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Successful practices for nutrient pollution management

WP2 Governance models to support dialogue and cooperation.

NENUPHAR

New governance models to enhance nutrient pollution handling and nutrients recycling

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Executive summary

Nutrients such as nitrogen (N) and phosphorus (P) are **essential elements for plants**, which is why they are often used as fertilisers in agriculture to ensure higher yields and quality products. However, increasing demand in food production has resulted in increased production and use of fertilisers with **significant inefficiencies, leading to pollution of water, air, and soil**, affecting human health and the environment.

NENUPHAR was conceived to solve this need by developing new governance and value chain solutions. Within NENUPHAR this analysis aims to **understand governance barriers, and success factors such as capacities, frameworks, and structures** relevant for transitioning to a regional or macro-regional circular nutrient management.

Governance can be defined as the decentralized and horizontal devolution of power, contrasting with government, which is a centralized and vertical exertion of power. **Governance involves various actors and sectors including public and private** policymakers, practitioners, and a mix of organizations like NGOs, corporations, and cooperatives. These actors **participate actively in decision-making and implementation processes**, which are more collaborative and consensus-driven compared to traditional government approaches.

Implemented examples of governance practices in nutrient management shows that **EU Member States have different management strategies to tackle the problem of nutrients from diffuse agricultural sources and** there is a wide range of management approaches, some of which are more **resource-based** and others more **impact-based.**

The governance structures of environmental and agricultural policies consist of a **national approach, organisational** and **programme integration** and **participatory governance**. The main barriers of existing institutional frameworks are interconnected network of actors, lack of **unified global governance** and legislative framework, strongly **vertically concentrated models**, the incorrect socialist common beliefs and **bureaucracy**, fact that farmers more likely to prefer **subsidies** or cost-share programs as policy incentives, **lack of staff** and lack of agricultural stakeholders in decision making, ignoring **market conditions** when decision were made etc. The success factors, may contribute to a better nutrient cycle management are **international body** for global assessment of nutrient resources, **education, insurance and local management groups** to accommodate local **knowledge**, bringing together different stakeholders (researchers, policy makers, farmers, NGOs, chamber, etc.), **modelling of nutrient flow**, enforcing existing interlinkages as CLRTAP and WHO, **impact assessments** when planning, preparing and proposing new legislation, **civil dialogue** groups and agricultural committees to best shape law and policies, **collaborative approaches** involving local civil society etc.

The groundwork for the research, which involved the **compilation of a structured interview** designed to investigate the characteristics of the governance structures of the demos participating in the project. To get a broader view on the characteristics of nutrient pollution management systems, the survey was complemented two representative of an international organisation (FAO) and a related international project (BIOEAST).

Based on the responses to the semi-structured interviews and the structured interviews assessed in the demos, it emerges that there is a **very wide range of stakeholders involved** in the design of the governance solution to nutrient pollution - from the national level regulator to the stakeholders who apply the legislation in practice - whose cooperation is the basis for successful implementation. The processing of the semi-structured interviews shows that there is a **wide range of problems** that stakeholders face when implementing nutrient pollution reduction.

On the regulatory and enforcement side, **good communication and coordination between the different ministries** involved within a country is the most important factor in developing a successful governance model. At policy level, this can be facilitated, for example, by the establishment and operation of **inter-ministerial expert groups**.

The policy background in these areas is usually in different ministries and often there is insufficient harmonisation of legislation between ministries. Therefore, there is a need for appropriate **harmonisation of legislation between ministries** and for the **development and harmonisation of appropriate implementation structures and enforcement practices.** On the policy side, the **effective flow of information to farmers** on the different policies and objectives is important for successful implementation. **Before a regulation is introduced**, it is important **to inform and prepare farmers and other stakeholders** in a timely manner and to mitigate the effects of changes. Communication should focus on the willingness to compromise, the importance of building partnerships and the appropriate presentation of new scientific results.

Good cooperation between stakeholders is based on networking, where they can get to know each other and each other's activities. A good example of how this can be done is for farmers who are open to change to work together and create a **'demonstration space'** on their farm to set an example for other farmers. In addition to good practice, it is always necessary to be able to **demonstrate an economic and financial return** for farmers. Successful implementation requires the **availability of adequate financial support,** incentives and a financial payback period, preferably less than 5 years.

Most countries have different levels of **statistical data collection**, but **the availability** of data to stakeholders and the harmonisation and interoperability of data collected by different authorities and agencies is a necessary condition for a successful governance solution.

As a general experience, a key condition for successful governance is that the **legal framework** should be analysed and established **at national level**, but the **practical implementation** of the governance model should be developed **at local level**, specific to the problem at hand, with **broad stakeholder involvement**.

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List of abbreviations and acronyms

AABS - Association for the Advancement of the Baltic Studies

AKI - AKI Agrárközgazdasági Intézet Nonprofit Kft

AMTF - Agricultural Market Task Force

BAT - Best Available Techniques

BIOEAST - Central and Eastern European Initiative for Knowledge-based Agriculture, Aquaculture and Forestry in Bioeconomy

BSAP - The Baltic Sea Action Plan

CA - Consortium Agreement

CAP - Common Agriculture Policy

CAYC - Comunidad General de Regantes del Canal de Aragón y Cataluña

CEPhosPOL - Towards Circular Economy in wastewater sector: Knowledge transfer and identification of the recovery potential for Phosphorus in Poland

CIRCE - Fundación CIRCE – Centro de Investigación de Recursos y Consumos Energéticos

CLRTAP - Convention on Long-Range Transboundary Air Pollution

CPP - Czech Phosphorus Platform

CRM - Critical Raw Materials

D - Deliverable

DoA - Description of Action

DRBMP - Danube River Basin Management Plan

EC - European Commission

EU - European Union

European IPPC Bureau - European Integrated Pollution Prevention and Control Bureau

FAO - Food and Agricultural Organization of the United Nations (UNFAO)

FDM - Food, Drink and Milk (Industries)

GA - General Assembly

GPNM - Global Partnership for Nutrient Management

H2020 - Horizon 2020 The 8th EU Framework Programme for Research and Innovation

HELCOM - Helsinki Commission - Healthy Baltic Sea environment with diverse biological components functioning in balance, Action Plan

HEU - Horizon Europe – the 9th framework Programme of the EC for research, technological development and innovation activities.

