewee #4].

Within the new collective approach, the national government is responsible for designing national targets and providing guidance on possible conservation activities and payments (listed in the Annex of the Dutch RDP). It also establishes a national framework for controls and sanctions (conducted by the paying agency). The provincial government is responsible for conservation policies and selects the target species, the designated areas where conservation activities are expected to be most effective, and allocates the budget. Accordingly, Friesland province organizes regular meetings with the collectives - including NFW - to discuss the submission of the territorial application for a six-year contract and the budget and assess the feasibility and quality of the application before approval. Certified collectives can submit proposals for new measures to be evaluated by a national expert committee and eventually added to the RDP Annex [interviewee #1]. NFW is the beneficiary of the scheme and is responsible for preparing its territorial application and an annual management plan. Accordingly, it selects appropriate conservation targets and activities from the government list, defines ecological preconditions and guidelines for participants, and consults farmers and other relevant stakeholders [interviewees #1, #2, #4, #7]. The collective also collects individual contractual preferences from potential members and rejects applications that do not fit the plan.

Regarding implementation of the scheme, knowledge exchange is high [interviewees #1, #3, #4, #5, #6]. NFW organizes regular information meetings with the farmers participating in the scheme and its field coordinators provide advice and guidance. Moreover, the collective develops guidelines to arrange individual contracts and payments, performs most of the administrative work and is responsible for monitoring the implementation of the adopted measures. Finally, NFW assesses the conservation activities on an annual basis and adjusts the management plan accordingly, usually in consultation with its field coordinators and farmer members [interviewees #3, #4, #5, #6]. Flexibility in implementation also increased over the years, mostly regarding the design and location of conservation activities, and individual payments and sanctions of farmer members [interviewee #6].

6. Outcome: Implementation success of NFW scheme

Following agri-environmental governance studies that distinguish between agri-environmental outputs, outcomes, and impacts (Koontz et al., 2020; Newig et al., 2013), we identify the outputs as the collective contractual arrangements between the Friesland province and the NFW agrarian collective, and between the NFW collective and its members. Outcome refers to the degree to which agri-environmental outputs are implemented (Koontz et al., 2020). Operationalizing successful implementation of the scheme refers to the degree to which outputs are translated into outcomes, i.e., the change needed to address the environmental problem at stake (Bazzan et al., 2022a). We combine two dimensions when operationalizing successful implementation of the NFW agricultural landscape management scheme: (i) the number of NFW farmer members who sign up to the scheme, and (ii) the participants' capacity to meet the requirements and overcome potential barriers to compliance, which emerged from the in-depth interviews conducted.

Uptake increased from 562 to 698 participants between 2016 (when the new collective approach was introduced) and 2021 (see Table 1). Regarding implementation, NFW considers itself successful in achieving nature conservation [interviewee #4] while how to implement the measures stipulated in their contracts is generally clear to farmer participants [interviewees #3, #5]. From the NFW field coordinators' perspective [interviewee #6], farmers' capacity to overcome barriers mostly depends on their motivation and their type of land - whether the farmland area is large (easier to implement) or small (more difficult). From the perspective of the Friesland province, the challenge of compliance capacity mainly depends on whether the farmer is implementing open grassland measures (e.g., meadow birds) (easier), or landscape features (more difficult). Finally, from the RVO's (paying agency) perspective, implementation improved after the introduction of the new scheme, as there is higher administrative quality and a lower administrative burden [interviewee #7]. This is mainly because the number of applications reduced from 13,500 individual to 40 collective applications. The stakeholders involved consider the implementation of the scheme a success [interviewees #1, #3, #4, #5, #6, #7], both in terms of farmers' uptake and capacity to achieve the stipulated objectives and overcome barriers.

7. Context

The NFW agriculture landscape management scheme fits with a long Dutch tradition of agrarian collectives. In the 1990 s, farmers in various locations started environmental collectives, and in 1992, in the NFW's area, farmers founded two collectives as predecessors to the NFW association. The collectives started with the aim of developing a local and collaborative approach to maintain natural resources in the area, choosing their own nitrogen reduction strategies, and integrating these landscape and environmental concerns into food production. Between

NFW	farmer	members'	uptake	of the	scheme.

Management type∕ habitat type↓	Year →	2016	2017	2018	2019	2020	2021
Wet infrastructure	16	18	35	36	36	36	
Water quality manage	0	0	0	25	27	27	
Landscape features (e hedges)	386	392	391	410	423	422	
Open grassland (e.g. birds)	160	171	183	187	199	205	
Open arable land	0	0	0	2	7	8	
Total	562	581	609	660	692	698	

1992 and 1995, the two collectives developed an action plan in which all farmer members participated in improving landscape maintenance and managing water and soil quality. The collective initiated study groups and worked closely with local citizens. At that time, Friesland and the Northern Farmers Organization (LTO Noord) provided expert knowledge and administrative support. In 1995, the government granted the two collectives 'governance experiment' status (Termeer et al., 2013; Wiskerke et al., 2003) [interviewee #8]. In 2001, the two collectives and four others established the NFW. Since then, the NFW association has been deeply embedded in the regional farming community and local community [interviewees #1, #3, #4, #5, #6, #8]. At that time, multiple working groups were formed on several issues such as improving water quality, biodiversity, and landscape maintenance. NFW, together with its field coordinators and farmer members, initiated reflections on implemented conservation activities and used them to adjust its action plan [interviewees #4, #8]. Moreover, the collective established an inspection committee to monitor farmers' conservation activities and provide advice. A certification scheme was developed for farmers who participated in such conservation activities. In 2004, the NFW and other regional partners signed a regional covenant to improve the quality of the area (Termeer et al., 2013). Equally important, the NFW association has always been quite successful in governing itself (Termeer et al., 2013), organizing over 800 farmers, founding an effective organization, and taking part in experimental research programs. Between 2011 and 2014, the collective led one of four pilots to test the new collective approach, and it has always been very active in developing innovative activities for nature conservation, energy production, and reducing nitrogen pollution in the region [interviewee #8] (Termeer et al., 2013). It became a crucial stakeholder for the Dutch government, and actively collaborates with the province of Friesland, municipalities, wildlife management units, the Frisian Environmental Federation, and site management organizations [interviewees #1, #4, #7, #8]. When designing the pilot scheme, relevant stakeholders were regularly consulted as official members of the NFW board. Membership includes municipality officials, local environmental NGOs, researchers, and university representatives [interviewee #8]. The pilot scheme opened the opportunity for the collective to have farmer members, field coordinators, and volunteers from local environmental organizations to reflect jointly on implementation experiences and update the action plan accordingly [interviewee #8].