IAGLR - Association of Great Lakes Research

ICPDR - International Commission for the Protection of the Danube River

ILRI - International Livestock Research Institute

InPhos - Sustainable management of phosphorus in the Baltic region

IPPC - Integrated Pollution Prevention and Control

IPR - Intellectual Property Right

IT – Information Technology

JRC - EU Joint Research Centre

JU - Joint Undertaking

LEAP - Livestock Environmental Assessment and Performance

LEX4BIO - Optimising bio-based fertilisers in agriculture

N - Nitrogen

NENUPHAR - New governance models to enhance nutrient pollution handling and nutrients recycling

NGO - Nongovernmental organization

OECD - Organisation for Economic Co-operation and Development

P - Phosphorous

PAS - Patient Access Scheme

PC - Project Coordinator

PDO - Protected Designation of Origin

PhosForce - Market ready technologies for P-recovery from municipal wastewater

PI - Public Interest

PolFerAsh - Polish Fertilizers form Ash

SC - Steering Committee

SACEP - South Asia Cooperation Programme for Environmental Protection

SME – Small and Medium Enterprise

SUA - Slovenska Polnohospodarska Univerzita V Nitre

SZE - Széchenyi István University

TEBIKE - TEBIKE Ltd

UN - United Nations

V4 nations - Visegrad Group the Czech Republic, Hungary, Poland, and Slovakia.

WFD - Water Framework Directive

WWTPs - Wastewater Treatment Plants

WP - Work package

ZSA - Zemnieku Saeima

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Introduction

The excess of nutrients, especially nitrogen and phosphorous, is one major source of pollution at EU Level, affecting soil, water and air and having a severe impact on biodiversity on both inlands waters (rivers and lakes) and on seas. In Europe, nutrient pollution is generated from an intensive agricultural and farming activities and from urban areas with high population density. The European Union has carried out significant regulatory and political efforts to develop a suitable framework to mitigate nutrient pollution and enable their recovery. NENUPHAR supports the achievement of these goals by developing new governance and value chain solutions addressing three waste streams with high nutrient load and widely present in the EU: manure, sewage sludge and dairy wastewater. The NENUPHAR project addresses four main innovations:

- A methodology for estimating N/P emissions from the application of a fertiliser on soil to allow a more effective control and monitoring of nutrients pollution.
- **New governance models based on a network governance approach.**
- Innovative economic and financial incentives for public and private entities.
- A set of enabling technologies to treat the manure, sludges and dairy wastewaters.

The current study examines the "New governance models based on a network governance approach" of the above points.

The analysis of management solutions and the development of a new, innovative management model is of crucial importance to reduce nutrient pollution from agricultural sources and to recover nitrogen and phosphorus from waste streams. This is necessary because reducing nutrient pollution requires not only the right policy and regulatory environment and adequate management efforts, but also the cooperation and ongoing dialogue between all key stakeholders involved in this process, working together at local level to achieve this. Governance includes economic, political, and administrative dimensions, and these layers interact in sustainable development. Reducing nutrient pollution from agricultural sources is of critical environmental importance, and a key element of this is the implementation of good governance practices. Pollution from agricultural sources is a complex set of problems that involves many actors, from regulators at EU level to local stakeholders. To address this, an innovative and adaptive management model is needed, based on broad stakeholder involvement and cooperation. The following steps were taken to examine the issue.

The first chapter looks at governance structures. We describe the evolution of governance as a concept distinct from traditional government practices. In this chapter, particular emphasis is placed on a more decentralised, participatory approach to governance, aimed at involving as wide a range of stakeholders as possible, rather than the centralised approach that is considered optimal for achieving nutrient pollution reduction.

Based on a review of the literature, the first chapter aims to provide a comprehensive picture of how governance, particularly in the context of nutrient pollution, is evolving to address the complexities of modern policy-making and governance, through a detailed examination of both theoretical and practical

aspects. This chapter also assesses the current state of agri-environmental governance and explores possible pathways towards more effective and sustainable governance practices.

After a review of the literature on management systems, the second chapter aims to provide an overview of the global situation of nitrogen and phosphorus management and presents some examples of initiatives and documents produced by international organisations and cooperation to promote sustainable nutrient management. This is necessary because the global situation of nitrogen and phosphorus management shows that, although initiatives have been taken towards sustainable nutrient management, nutrient management is currently inefficient. In order to overcome these challenges, a comprehensive global policy and better coordination of nutrient cycle policies, governmental bodies and stakeholders at national, regional and global levels would be beneficial instead of fragmented national policies. One step towards this is to identify some of the practices that have already been implemented. Therefore, the chapter will present examples of governance practices, solutions or initiatives in nutrient management that have already been implemented in different regions (Baltic Sea Region, Visegrad Four) and countries (Netherlands, Flanders in Belgium, Lower Saxony in Germany, Denmark, Ireland and France, Spain, Austria, Czech Republic, Italy).

EU Member States use different management strategies to address the problem of nutrients from diffuse agricultural sources. This shows that there is a wide range of management approaches, some of which are more resource-based and others more impact-based. The third chapter aims to show what are the main success factors and obstacles to governance structures, in terms of capacities, frameworks and structures. The cases reviewed in the literature show that there are different approaches to consensual or antagonistic discourses, and differences in the use of more binding instruments or area-based policies. As the analysis in the first chapter shows (in line with Wiering 2023), the governance structure of environmental and agricultural policies consists of a national approach, organisational and programme integration, and participatory governance. The role of public authorities, in turn, is related to the content of the practical measures taken in response to regulators (impact-based and resource-based measures) and the choice of policy instruments (e.g. preaching, carrots and sticks). The third chapter, in this light, reviews the importance of representativeness in the decision-making process. The literature review identifies the success factors and constraints that support or hinder the implementation of successful governance solutions. What elements and frameworks are good or missing, and what are currently limiting governance models.

As the chapter concludes, this requires the effective involvement of a wide range of stakeholders and their values, knowledge, and interests. It also highlights the need for political will and social leadership to implement the necessary reforms in legal, jurisdictional, socio-economic, and institutional frameworks and water use patterns.

The first part of the study is a literature review. In the first chapter, the subject of governance is explored. This included a mapping of the characteristics of governance models, with a particular focus on nutrient pollution. The text delves into the evolution of governance as a concept distinct from traditional government practices, emphasizing a more decentralized, participatory approach that engages a variety of stakeholders beyond the confines of formal governance structures. The second chapter aims to overview the global situation of nitrogen and phosphorus governance and show examples of governmental features, solutions, or initiatives in some regions (Baltic Sea region, Visegrad Four region) and countries (the Netherlands, Flanders in Belgium, Lower Saxony in Germany, Denmark, Ireland and France, Spain, Austria, Czech Republic, Italy) for nutrient management based on literature review and case

studies. The third chapter identifies the success factors and constraints that support or hinder the implementation of successful governance solutions. What elements and frameworks are good or missing, and what are currently limiting governance models. This thematic literature review laid the foundation for the next step of the research, which involved the compilation of a structured interview aimed at identifying the governance structures of the demo-sites involved in the project.

In compiling the structured interview, we sought to understand the factors that shape the governance structures of each demo-site. In doing so, we focused on the knowledge that each partner had about nutrient pollution and the framework that governs it. We assessed their knowledge and the framework in which they operate on issues related to the existence of nutrient cycle monitoring mechanisms at the demo site, the nutrient management regulatory environment, partner cooperation and policy instruments. In particular, what other stakeholders they work with, what factors influence this and what they would need to develop a more effective governance system specific to each demosite. By this structured interview, we address specific problems of governance characteristics, general patterns of policy styles, types of intervention and governance structures, which can support the planning of effective nutrient management measures. This analysis aims to understand the governance barriers, and success factors such as capacities, frameworks and structures relevant for transitioning to a regional/macroregional circular nutrient management, and in particular, at the demo-site level.

In order to get a broader view on the characteristics of nutrient pollution management systems, the survey was complemented by two semi-structured interviews with a representative of an international organisation (FAO) and a related international project (BIOEAST). The purpose of these interviews was to gain a better understanding of the factors on the policy side that could contribute to a more successful governance model. The structured interviews were completed by a representative of each demos, and the answers to the questions are presented in a case study format, with a summary of the weaknesses and success factors for each demos at the end of each chapter.

At the end of our work, we conclude by summarising the factors that we have identified as essential for the development of a well-functioning, innovative governance solution, based on the literature analysis, the practical examples examined in the literature, the structured interview survey on demos and the semi-structured interviews.

1. Overview of governance structures

In this chapter, the subject of governance is explored. The text delves into the evolution of governance as a concept distinct from traditional government practices, emphasizing a more decentralized, participatory approach that engages a variety of stakeholders beyond the confines of formal governance structures.

The multiple dimensions of governance include economic, political, and administrative aspects, and these layers interact in the context of sustainable human development. Our focus is particularly on the governance of agricultural nutrient pollution – a critical environmental issue that impacts water quality and ecosystem health worldwide. The 'wicked' nature of nutrient pollution is characterized by complexity and resistance to straightforward solutions and highlights the necessity for innovative governance strategies that are adaptable and inclusive of diverse stakeholder input.

Through a detailed exploration of both theoretical and practical aspects, the chapter provides a comprehensive look at how governance, particularly in the context of environmental challenges like nutrient pollution, is evolving to address the complexities of modern- policy-making, and management, not only assessing the current state of agri-environmental governance but also examining potential pathways toward more effective and sustainable governance practices in the future.

1.a The concept of governance

The term "governance" has gained prominence in social sciences, especially public administration, as a refreshing concept that suggests a new and improved approach to government and public administration. Its rising popularity is linked to growing public distrust in the government's problem-solving capabilities, leading to a re-evaluation of conventional public administration theories. Various alternative theories have emerged, with governance receiving significant attention as a potential replacement for the traditional bureaucratic administration model (Lee, 2003). It is needed to differentiate between government and governance. The government is defined as the formal, centralized, and vertical exertion of power and authority, for instance, via regulation or market-based mechanisms. On the other hand, the governance involves a horizontal decentralization and devolution of power and authority to a wider segment of society (Harrington et al., 2008). Government and governance represent two ends of a spectrum where the state's role shifts from direct intervention, or governing society through authoritative value allocation, to significant societal autonomy, characterized by self-organized, self-governing private and voluntary actors and networks that can resist government interference (Hysing, 2009). For more specific definitions of governance, see Annex 1.

Governance involves **interactions and partnerships** between the state and society, encompassing a **variety of organizations** – public, private, and cooperatives – and the intricate relationships among them (Dasgupta & Roy, 2011). In governance, the individual actor is the fundamental unit, driven by specific goals and roles, actively participate in discussions, decision-making, and the implementation of collaborative efforts. There are four main sectors of governance actors: public and private policymakers, and public and private practitioners (Gieseke, 2020).