This collaboration over almost two decades provided a conducive context for the establishment of the new collective approach in 2016 [interviewees #4, #6, #8]. It created an environment in which a wide range of stakeholders, including farmers, and public authorities were engaged in intensive collaboration to shape and implement pilot projects. The collaboration was important for transferring legitimacy to the projects and the collectives and their activities which, in turn, created commitment amongst the stakeholders to the success of the projects. A side effect of the collaboration was the emergence of local cultural identity. Perhaps, most importantly, Frisian farmers came to see the landscape as a resource they created themselves.

8. Mechanisms

8.1. Mechanism 1 – Social learning

Within natural resource management scholarship, *social learning* is understood as a mechanism that entails a process of *collective and communicative learning* in which social interaction results in gains in knowledge, new skills, and interpersonal relations (Muro and Jeffrey, 2008). Communication and interaction in participatory processes – fostered by, e.g., repeated meetings, small group interaction, open communication, diverse participation, multiple sources of knowledge, and egalitarian atmosphere – enables social learning which, in turn, contributes to common understanding, mutual agreement, and collective action (Keen et al., 2005; Mostert et al., 2007; Pahl-Wostl, 2002; Rist et al., 2007; Schusler et al., 2003; Webler et al., 1995). When social learning occurs, implementers attempt to ensure success because they recognize each other's goals and perspectives, they make underlying values explicit, and they acknowledge the costs of defecting (Busetti and Dente, 2018). This mechanism is triggered by an interplay of elements related to both design features increasing interactions and context features increasing interdependence among participants (see Fig. 2).

In the case study, as the contracts are agreed between the provincial government and a collective, the collective members must interact to consider which specific ecosystem services can realistically be offered and how they can be delivered. In this process, knowledge and ideas are exchanged between members resulting in social learning, whereby the collective as a whole gains additional knowledge. A number of interview statements supported this argument. As an officer from Friesland province said:

"As a province, we organize some knowledge exchange gatherings for the new designated areas, especially the wet infrastructure and the arable land, to which we invite specialists. [...] We organize these knowledge exchange gatherings around 2 times a year, while the collectives themselves and Boerennatur organize them around 4–5 times a year. These are national-scale events where collectives can learn and improve." [Interviewee #1]

An officer from the Dutch Enterprise Agency (RVO) agreed when highlighting:

"Knowledge exchange activities and learning processes are very important for the functioning of the collective approach. This is not just valuable for the individual farmer but also for the collectives. You really see they are committed to organizing knowledge exchange activities, hiring experts, and inviting specialists. There is a good connection with the universities for instance." [Interviewee #2]

Interviewees stated that the frequent interactions between the stakeholders at the national level (through Boerennatuur), provincial level (with Kollektivenberied Fryslân and the provincial government), and within the collective (through the field coordinators) fostered social learning [interviewees #1, #4, #6, #7], facilitating knowledge gains

and valued relations among them. More specifically, the officer from Friesland province explained that:

"Around six times a year, the provincial officers go to the field to assess progress in the management of the contract by the collective, resulting in a process called *learning management*, which enables the collectives to improve every year. This is done following a plan-docheck-act cycle, about which the collective has to report to the province once a year." [Interviewee #1, author emphasis].

An expert scholar explained how this learning outcome was rooted in a bottom-up process:

"Informal control on the landscape is an important factor [for successful implementation of the scheme]: more learning, less sanctioning. This comes from the bottom, from the pilot scheme that ran between 2011 and 2014, and continued during the implementation of the collective scheme." [Interviewee #8]

After the contract between the collective and the provincial government had been signed, it was crystalized into contracts with individual farmers. To agree and implement individual contracts with farmers, knowledge had to be exchanged between farmer members. Throughout the implementation of the new collective scheme, social learning was activated by the knowledge exchange activities regularly organized by NFW, including information meetings, training, and oneto-one advice to farmers [interviewees #1, #4, #6, #7]:

"It only works if you customize it with the sector itself, you cannot throw it top-down from the government to the field, you have to collaborate with the farmers and it only works if you have management in the region, and not by the province but by the field coordinators." [Interviewee #1]

The collaborative tradition developed in the past created a conducive context for social learning regarding implementation of the NFW agricultural landscape management scheme. Farmers, other stakeholders, and public authorities were already frequently collaborating on specific projects. This past and mainly positive experience provided conditions for maintaining interpersonal relations and improving knowledge among the participants about each other's views as well as information



Fig. 2. Social learning

exchange resulting in improved collective understanding of the challenges of landscape management. The frequency of interactions over the years and the embeddedness of NFW in the local community created a sense of mutual dependency.

8.2. Mechanism 2 - Trust-building

Trust-building refers to the process of establishing trust relationships among participants (Khodyakov, 2007). Trust can be expected to facilitate coordination without imposition by reducing the uncertainty of vulnerability when relying on others, especially when someone demonstrates trustworthiness, and formal or informal rules facilitate the process (Barber, 1983; Luhmann, 2018; McEvily et al., 2003; Offe, 1999). Trust, "describes the non-trivial belief of an actor in the reliability of other entities, including actors, organizations, or processes" (Cairney & Wellstead, 2019). It usually results in a shared sense of purpose, confidence in other stakeholders' competences, and shared positive expectations about others' intentions and behavior (Newig et al., 2018; Siddiki et al., 2017). Trust may develop when participants communicate on a regular basis, have an understanding of common interests, cooperate with each other, and have proven reliable in the past (Ostrom, 1990). The mechanism is triggered by an interplay between contextual conditions increasing agreement on good implementation among the participants and design features enhancing transparency and participation (see Fig. 3).