Global governance addresses issues beyond the scope of individual national governments. **National governance** involves governance within a country, traditionally seen as the domain of government at

various levels (*national, regional, local*). It also includes the role of civil society and community organizations in decision-making. Plumptre and Graham (1999) add **corporate governance** that pertains to the management of both private and public organizations, accountable to a board of directors (see more in Annex 1).

According to the United Nations Development Programme's policy document "Governance for sustainable human development", governance comprises **three pillars: economic, political, and administrative**. Economic governance involves the decision-making processes impacting a nation's economic actions and its interactions with other economies, significantly affecting equity, poverty, and quality of life. Political governance refers to the decision-making process for policy formation. Meanwhile, administrative governance represents the framework through which policies are implemented. **Good governance** encompasses the procedures and frameworks that shape political and socio-economic interactions. It is characterized by being participatory, transparent, and accountable, as well as effective and fair, while upholding the rule of law. Good governance guarantees that political, social, and economic agendas are established on a wide societal agreement (UNDP, 1997).

The main fields of governance concerned by nutrient pollution are agriculture and environment, as well as their interrelations. As defined by FAO/Dasgupta & Roy (2011, p. 3), "**agricultural governance** is concerned with augmentation of growth and development of a country's agriculture sector and managing the consequences of this process through the effective functioning of its institutions, the application of technology and scientific innovations, the implementation of policies, adherence to acts and regulations, and active participation of all involved stakeholders". **Environmental governance** is "the interrelated and increasingly integrated system of formal and informal rules, rule-making systems, and actor-networks at all levels of human society (from local to global) that are set up to steer societies toward preventing, mitigating, and adapting to global and local environmental change and, in particular, earth system transformation, within the normative context of sustainable development" (Biermann et al. 2009, p. 3).

Management and governance differ, as pointed out by Armitage et al. (2012) in their work related to environmental governance: management focuses on operational decisions for outcomes, while governance encompasses the wider decision-making processes. However, they overlap, as management also entails dealing with uncertainty, negotiation, deliberation, and social-ecological dynamics. The organisation Good Governance Improvement (GGI, 2021) explains the difference between management and governance through the example of corporate governance: governance operates on a principle of power separation, ensuring those managing an organization are accountable both to themselves and to a governing body focused on broader organizational interests. This system balances the needs of investors, owners, and stakeholders, preventing operation solely for the staff's benefit. The board, responsible for governance, recruits a skilled management team for daily operations, leveraging their unique insight into the organization to meet all stakeholders' needs effectively.

Governance styles refer to the methods of decision-making and implementation, including how involved organizations interact with each other (Gieseke, 2020 based on Kersbergen & Van Waarden, 2004). According to Thompson (1991), organizations utilize three primary governance styles:

- *Hierarchy:* a conformist, top-down framework with emphasis placed on seniority. Promotes conformity and subordinate accountability. Mosty associated with government, military, schools, churches, etc.
- *Market:* an incentive-based, top-down framework with emphasis placed on innovation and profit incentives. Mostly associated with corporations. (See corporate governance)
- *Network:* a non-hierarchy framework with emphasis placed on purpose and trust; formed around multiple relationships in both horizontal and vertical manners. Mostly associated with NGOs.

Ran and Qi (2018) argue that the terms **network governance** and **collaborative governance**/public management/decision-making capture a common and emerging phenomenon - the collaboration of different organisations from the public, private and civil sectors working together as stakeholders, based on informed consensus and collective decision-making, to achieve common goals that could not be achieved separately. In collaborative governance, different actors inside and outside government work together in non-hierarchical and flexible alliances (Murdoch and Abram, 1998).

Multi-level governance refers to the sharing of powers at several levels, such as local, regional, national and supranational, especially in the context of the European Union (Hooghe & Marks, 2003). While Bache and Flinders (2004) still maintain that there is no widely accepted definition of multilevel governance, four common features can be found in almost all related research: 1) The increasing involvement of non-state actors such as NGOs, corporations, trade unions in governance functions; 2) The proliferation of overlapping decision-making networks involved in such functions; 3) The changing role of the state from command and control to direction, coordination and networking; 4) The challenges of multilevel governance in assigning responsibility and in the practice of democratic accountability.

Wälti (2010) emphasizes the development and implications of environmental policies within the framework of multi-level governance arrangements that provide a lens to examine the interplay of political, institutional, and actor-centred factors in environmental policy. The presence of multiple governance levels can offer opportunities for environmental movements, accommodate diverse political demands, and enable intergovernmental politics that might lead to the adoption of more stringent environmental policies.

Concepts and understandings of multi-level, collaborative and networked governance are interlinked, forming a **unified paradigm** that emphasises decentralisation, networking, and localism (Bite et al., 2019).

1.b Governance and public policies

Government action is evaluated based on four **core values**: effectiveness, efficiency, legality, and democracy. The **value of democracy** strongly relates to the governance paradigm showing how well policy design and implementation align with established norms of government-citizen interactions in a democracy. This typically involves the extent to which citizens can participate in, consult on, and be informed about policy processes. Additionally, democracy encompasses the ability of political representative bodies (like parliament and local councils) to exercise effective political control. (Bemelmans-Videc, 1998)

Based on the range of instruments and theories concerning their selection, Vedung (1998) **classified policy instruments**, emphasizing that the key feature of public policy instruments is their level of authority or coercion in governance. The three categories of instruments: **regulation (the stick), subsidies (the carrot), and information campaigns (the sermon)**. Policymakers tend to initially opt for the least coercive methods, gradually moving towards more forceful instruments in a policy domain (Linder & Peters, 1989). Choosing policy instruments within the framework of good governance requires a strategic balance among their impacts on effectiveness, efficiency, legality, and democracy. This highlights the decision-making process as a quest for the best mix of instruments to achieve optimal results across these criteria. The key question is how to logically combine these instruments to maximize their collective performance in meeting the mentioned standards (Van der Doelen, 1998).