As successful implementation of the collective scheme requires both high uptake of the scheme and high capacity among farmer participants to overcome barriers, coordination and cooperation between involved stakeholders was necessary. This was evident in a statement by a NFW board member: "In the collective approach, you don't only need learning, but also communication, transparency, and trust." [Interviewee #4]. Through learning and communication, an agreement about good implementation will be reached and transparency and participation fostered, resulting in trust relationships between participants and stakeholders, including public authorities and the collectives. As an officer from Friesland province explained: "Relation management and building trust between the government and the collectives required more time at first [when the collective approach was introduced in 2016]. Now everybody knows each other, there is a good sense of trust on both sides. Through the years, the system improved and became much clearer for everyone." [Interviewee #1]

The collaborative environment that developed in the past and the emergence of local cultural identity provided a conducive environment for establishing trust relationships between stakeholders, fostering peersupport among the participants [interviewee #8]. Since the establishment of a participatory action plan (in the 1990 s) and the pilot running between 2011 and 2014, the farmers in the area have been improving nature conservation through working groups and experimental programs (Termeer et al., 2013) [interviewees #1, #8]. As an interviewee explained, "Local cultural identity is very important, enhancing collaboration and trust among participants in the scheme" [Interviewee #8].

In addition, stakeholder participation in developing the nature conservation activities between 2016 and 2021 helped to create a shared sense of purpose, thereby activating trust-building [interviewees #1, #2, #4, #7]. The role of participation was emphasized by an officer from the Dutch Enterprise Agency (RVO):

"There has been collaboration in the development of the collective approach. Between 2011 and 2014, we ran four pilots, and we developed the current collective system. This was done in close collaboration with the collectives, and of course the provinces. [...] The collective approach creates more ownership for the farmers and the collectives." [Interviewee #2].

Similarly, the interviewed NFW board member stressed importance of participation for trust-building:

"Learning, communication, trust, and transparency. [...] The feeling that you work as a group together, you have a common sense of participation. For farmers, this is important. Farmers feel responsible for the environment, the place they live. This is very important



Fig. 3. Trust-building.

because then you are motivated to do something about it. For us as a collective, it is important that there is this shared sense of purpose, we have the connection with the farmers to help them with that. It is also a trust creation process." [Interviewee #4]

Equally important was the establishment of the internal monitoring committee in the 2000 s (maintained during the pilot scheme and the new collective scheme), which activated trust-building by facilitating ecological guidance for farmer participants and by enhancing transparency [interviewees #1, #6]. As an interviewee explained:

"At the beginning of the contract period, farmers are informed and the controls are not only for sanctions but are especially for teaching and give information and advice on how they can improve it. [...] The collective conducts many monitoring activities and specialists and ecologists join the annual review with the province. All the specialists and participants involved cooperate, as the goal is to improve implementation for the next year and create good commitment between the province and the collective." [Interviewee #1]

9. Discussion and conclusions

In this article, we demonstrate that connecting the agrienvironmental governance literature with a mechanism-based perspective enables us to uncover the plausible causal processes that underlie actions and interactions within agri-environmental governance arrangements and provides insights into the role the interplay between contexts and scheme design play in enabling successful agrienvironmental outcomes.

Our analysis suggests that two causal mechanisms explain the successful implementation of the collective agricultural landscape management scheme in the NFW area in the Netherlands between 2016 and 2021: social learning and trust-building. We showed that the contextual conditions of local cultural identity, embeddedness of the NFW association in the local community, and a history of successful self-governance activated the underlying mechanisms. They were triggered by different combinations of design features enhancing transparency and participation and increasing interactions. These empirical observations provide important insights for agri-environmental governance scholars interested in the role the interplay between contexts and scheme design play in enabling successful implementation. While we cannot generalize from the single case study, the findings do reach beyond the case as they align with recent studies of Dutch agricultural landscape management, which highlighted trust-building as a core process in the collaboration within farmer groups (Westerink et al., 2020b) and social learning as a promising supportive process for behavioral change (Westerink et al., 2020a). To increase the external validity of the findings, further research is needed to verify whether the causal mechanisms identified in this study hold across different contexts, e.g., by extending the analysis to other arrangements in the Netherlands (where the collective approach is also in place), e.g., top-down initiated collectives (Barghusen et al., 2022), or other European regions.

To identify the mechanisms that explain the successful implementation of a Dutch agricultural landscape management scheme, we applied process-tracing. By shedding light on the 'why' and 'how' behind successful agri-environmental governance, we called for a mechanistic understanding of causality and for applying such an approach in agri-environmental governance studies. We have demonstrated that unpacking and disaggregating contexts and scheme design facilitates a more precise identification of contexts into which a design is introduced, and the mechanisms which transmit agri-environmental policy measures into behavioral outcomes. Together, these analytical steps may help scholars move beyond generalizations about success (or failure) of agri-environmental measures based on correlations, while also highlighting specific contextual factors that help explain the functioning of certain mechanisms. We encourage future scholars to investigate context-design-mechanism interactions in agrienvironmental governance processes by, e.g., focusing on the mechanistic sequence that explains unsuccessful implementation.

An important recommendation is to strengthen social learning and trust within agri-environmental governance arrangements by, e.g., introducing participatory action plans, developing monitoring procedures, and promoting knowledge exchange activities and frequent interaction between stakeholders. Establishing these conditions in agrienvironmental schemes is a necessary step to improving their contribution to climate change adaptation and mitigation, fostering efficient management of natural resources and landscapes, contributing to the protection of biodiversity, improving water quality and, more generally, improving the conditions for sustainable food production.

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CRediT authorship contribution statement

Giulia Bazzan: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft. Jeroen Candel: Conceptualization, Methodology, Formal analysis, Writing – review & editing. Carsten Daugbjerg: Conceptualization, Methodology, Validation, Formal analysis, Writing – review & editing.