Pacheco-Vega (2020) revisited Vedung's policy instrument typology (sticks, carrots, sermons), assessing its application in environmental regulation. Despite a shift towards New Environmental Policy Instruments (NEPIs) favouring economic and informational tools over traditional regulatory approaches in the late 1990s, the study finds that the use of **policy instrument mixes**, which combine various types of policy tools, has gained interest. This interest is attributed to the complex and uncertain conditions in which environmental governance operates. The author highlights the continued relevance and necessity of environmental regulation within the mix of policy instruments, especially in contexts where economic or voluntary instruments alone might be less effective or more challenging to implement.

1.c Governance on agricultural nutrient pollution

Addressing **diffuse pollution from agriculture** and its effect on water ecosystems (eutrophication) is recognized as a **"wicked problem"** (Patterson et al., 2013; Graversgaard et al., 2018; Jetoo, 2018; Sharma, 2020; Wiering et al., 2020, 2023). A wicked problem (originally introduced by Rittel & Webber, 1973) typically involves characteristics like being uniquely complex; having no clear definition; possessing multiple possible explanations; lacking a clear method to evaluate responses; responses being evaluated on a spectrum of better to worse, rather than true or false; significant consequences for every attempted solution, with no chance of trial-and-error learning (Bevir & Hall, 2011). This framework helps explain why the issue of agricultural nutrient pollution has remained pervasive, as traditional policy planning processes fail to account for the problem's inherent complexities and the need for adaptable, localized solutions (Sharma, 2021). There is also a need for re-evaluation of the role of governance in environmental policy, advocating for a broader understanding of the factors that influence policy effectiveness in the face of wicked environmental problems. (Wiering et al., 2020, 2023)

Referring to nutrient pollution as one of the major threats to the environment and human health, Kanter (2023, p. 2) presumes the following as part of the introduction to “Governing Nutrient Pollution Beyond Farmers” (NuGov) project: “Managing this delicate balance between environmental protection and agricultural production is the central challenge of nutrient pollution governance. However, the narrow focus of most agricultural nutrient pollution policies on changing farmer behaviour ignores the underlying forces and actors that shape and constrain this behaviour. This has led to policies which have been largely ineffective in reducing agricultural nutrient losses to the environment in Europe and around the world.”

Looking at the governance of global N and P cycles, Ahlström and Cornell (2018) underlines **polycentric governance** as a potential strategy to address global change problems: „a case where self-organised

formation of platforms and partnerships that bridge different actors in science, policy and practice maintain the organisational flexibility of a worldwide network structure of formal institutions for the global good." (Ahlström & Cornell, 2018 p. 64)

Utilizing the adaptive governance theoretical framework, Belinskij et al. (2019) argue for a reconfiguration of governance structures to better accommodate innovative approaches to nutrient management. This includes a move away from rigid, top-down regulations towards more **flexible, participatory governance mechanisms** that can adapt to changing conditions and technologies. Reforming regulatory frameworks to better support innovative, bottom-up solutions to nutrient management includes the enhancement of the adaptive capacity of legal frameworks, recognizing and encouraging nutrient offsetting, and fostering a more integrated approach to managing agricultural nutrient loading. Sharma (2020) points out that flexible, **adaptive governance structures** that can respond to the dynamic nature of the problem and encourage collaborative, cross-sectoral solutions by integrating local stakeholder knowledge and participatory governance models allow for more nuanced and context-specific strategies that better align regulatory objectives with the realities of agricultural production and environmental protection.

According to Andersen et al. (2023) countries with vertically concentrated governance structures, yet horizontally fragmented, face challenges in leveraging implementation due to the lack of coordination and comprehensive strategies that span across different sectors and levels of government. **Informal institutions**, or the **soft aspects of governance** such as norms, practices, and relationships, play a critical role in the implementation process. Countries that foster **collaborative and consensus-driven approaches** are more likely to effectively manage agricultural nutrient runoff.

Two opposite **governance options** were investigated by Morseletto (2019): **"holistic" and "origin-based"**. The holistic approach aims for an integrated governance that encompasses all nitrogen-related issues, potentially leading to comprehensive solutions. In contrast, the origin-based approach focuses on specific sources of nitrogen pollution, allowing for more targeted and potentially quicker solutions. Evaluating these governance options based on several criteria (i.e., achievability, manageability, effectiveness, efficiency, responsiveness, coherence, and coordination), it concludes that origin-based solutions may be preferable due to their specificity and potential for immediate results. The two approaches are compatible though, as an origin-based solution can eventually be integrated into a holistic solution, serving as an intermediate step towards comprehensive governance. However, the success of any governance arrangement depends on the speed at which it can be implemented to combat the growing issue of nitrogen pollution.

Van den Brink et al. (2021) examined the impact of agricultural practices on groundwater quality, focusing on the reduction of pollutants through governance approaches based on mutual gains and **voluntary measures**. The study highlights the importance of engaging farmers through voluntary measures (i.e., "voluntary adoption of the best management practices, resulting in improvements in environmental and farm management"), showing that such engagement can create a platform for meaningful interactions, add economic benefits to farms, and reduce agricultural impact on groundwater quality. The engagement process is instrumental in building trust, sharing knowledge, and encouraging the adoption of more sustainable practices. While voluntary measures can be effective, their success depends on factors such as economic incentives, farmer engagement, and the availability of alternative practices.

Transition theories, as summarized by Hoes and Aramyan (2022), suggest that governments should employ a variety of strategies to guide the sustainability transition process, destabilizing unsustainable practices while supporting new, sustainable ones. Market-based instruments and policies that reward sustainable agriculture can facilitate this transition. Their study shows that failing to meet international environmental standards has led to stronger policy measures against unsustainable practices. However, there is a lack of policy **support for innovative farmers** who are creating sustainable alternatives. To foster a more responsible and inclusive transition, specific policies are needed to support these pioneering farmers, who not only produce food but also contribute ecological and other community benefits.

Wiering et al. (2023) examined how consensual policy styles, organizational and program integration, participatory governance, and the capacities of public authorities relate to the substance of **measures** taken (effect- vs. source-based measures) and the choice of **policy instruments** ("sermons, carrots, sticks")[1]. Based on their experience, measures to mitigate nutrient pollution exhibit a mix of both source-based and effect-based approaches, predominantly implemented through non-mandatory instruments (voluntary measures and financial incentives). They highlight the need to consider additional contextual factors these governance structures are embedded in, suggesting that different governance structures may compensate for effects on practical measures and policy instrument choices.

In their study, Harseim et al. (2021) address the critical issue of managing phosphorus within the constraints of planetary boundaries through strategic local planning. They underscore the **urban dimension** of phosphorus management as with the growing urban population, cities are becoming increasingly important in phosphorus governance, contributing to both the demand for phosphorus and its recycling. A governance gap can be identified at the international level for managing phosphorus flows and points towards local initiatives and planning as a way to meaningfully impact these flows. Local actions, informed by thorough inventories of urban metabolism, can contribute to a more sustainable global phosphorus management. Cities to adopt strategic local phosphorus planning, should aim at building public administration capacity, collaborating across administrative boundaries, improving data availability, and implementing targeted measures to increase phosphorus recycling and reduce imports.

Given the growing interest in community **self-governance** of natural resources, such as water and soil, to address environmental concerns and enhance sustainability, Termeer et al. (2013) investigated the challenges and opportunities of integrating self-governance within sectors that are subject to extensive regulation. They identified that while self-governance initiatives offer potential benefits, including more adaptive and locally relevant environmental management, they often face obstacles due to conflicts with established rules and institutional arrangements. The challenges while implementing self-governance in environments characterized by dense regulation include negotiating exemptions or modifications to existing policies, aligning interests among diverse stakeholders, and managing the transition from traditional governance models to more participatory and decentralized approaches. Adequate internal arrangements within a community can strengthen its position in negotiations with policymakers,

[1] guidance programs (sermons), financial incentives (carrots), and regulatory measures (sticks)

potentially leading to more favourable conditions for self-governance. Conversely, supportive policy environments can enable more effective self-governance arrangements.

1.d Key elements of the governance approach

Governance can be defined as the decentralized and horizontal devolution of power, contrasting with government, which is a centralized and vertical exertion of power. There is a growing distrust in government's problem-solving capabilities, which has led to a re-evaluation of traditional public administration models and the emergence of governance as a potential alternative.

Governance involves various actors and sectors including public and private policymakers, practitioners, and a mix of organizations like NGOs, corporations, and cooperatives. These actors participate actively in decision-making and implementation processes, which are more collaborative and consensus-driven compared to traditional government approaches.

Emerging trends like collaborative governance and multi-level governance highlight the involvement of non-state actors and the increasing complexity of governance structures that operate across different levels from local to global.

Governance is linked to the selection and effectiveness of public policy instruments, which range from regulatory (coercive) to economic and informational (non-coercive). Effective governance, enabling effectiveness, efficiency, legality, and democratic values, requires a balance of policy instruments (regulation, subsidies, information campaigns) that can adapt to changing conditions, especially in agri-environmental areas.

Agricultural nutrient pollution, particularly nitrogen and phosphorus, can be characterized as a "wicked problem" due to its complex nature and the absence of clear solutions. This complexity requires a re-evaluation of traditional governance and policy approaches.

The need for polycentric governance can be highlighted to handle the dynamic aspects of nutrient pollution, which involves multiple levels of decision-making and flexible, adaptive management strategies. Such governance encourages the integration of various stakeholders in the decision-making process, fostering more effective and localized solutions.

The effectiveness of governance strategies is also linked to the role of informal institutions and soft aspects, such as norms, practices, and relationships, which are crucial for implementing and coordinating governance across different sectors and levels.

Two contrasting governance approaches are "holistic" and "origin-based." The holistic approach deals with pollutant-related issues comprehensively, while the origin-based approach targets specific sources of pollution, allowing for quicker, more targeted responses. Both approaches have their merits and can be integrated for effective governance.

The engagement of farmers through voluntary measures helps to foster trust, share knowledge, and encourage the adoption of sustainable practices, which can lead to economic benefits and reduced environmental impacts.

A variety of strategies necessary to guide the transition towards sustainable agricultural practices includes market-based instruments and policies that reward sustainable practices and support innovative farmers.

With the increasing urban population, the governance of pollutants becomes critical in cities that play a key role in managing phosphorus flows through strategic local planning and actions that improve phosphorus recycling and reduce imports.

Community self-governance of natural resources can provide more adaptive and locally relevant solutions, however, it often faces hurdles due to existing regulations and the need to align diverse stakeholder interests.

2. State of the art of current governance practices

This chapter aims to overview the global situation of nitrogen and phosphorus governance and show examples of governmental features, solutions, or initiatives in some regions (Baltic Sea region, Visegrad Four region) and countries (the Netherlands, Flanders in Belgium, Lower Saxony in Germany, Denmark, Ireland and France, Spain, Austria, Czech Republic, Italy) for nutrient management based on literature review and case studies.

The global situation of nitrogen and phosphorus management shows that although initiatives for sustainable nutrient management have been taken, the global nutrient management is currently inefficient. To overcome challenges, instead of the fragmented national policies, a comprehensive worldwide policy and a better coordination of nutrient cycle policies, government bodies and stakeholders would be beneficial at national, regional, and global levels.

In case of six European countries and regions (the Netherlands, Flanders in Belgium, Lower Saxony in Germany, Denmark, Ireland and France), the practical implementation of the Water Framework Directive (WFD) related to diffuse agricultural pollution by nutrients shows that while governance approaches varied significantly, the kinds of measures implemented by the countries were not that different. The majority of countries place a strong focus on farmer-friendly, voluntary measures and policy instruments.