Declaration of Competing Interest

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Data Availability

The authors do not have permission to share data.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.envsci.2023.05.002.

References

- Albrecht, M., Duelli, P., Müller, C., Kleijn, D., Schmid, B., 2007. The Swiss agrienvironment scheme enhances pollinator diversity and plant reproductive success in nearby intensively managed farmland. J. Appl. Ecol. 44 (4), 813–822. https://doi. org/10.1111/j.1365-2664.2007.01306.x.
- Ansell, D., Freudenberger, D., Munro, N., Gibbons, P., 2016. The cost-effectiveness of agri-environment schemes for biodiversity conservation: a quantitative review. Agric., Ecosyst. Environ. 225, 184–191. https://doi.org/10.1016/j. agee.2016.04.008.
- Arata, L., Sckokai, P., 2016. The impact of agri-environmental schemes on farm performance in five E.U. member states: a DID-matching approach. Land Econ. 92 (1), 167–186. https://doi.org/10.3368/le.92.1.167.
- Ayambire, R.A., Pittman, J., 2022. Opening the black box between governance and management: a mechanism-based explanation of how governance affects the management of endangered species. Ambio 51 (10), 2091–2106. https://doi.org/ 10.1007/s13280-022-01728-w.
- Baird, J., Schultz, L., Plummer, R., Armitage, D., Bodin, Ö., 2019. Emergence of collaborative environmental governance: what are the causal mechanisms. Environ. Manag. 63 (1), 16–31. https://doi.org/10.1007/s00267-018-1105-7.
- Balana, B.B., Vinten, A., Slee, B., 2011. A review on cost-effectiveness analysis of agrienvironmental measures related to the EU WFD: Key issues, methods, and applications. Ecol. Econ. 70 (6), 1021–1031. https://doi.org/10.1016/j. ecolecon.2010.12.020.

Barber, B., 1983. The logic and limits of trust. Rutgers University,.

Barghusen, R., Sattler, C., Berner, R., Matzdorf, B., 2022. More than spatial coordination - how Dutch agricultural collectives foster social capital for effective governance of

G. Bazzan et al.

agri-environmental measures. J. Rural Stud. 96, 246–258. https://doi.org/10.1016/j.jrurstud.2022.10.023.

Bartkowski, B., Bartke, S., 2018. Leverage points for governing agricultural soils: a review of empirical studies of european farmers' decision-making. Sustainability 10 (9), 9. https://doi.org/10.3390/su10093179.

- Batáry, P., Báldi, A., Kleijn, D., Tscharntke, T., 2011. Landscape-moderated biodiversity effects of agri-environmental management: a meta-analysis. Proc. R. Soc. B: Biol. Sci. 278 (1713), 1894–1902. https://doi.org/10.1098/rspb.2010.1923.
- Batáry, P., Dicks, L.V., Kleijn, D., Sutherland, W.J., 2015. The role of agri-environment schemes in conservation and environmental management. Conserv. Biol. 29 (4), 1006–1016. https://doi.org/10.1111/cobi.12536.
- Bazzan, G., Candel, J., Daugbjerg, C., Pecurul, M., 2022. Identifying institutional configurations for policy outcomes: a comparison of ecosystem services delivery. Policy Stud. J. 12476. https://doi.org/10.1111/psj.12476.
- Bazzan, G., Daugbjerg, C., Tosun, J., 2022. Attaining policy integration through the integration of new policy instruments: the case of the farm to fork strategy. Appl. Econ. Perspect. Policy 13235. https://doi.org/10.1002/aepp.13235.
- Beach, D., 2016. It's all about mechanisms what process-tracing case studies should be tracing. N. Political Econ. 21 (5), 463–472. https://doi.org/10.1080/ 13563467.2015.1134466.
- Beach, D., Pedersen, R.B., 2013. Process-Tracing Methods: Foundations and Guidelines. University of Michigan Press,
- Beach, D., Pedersen, R.B., 2016. Causal Case Study Methods: Foundations and Guidelines for Comparing, Matching, and Tracing. University of Michigan Press,.
- Beach, D., Pedersen, R.B., 2018. Selecting appropriate cases when tracing causal mechanisms. Sociol. Methods Res. 47 (4), 837–871. https://doi.org/10.1177/ 0049124115622510.
- Bertoni, D., Curzi, D., Aletti, G., Olper, A., 2020. Estimating the effects of agrienvironmental measures using difference-in-difference coarsened exact matching. Food Policy 90, 101790. https://doi.org/10.1016/j.foodpol.2019.101790.
- Biesbroek, G.R., Termeer, C.J.A.M., Klostermann, J.E.M., Kabat, P., 2014. Rethinking barriers to adaptation: mechanism-based explanation of impasses in the governance of an innovative adaptation measure. Glob. Environ. Change 26, 108–118. https:// doi.org/10.1016/j.gloenvcha.2014.04.004.
- Biesbroek, R., Candel, J.J.L., 2020. Mechanisms for policy (dis)integration: explaining food policy and climate change adaptation policy in the Netherlands. Policy Sci. 53 (1), 61–84. https://doi.org/10.1007/s11077-019-09354-2.
- Biesbroek, R., Dupuis, J., Wellstead, A., 2017. Explaining through causal mechanisms: resilience and governance of social–ecological systems. Curr. Opin. Environ. Sustain. 28, 64–70. https://doi.org/10.1016/j.cosust.2017.08.007.
- Brady, M., Kellermann, K., Sahrbacher, C., Jelinek, L., 2009. Impacts of decoupled agricultural support on farm structure, biodiversity and landscape mosaic: some EU results. J. Agric. Econ. 60 (3), 563–585. https://doi.org/10.1111/j.1477-9552.2009.00216.x.
- Brereton, T.M., Warren, M.S., Roy, D.B., Stewart, K., 2008. The changing status of the Chalkhill Blue butterfly Polyommatus coridon in the UK: The impacts of conservation policies and environmental factors. J. Insect Conserv. 12 (6), 629–638. https://doi.org/10.1007/s10841-007-9099-0.
- Bullock, J.M., Pywell, R.F., Walker, K.J., 2007. Long-term enhancement of agricultural production by restoration of biodiversity. J. Appl. Ecol. 44 (1), 6–12. https://doi. org/10.1111/j.1365-2664.2006.01252.x.

Bunge, M., 1997. Mechanism and explanation. Philos. Soc. Sci. 27 (4), 410-465.

- Busetti, S., Dente, B., 2018. Designing multi-actor implementation: a mechanism-based approach. Public Policy Adm. 33 (1), 46–65. https://doi.org/10.1177/ 0952076716681207
- Capano, G., Howlett, M., 2020. A Modern Guide to Public Policy. Edward Elgar Publishing. https://doi.org/10.4337/9781789904987.
- Capano, G., Howlett, M., 2021. Causal logics and mechanisms in policy design: how and why adopting a mechanistic perspective can improve policy design. Public Policy Adm. 36 (2), 141–162. https://doi.org/10.1177/0952076719827068.

Capano, G., Howlett, M., Ramesh, M., Virani, A. (Eds.), 2019. Making Policies Work: First- and Second-order Mechanisms in Policy Design. Edward Elgar Publishing.

- First- and Second-order Mechanisms in Policy Design. Edward Elgar Publishing. Carey, P.D., Manchester, S.J., Firbank, L.G., 2005. Performance of two agri-environment schemes in England: a comparison of ecological and multi-disciplinary evaluations. Agric., Ecosyst. Environ. 108 (3), 178–188. https://doi.org/10.1016/j. agree 2005.02.002
- Chabé-Ferret, S., Subervie, J., 2013. How much green for the buck? Estimating additional and windfall effects of French agro-environmental schemes by DIDmatching. J. Environ. Econ. Manag. 65 (1), 12–27. https://doi.org/10.1016/j. jeem.2012.09.003.
- Christensen, T., Pedersen, A.B., Nielsen, H.O., Mørkbak, M.R., Hasler, B., Denver, S., 2011. Determinants of farmers' willingness to participate in subsidy schemes for pesticide-free buffer zones—a choice experiment study. Ecol. Econ. 70 (8), 1558–1564. https://doi.org/10.1016/j.ecolecon.2011.03.021.
- Critchley, C.N.R., Burke, M.J.W., Stevens, D.P., 2004. Conservation of lowland seminatural grasslands in the UK: a review of botanical monitoring results from agrienvironment schemes. Biol. Conserv. 115 (2), 263–278. https://doi.org/10.1016/ S0006-3207(03)00146-0.
- van der Heijden, J., Kuhlmann, J., Lindquist, E., Wellstead, A., 2021. Have policy process scholars embraced causal mechanisms? A review of five popular frameworks. Public Policy Adm. 36 (2), 163–186. https://doi.org/10.1177/0952076718814894.
- Derissen, S., Latacz-Lohmann, U., 2013. What are PES? A review of definitions and an extension. Ecosyst. Serv. 6, 12–15. https://doi.org/10.1016/j.ecoser.2013.02.002.
- Dessart, F.J., Barreiro-Hurlé, J., van Bavel, R., 2019. Behavioural factors affecting the adoption of sustainable farming practices: a policy-oriented review. Eur. Rev. Agric. Econ. 46 (3), 417–471. https://doi.org/10.1093/erae/jbz019.