The analysis of governance case studies in Austria, Czech Republic, Germany, Italy, the Netherlands and Spain highlighted the significance of the interactions between stakeholders in the development of circular economy for agriculture – all stakeholders must cooperate to identify cross-cutting issues, common goals, and barriers (Franceschi and Rose, 2020).

The Spanish water governance example is based on integrated management articulated around the principle of unity of management of the river basin district. It involves and connects many actors with responsibilities for different aspects of water management and water service provision on local, regional, and national levels.

In the Baltic Sea region, a large number of governmental organizations and regulatory frameworks related to the reduction of eutrophication exist but there is no common solution in the Baltic Region due to the complexity of both the environmental and legislative context and the lack of economic motivations. Salman (2009) states that for the implementation of Baltic Sea region's phosphorus management the development of innovative technology, finance strategies, business models, and policies, and also systemic changes in people's awareness and behaviour is necessary. An analysis of national policy and governance capacity in nine coastal states (Russia, Poland, Germany, Sweden, Finland, Denmark, Estonia, Latvia, Lithuania, Sweden, Finland, Denmark) shows that governments that are strongly vertically concentrated and horizontally fragmented lack the capacity to implement the nutrient emission reduction provisions of the Helsinki Convention (Andersen et al. 2022)

There is currently a study gap regarding the identification of nutrient recovery potential and best practices for nutrient recovery in V4 countries. Phosphorus usage in V4 countries results losses due to the lack of knowledge of amount and recovery potential of P-rich waste sources, know-how, lack of action plan, financial resources, or low awareness on P importance for people’s lives. However, V4 nations have made

efforts to increase societal awareness of P sources. Further initiatives (economic, environmental, legal or social) should be developed to support the implementation of P recovery technologies.

2.a General state of nutrient governance

In chapter 2.a we show the current global situation of nitrogen and phosphorus management, and some examples of initiatives and documents created by international organisations and cooperations that enhance the promotion of sustainable nutrient management.

According to the Fourth and Fifth session of the United Nations Environment Assembly on Sustainable Nitrogen Management in 2019 and 2022 and on the Colombo Declaration in 2019, despite the many efforts and measures that have been taken at global level to promote sustainable nitrogen management – such as the Global Partnership for Nutrient Management (GPNM), the International Nitrogen Management System, the South Asia Cooperation Programme for Environmental Protection (SACEP), and the International Nitrogen Management System focusing on the South Asian Marine Region – the global economic nitrogen use is currently inefficient and that an extremely high proportion of anthropogenic reactive nitrogen is released into the environment. Among the reasons for this are that current policies on reactive nitrogen are fragmented in many countries and cross-sectoral approaches to the global nitrogen cycle are incoherent, resulting in unquantified trade-offs between different forms of nitrogen pollution and contributing to barriers to the adoption of policies. They stated that there is a need for the development of national action plans for sustainable nitrogen management by Member States and for better coordination of nitrogen cycle policies at national, regional, and global levels, including consideration of the case for establishing an intergovernmental mechanism for coordination of nitrogen policies. In addition, there is a need to identify ways to better manage the global nitrogen cycle, share good practices, guidance documents, new technologies, promote innovation. To assess the benefits of better nitrogen management, ensure a coordinated management of relevant data sets, develop an integrated and sustainable approach to nitrogen management in order to identify current information gaps would be needed. The importance of awareness raising and training, not only for practitioners but also for policy makers, is highlighted as well.

Beyond the declarations on sustainable nitrogen management, "Our Phosphorous Future" report draws attention to the importance of sustainable phosphorus management. The Our Phosphorus Future report claims that there is no single, comprehensive worldwide policy in place for managing nutrients in aquatic ecosystems. Improving the integration of a sustainable phosphorus strategy into both current and future policy frameworks is a major task. While operating inside broad frameworks, such as the EU Water Framework Directive, appropriate mitigation measures must take local factors into account (Brownlie et al, 2022). The authors of the report have summarised the challenges of sustainable phosphorus use for decision-makers and proposed actions for solutions including the challenges and the possible solutions for recycling phosphorus-rich organic materials. They stated that there is a lack of policy, infrastructure, and financial support for recycling. To overcome the challenges, better coordination between the relevant government bodies and stakeholders is needed to develop coherent, holistic policies and create a market for recovered phosphorous fertilisers. Investment in infrastructure and technologies supported by cross-sectorial innovation is also needed and co-creation and knowledge sharing can help to make phosphorus recycling simpler and more efficient. Besides, the economic benefits for society of recycling phosphorus need to be better quantified and used to encourage stakeholders to recycle phosphorus more efficiently. The value of recovering phosphorus can be maximised by selecting methods to process organic materials

that produce additional co-benefits. The authors of the report, in Helsinki Declaration (2022) are calling on policy makers worldwide to support a move towards more sustainable phosphorus management, in line with global action on carbon, nitrogen, food and water.

According to Franceschi and Rose (2020) in the framework of Circular Agronomics Project the main obstacles, opportunities, and recommendations for the transition of the agricultural sector to a more circular economy, as identified in the literature, are summarised below:

- Lack of policy alignment;
- Dependency on the choice of national instruments and priorities and the low consideration given to the reduction in inputs and consumption;
- Narrow focus on specific nutrient recovery technologies could lead to new lock-ins preventing further action;
- Enhanced cooperation between all stakeholders;
- Shifting mindsets towards the 'reduce-reuse-recycle-recover' narrative;
- Changing farm structures to allow more efficient use of manure and other nutrient sources in agriculture;
- Increasing stakeholder collaboration, in particular between treatment plants, the fertiliser industry and farmers, placing the focus on agri-food chain actors capable of influencing N management at farm level, from the fertiliser industry to wastewater treatment companies, in order to shift the regulatory burden away from farmers alone;
- Finding the right incentives to boost circular nutrient technologies and practices;
- and consider ensuring fair P fertiliser pricing by internalising externalities of phosphate mining.