- Edwards, A.R., Mortimer, S.R., Lawson, C.S., Westbury, D.B., Harris, S.J., Woodcock, B. A., Brown, V.K., 2007. Hay strewing, brush harvesting of seed and soil disturbance as tools for the enhancement of botanical diversity in grasslands. Biol. Conserv. 134 (3), 372–382. https://doi.org/10.1016/j.biocon.2006.08.025.
- European Environment Agency. (2015). State of nature in the EU. Results from reporting under the nature directives 2007–2012.
- European Environment Agency. (2019). The European environment—State and outlook 2020 Knowledge for transition to a sustainable Europe.
- Falleti, T.G., Lynch, J.F., 2009. Context and causal mechanisms in political analysis. Comp. Political Stud. 42 (9), 1143–1166. https://doi.org/10.1177/ 0010414009331724.
- Filbee-Dexter, K., Symons, C.C., Jones, K., Haig, H.A., Pittman, J., Alexander, S.M., Burke, M.J., 2018. Quantifying ecological and social drivers of ecological surprise. J. Appl. Ecol. 55 (5), 2135–2146. https://doi.org/10.1111/1365-2664.13171.
- Finn, J.A., Bartolini, F., Bourke, D., Kurz, I., Viaggi, D., 2009. Ex post environmental evaluation of agri-environment schemes using experts' judgements and multicriteria analysis. J. Environ. Plan. Manag. 52 (5), 717–737. https://doi.org/10.1080/ 09640560902958438.
- George, A.L., Bennett, A., 2005. Case Studies and Theory Development in the Social Sciences. MIT Press.
- Gerring, J., 2005. Causation: a unified framework for the social sciences. J. Theor. Polit. 17 (2), 163–198. https://doi.org/10.1177/0951629805050859.
- Gerritsen, A.L., Stuiver, M., Termeer, C.J.M., 2013. Knowledge governance: an exploration of principles, impact, and barriers. Sci. Public Policy 40 (5), 604–615. https://doi.org/10.1093/scipol/sct012.
- Granlund, K., Räike, A., Ekholm, P., Rankinen, K., Rekolainen, S., 2005. Assessment of water protection targets for agricultural nutrient loading in Finland. J. Hydrol. 304 (1), 251–260. https://doi.org/10.1016/j.jhydrol.2004.07.033.
- Hanley, N., 2014. Incentivizing the provision of ecosystem services. Int. Rev. Environ. Resour. Econ. 7 (3–4), 299–331. https://doi.org/10.1561/101.00000064.
- Hanley, N., Whitby, M., Simpson, I., 1999. Assessing the success of agri-environmental policy in the UK. Land Use Policy 16 (2), 67–80. https://doi.org/10.1016/S0264-8377(98)00041-6.
- Hardy, S.D., Koontz, T.M., 2009. Rules for collaboration: institutional analysis of group membership and levels of action in watershed partnerships. Policy Stud. J. 37 (3), 393–414. https://doi.org/10.1111/j.1541-0072.2009.00320.x.
- Hasler, B., Czajkowski, M., Elofsson, K., Hansen, L.B., Konrad, M.T., Nielsen, H.Ø., Niskanen, O., Nömmann, T., Pedersen, A.B., Peterson, K., Poltimäe, H., Svensson, T. H., Zagórska, K., 2019. Farmers' preferences for nutrient and climate-related agrienvironmental schemes: a cross-country comparison. Ambio 48 (11), 1290–1303. https://doi.org/10.1007/s13280-019-01242-6.
- Hasler, B., Termansen, M., Nielsen, H.Ø., Daugbjerg, C., Wunder, S., Latacz-Lohmann, U., 2022. European agri-environmental policy: evolution, effectiveness, and challenges. Rev. Environ. Econ. Policy 16 (1), 105–125. https://doi.org/10.1086/718212.
- Hedström, P., Ylikoski, P., 2010. Causal mechanisms in the social sciences. Annu. Rev. Sociol. 36 (1), 49–67. https://doi.org/10.1146/annurev.soc.012809.102632.
- Hodge, I., McNally, S., 2000. Wetland restoration, collective action and the role of water management institutions. Ecol. Econ. 35 (1), 107–118. https://doi.org/10.1016/ S0921-8009(00)00171-3.
- Jones, J.I., Murphy, J.F., Anthony, S.G., Arnold, A., Blackburn, J.H., Duerdoth, C.P., Hawczak, A., Hughes, G.O., Pretty, J.L., Scarlett, P.M., Gooday, R.D., Zhang, Y.S., Fawcett, L.E., Simpson, D., Turner, A.W.B., Naden, P.S., Skates, J., 2017. Do agrienvironment schemes result in improved water quality. J. Appl. Ecol. 54 (2), 537–546. https://doi.org/10.1111/1365-2664.12780.
- Keen, M., Brown, V.A., Dyball, R. (Eds.), 2005. Social Learning in Environmental Management: Towards A Sustainable Future. Earthscan.
- Khodyakov, D., 2007. Trust as a process: a three-dimensional approach. Sociology 41 (1), 115–132. https://doi.org/10.1177/0038038507072285.
- Kleijn, D., Sutherland, W.J., 2003. How effective are European agri-environment schemes in conserving and promoting biodiversity. J. Appl. Ecol. 40 (6), 947–969. https://doi.org/10.1111/j.1365-2664.2003.00868.x.
- Kleijn, D., Berendse, F., Smit, R., Gilissen, N., Smit, J., Brak, B., Groeneveld, R., 2004. Ecological effectiveness of agri-environment schemes in different agricultural landscapes in The Netherlands. Conserv. Biol. 18 (3), 775–786. https://doi.org/ 10.1111/j.1523-1739.2004.00550.x.
- Kleijn, D., Baquero, R.A., Clough, Y., Díaz, M., Esteban, J., Fernández, F., Gabriel, D., Herzog, F., Holzschuh, A., Jöhl, R., Knop, E., Kruess, A., Marshall, E.J.P., Steffan-Dewenter, I., Tscharntke, T., Verhulst, J., West, T.M., Yela, J.L., 2006. Mixed biodiversity benefits of agri-environment schemes in five European countries: Biodiversity effects of European agri-environment schemes. Ecol. Lett. 9 (3), 243–254. https://doi.org/10.1111/j.1461-0248.2005.00869.x.
- Kleijn, D., Rundlöf, M., Scheper, J., Smith, H.G., Tscharntke, T., 2011. Does conservation on farmland contribute to halting the biodiversity decline. Trends Ecol. Evol. 26 (9), 474–481. https://doi.org/10.1016/j.tree.2011.05.009.

Knill, C., Tosun, J., 2020. Public policy: A new introduction, second ed. Macmillan International Higher Education.

- Koontz, T.M., Jager, N.W., Newig, J., 2020. Assessing collaborative conservation: a case survey of output, outcome, and impact measures used in the empirical literature. Soc. Nat. Resour. 33 (4), 442–461. https://doi.org/10.1080/ 08941920.2019.1583397.
- Lastra-Bravo, X.B., Hubbard, C., Garrod, G., Tolón-Becerra, A., 2015. What drives farmers' participation in EU agri-environmental schemes?: Results from a qualitative meta-analysis. Environ. Sci. Policy 54, 1–9. https://doi.org/10.1016/j. envsci.2015.06.002.

G. Bazzan et al.

Latacz-Lohmann, U., Hodge, I., 2003. European agri-environmental policy for the 21st century. Aust. J. Agric. Resour. Econ. 47 (1), 123–139. https://doi.org/10.1111/1467-8489.00206.

Luhmann, N., 2018. Trust and Power. John Wiley and Sons.

Machamer, P., Darden, L., Craver, C.F., 2000. Thinking about mechanisms. Philos. Sci. 67 (1), 1–25.

- Mahoney, J., 2001. Review essay: Beyond correlational analysis: recent innovations in theory and method. Sociol. Forum 16 (3), 575–593.
- Mahoney, J., 2012. The logic of process tracing tests in the social sciences. Sociol. Methods Res. 41 (4), 570–597. https://doi.org/10.1177/0049124112437709.
- Matzdorf, B., Sattler, C., Engel, S., 2013. Institutional frameworks and governance structures of PES schemes. For. Policy Econ. 37, 57–64. https://doi.org/10.1016/j. forpol.2013.10.002.
- Mayntz, R., 2004. Mechanisms in the analysis of social macro-phenomena. Philos. Soc. Sci. 34 (2), 237–259. https://doi.org/10.1177/0048393103262552.
- McEvily, B., Perrone, V., Zaheer, A., 2003. Trust as an organizing principle. Organ. Sci. 14 (1), 91–103. https://doi.org/10.1287/orsc.14.1.91.12814.
- Mettepenningen, E., Vandermeulen, V., Delaet, K., Van Huylenbroeck, G., Wailes, E.J., 2013. Investigating the influence of the institutional organisation of agrienvironmental schemes on scheme adoption. Land Use Policy 33, 20–30. https://doi. org/10.1016/j.landusepol.2012.12.004.
- Meyer, C., Reutter, M., Matzdorf, B., Sattler, C., Schomers, S., 2015. Design rules for successful governmental payments for ecosystem services: Taking agrienvironmental measures in Germany as an example. J. Environ. Manag. 157, 146–159. https://doi.org/10.1016/j.jenvman.2015.03.053.
- Meyer, C., Chen, C., Matzdorf, B., 2018. Qualitative comparative institutional analysis of environmental governance: Implications from research on payments for ecosystem services. Ecosyst. Serv. 34, 169–180. https://doi.org/10.1016/j.ecoser.2018.07.008.
 Morgan, S.L., Winship, C., 2007. Counterfactuals and Causal Inference: Methods and

Principles for Social Research. Cambridge University Press.

Mostert, E., Pahl-Wostl, C., Rees, Y., Searle, B., Tàbara, D., Tippett, J., 2007. Social learning in European river-basin management: barriers and fostering mechanisms from 10 river basins. Ecol. Soc. 12 (1).

Moxey, A., White, B., 2014. Result-oriented agri-environmental schemes in Europe: a comment. Land Use Policy 39, 397–399. https://doi.org/10.1016/j. landusepol.2014.04.008.

Muro, M., Jeffrey, P., 2008. A critical review of the theory and application of social learning in participatory natural resource management processes. J. Environ. Plan. Manag. 51 (3), 325–344. https://doi.org/10.1080/09640560801977190.

Namugumya, B.S., Candel, J.J.L., Talsma, E.F., Termeer, C.J.A.M., 2020. A mechanismsbased explanation of nutrition policy (dis)integration processes in Uganda. Food Policy 92, 101878, https://doi.org/10.1016/i.foodpol.2020.101878.

Newig, J., Adzersen, A., Challies, E., Fritsch, O., Jager, N., 2013. Comparative analysis of public environmental decision-making processes – a variable-based analytical scheme. SSRN Electron. J. https://doi.org/10.2139/ssrn.2245518.

Newig, J., Challies, E., Jager, N.W., Kochskaemper, E., Adzersen, A., 2018. The environmental performance of participatory and collaborative governance: a framework of causal mechanisms: environmental performance of participation. Policy Stud. J. 46 (2), 269–297. https://doi.org/10.1111/psj.12209.

Offe, C., 1999. How can we trust our fellow citizens? Democracy and Trust. Cambridge University Press, pp. 42–87.

Olivieri, M., Andreoli, M., Vergamini, D., Bartolini, F., 2021. Innovative contract solutions for the provision of agri-environmental climatic public goods: a literature review. Sustainability 13 (12), 6936. https://doi.org/10.3390/su13126936.

Ostrom, E. (1990). Governing the Commons: The Evolution of Institutions for Collective Action.

Pahl-Wostl, C., 2002. Towards sustainability in the water sector – the importance of human actors and processes of social learning. Aquat. Sci. 64 (4), 394–411. https:// doi.org/10.1007/PL00012594.

Pattyn, V., Álamos-Concha, P., Cambré, B., Rihoux, B., Schalembier, B., 2020. Policy effectiveness through configurational and mechanistic lenses: lessons for concept development. J. Comp. Policy Anal.: Res. Pract. 1–18. https://doi.org/10.1080/ 13876988.2020.1773263.

Pawson, R., Tilley, N., 1997. Realistic Evaluation. Sage.

Pearl, J., 2000. Causality: Models, Reasoning, and Inference. Cambridge University Press.

Peerlings, J., Polman, N., 2009. Farm choice between agri-environmental contracts in the European Union. J. Environ. Plan. Manag. 52 (5), 593–612. https://doi.org/ 10.1080/09640560902958131.

Polman, N.B.P., Slangen, L.H.G., 2008. Institutional design of agri-environmental contracts in the European Union: the role of trust and social capital. NJAS -Wagening. J. Life Sci. 55 (4), 413–430. https://doi.org/10.1016/S1573-5214(08) 80029-2.

- Rist, S., Chidambaranathan, M., Escobar, C., Wiesmann, U., Zimmermann, A., 2007. Moving from sustainable management to sustainable governance of natural resources: The role of social learning processes in rural India, Bolivia and Mali. J. Rural Stud. 23 (1), 23–37. https://doi.org/10.1016/j.jrurstud.2006.02.006.
- Runge, T., Latacz-Lohmann, U., Schaller, L., Todorova, K., Daugbjerg, C., Termansen, M., Liira, J., Le Gloux, F., Dupraz, P., Leppanen, J., Fogarasi, J., Vigh, E.Z., Bradfield, T., Hennessy, T., Targetti, S., Viaggi, D., Berzina, I., Schulp, C., Majewski, E., Velazquez, F.J.B., 2022. Implementation of eco-schemes in fifteen European Union member states. EuroChoices 21 (2), 19–27. https://doi.org/10.1111/1746-692X.12352.
- Runhaar, H., 2017. Governing the transformation towards 'nature-inclusive' agriculture: insights from the Netherlands. Int. J. Agric. Sustain. 15 (4), 340–349. https://doi. org/10.1080/14735903.2017.1312096.

Runhaar, H., Polman, N., 2018. Partnering for nature conservation. Land Use Policy 73, 11–19. https://doi.org/10.1016/j.landusepol.2018.01.033.

- Runhaar, H., Melman, Th.C.P., Boonstra, F.G., Erisman, J.W., Horlings, L.G., de Snoo, G. R., Termeer, C.J.A.M., Wassen, M.J., Westerink, J., Arts, B.J.M., 2017. Promoting nature conservation by Dutch farmers: a governance perspective. Int. J. Agric. Sustain. 15 (3), 264–281. https://doi.org/10.1080/14735903.2016.1232015.
- Runhaar, H., Polman, N., Dijkshoorn-Dekker, M., 2018. Self-initiated nature conservation by farmers: an analysis of Dutch farming. Int. J. Agric. Sustain. 16 (6), 486–497. https://doi.org/10.1080/14735903.2018.1541299.
- Sattler, C., Trampnau, S., Schomers, S., Meyer, C., Matzdorf, B., 2013. Multiclassification of payments for ecosystem services: How do classification characteristics relate to overall PES success. Ecosyst. Serv. 6, 31–45. https://doi.org/ 10.1016/j.ecoser.2013.09.007.

Scheper, J., Holzschuh, A., Kuussaari, M., Potts, S.G., Rundlöf, M., Smith, H.G., Kleijn, D., 2013. Environmental factors driving the effectiveness of European agrienvironmental measures in mitigating pollinator loss—a meta-analysis. Ecol. Lett. 16 (7), 912–920. https://doi.org/10.1111/ele.12128.

Schomers, S., Sattler, C., Matzdorf, B., 2015. An analytical framework for assessing the potential of intermediaries to improve the performance of payments for ecosystem services. Land Use Policy 42, 58–70. https://doi.org/10.1016/j. landusepol.2014.06.025.

Schroeder, L.A., Isselstein, J., Chaplin, S., Peel, S., 2013. Agri-environment schemes: farmers' acceptance and perception of potential 'payment by results' in grassland—a case study in England. Land Use Policy 32, 134–144. https://doi.org/10.1016/j. landusepol.2012.10.009.

Schusler, T.M., Decker, D.J., Pfeffer, M.J., 2003. Social learning for collaborative natural resource management. Soc. Nat. Resour. 16 (4), 309–326. https://doi.org/10.1080/ 08941920390178874.

- Siddiki, S., Kim, J., Leach, W.D., 2017. Diversity, trust, and social learning in collaborative governance. Public Adm. Rev. 77 (6), 863–874. https://doi.org/ 10.1111/puar.12800.
- Smits, M.-J., Driessen, P., Glasbergen, P., 2008. Governing agri-environmental schemes: lessons to be learned from the new institutional-economics approach. Environ. Plan. C: Gov. Policy 26 (3), 627–643. https://doi.org/10.1068/c06106s.
- Sutherland, W.J., 2004. A blueprint for the countryside. Ibis 146 (s2), 230–238. https:// doi.org/10.1111/j.1474-919X.2004.00369.x.
- Termeer, C., Dewulf, A., Rijswick, H., van, Buuren, A., van, Huitema, D., Meijerink, S., Rayner, T., Wiering, M., 2011. The regional governance of climate adaptation: a framework for developing legitimate, effective, and resilient governance arrangements. Clim. Law 2 (2), 159–179. https://doi.org/10.1163/CL-2011-032.

Termeer, C.J.M., Stuiver, M., Gerritsen, A., Huntjens, P., 2013. Integrating self-governance in heavily regulated policy fields: insights from a Dutch farmers' cooperative. J. Environ. Policy Plan. 15 (2), 285–302. https://doi.org/10.1080/

1523908X.2013.778670.

Terwan, P., Deelen, J.G., Mulders, A., Peeters, E., 2016. The Cooperative Approach under the New Dutch Agrienvironment-climate Scheme. Background, Procedures and Legal and Institutional Implications. Dutch Ministry of Economic Affairs.

Thomann, E., 2015. Customizing Europe: transposition as bottom-up implementation. J. Eur. Public Policy 22 (10), 1368–1387. https://doi.org/10.1080/ 13501763.2015.1008554.

Thomann, E., 2018. Customized Implementation of European Union Food Safety Policy: United in Diversity? Springer.

Uthes, S., Matzdorf, B., 2013. Studies on agri-environmental measures: a survey of the literature. Environ. Manag. 51 (1), 251–266. https://doi.org/10.1007/s00267-012-9959-6.

Walker, K.J., Critchley, C.N.R., Sherwood, A.J., Large, R., Nuttall, P., Hulmes, S., Rose, R., Mountford, J.O., 2007. The conservation of arable plants on cereal field margins: an assessment of new agri-environment scheme options in England, UK. Biol. Conserv. 136 (2), 260–270. https://doi.org/10.1016/j.biocon.2006.11.026.

Webler, T., Kastenholz, H., Renn, O., 1995. Public participation in impact assessment: a social learning perspective. Environ. Impact Assess. Rev. 15 (5), 443–463. https:// doi.org/10.1016/0195-9255(95)00043-E.

Westerink, J., Jongeneel, R., Polman, N., Prager, K., Franks, J., Dupraz, P., Mettepenningen, E., 2017. Collaborative governance arrangements to deliver spatially coordinated agri-environmental management. Land Use Policy 69, 176–192. https://doi.org/10.1016/j.landusepol.2017.09.002.

- Westerink, J., Pérez-Soba, M., van Doorn, A., 2020. Social learning and land lease to stimulate the delivery of ecosystem services in intensive arable farming. Ecosyst. Serv. 44, 101149 https://doi.org/10.1016/j.ecoser.2020.101149.
- Westerink, J., Termeer, C., Manhoudt, A., 2020. Identity Conflict? Agri-environmental collectives as self-governing groups of farmers or as boundary organisations. Int. J. Commons 14 (1), 388–403. https://doi.org/10.5334/ijc.997.
- Whittingham, M.J., 2006. Will agri-environment schemes deliver substantial biodiversity gain, and if not why not?: Agri-environment schemes and biodiversity gain. J. Appl. Ecol. 44 (1), 1–5. https://doi.org/10.1111/j.1365-2664.2006.01263.x.
- Wunder, S., Börner, J., Ezzine-de-Blas, D., Feder, S., Pagiola, S., 2020. Payments for environmental services: past performance and pending potentials. Annu. Rev. Resour. Econ. 12 (1), 209–234. https://doi.org/10.1146/annurev-resource-100518-094206.
- Zimmermann, A., Britz, W., 2016. European farms' participation in agri-environmental measures. Land Use Policy 50, 214–228. https://doi.org/10.1016/j. landusepol.2015.09.019.