A network analysis of environmental policy and legal studies of global N and P governance exposed the structural patterns of a loose network among the principal institutions and actors, in which legal instruments of the European Union serve as key cross-scale and cross-sectoral 'gateways'. The loose network structure of formal institutions should be supported by self-organized platforms and partnerships that brings actors in science, policy, and practice together such as the Global Partnership for Nutrient Management (GPNM) which can contribute to the effectiveness of the loose institutional network (Ahlström et al. 2018). GPNM was founded in 2009 with the collaboration of governments, scientist community, industry, NGOs, and international organisations. Its goal is promoting effective nutrient management, minimising negative impacts on the environment and human health, maximizing the contribution to global sustainable development and poverty reduction. Members in GPNM collaborate across sectors and scales/regions. It is guided by a Steering Committee and the United Nations Environment Programme (UNEP) acts as secretariat. The role of GPNM is strategic advocacy and collaboration at global and regional levels to build consensus in favour of nutrient use efficiency and it is positioning of nutrient issues as part of international sustainable development agenda. Its work with stakeholders to develop strategies, guidelines, or policies and enhancing the capacities of various stakeholders to design and implement effective management policies. Besides, it serves as a knowledge platform to support science policy interaction and translating science for policy makers and it enhance innovation to reduce nutrient losses and improve overall nutrient use efficiency. To adapt the work of the

GPNM from the global level to the national level, Regional Platforms established, with the representation of lead government agencies with responsibility for agriculture, oceans and natural resources conservation, along with regional and international support agencies (Datta 2015).

In the following sections, some documents are presented, which prepared by international organisations or international cooperations, which - as sermons - provide information and guidance for the development of sustainable nutrient management.

To improve the environmental performance of nutrient management the measuring of nutrient flows is essential. This supported by a guideline document created by FAO titled “Nutrient flows and associated environmental impacts in livestock supply chains” to establish a uniform international methodology for evaluating nutrient flows and their environmental impact, particularly regarding eutrophication and acidification, across different livestock production systems. Developed by the Livestock Environmental Assessment and Performance (LEAP) Partnership, this initiative seeks to enhance the environmental sustainability of the livestock sector by improving metrics and data. The growing demand for livestock products, driven by population growth, increased income, and urbanization, has led to higher nutrient use in these production systems, contributing significantly to environmental issues like climate change, pollution, soil degradation, biodiversity loss, and health problems. Therefore, there is a pressing need to measure nutrient flows to better the sector's environmental footprint. The FAO guidelines, having undergone rigorous technical and public reviews, aim to refine recommendations for boosting nutrient use efficiency. Their periodic updates will encapsulate sectoral advancements, stakeholder feedback, and emerging methodologies. This effort represents a collaborative, cross-sectoral international push to standardize assessment methods, leading to a deeper understanding, transparent metric application, and tangible environmental improvements in the livestock industry.

The European Commission adopted the "Best Available Techniques (BAT) Reference Document for the Food, Drink and Milk (FDM) Industries" by the EU Joint Research Centre (JRC) in 2006, which was later reviewed and published in 2019. This document is an example of a collaborative information exchange involving different stakeholders such as EU Member States, relevant industries, environmental NGOs, and the Commission. The development process aims to create, review, and update BAT reference documents as needed. Technical experts nominated by forum members formed the technical working group responsible for drafting the document, with the European Integrated Pollution Prevention and Control (IPPC) Bureau leading the effort. The BAT conclusions were derived from a stepwise process that identified the key environmental challenges in the FDM Industries; assessed the most effective techniques to address these challenges; determined the best environmental performance levels based on EU and global data; reviewed the conditions for achieving these levels, including costs and cross-media effects; and selected the optimal available techniques and their associated emission levels for sector monitoring. Given the evolving nature of BAT, including the emergence of new measures and technological advancements, this document is subject to ongoing review and updates to reflect industry developments and their impact on BAT standards.

The Danube River Basin Management Plan (DRBMP) Update 2021, developed under the aegis of the International Commission for the Protection of the Danube River (ICPDR), is a comprehensive document aimed at improving water quality and promoting sustainable water management across the Danube River Basin. According to the document, ICPDR endorses the European Commission's efforts to achieve sustainable agriculture, focusing on profitability, rural vitality, and the protection of water resources to

maintain good ground and surface water status. The ICPDR's Guidance Document on Sustainable Agriculture, developed in concert with the agricultural sector, seeks to harmonize agri-environmental policies with economic growth, emphasizing incentive-based strategies over traditional regulatory methods. This initiative advocates for integrating water and agricultural policies to minimize income loss among farmers while protecting water bodies, promoting a shift from traditional regulatory approaches to more balanced, incentive-based strategies. This approach emphasizes mutual understanding and compromise between water management and agriculture to develop policies that detach agricultural growth from nutrient pollution and water scarcity, contributing to sustainable agricultural practices. The guidance aligns with the EU's CAP post-2020, Green Deal, and other strategies focusing on environmental protection and climate change adaptation. It recommends policy instruments, financial programs, and agricultural measures for managing nutrients, addressing drought, and tackling pesticide pollution, with future updates planned to include broader environmental concerns. The document is intended to be a dynamic resource, evolving through stakeholder input and legislative developments.

2.b Governance solutions in European countries: case studies and projects

In chapter 2.b we show examples for governmental features, solutions, or initiatives in some regions (Baltic Sea region, Visegrád Four region) and countries (the Netherlands, Flanders in Belgium, Lower Saxony in Germany, Denmark, Ireland and France, Spain, Austria, Czech Republic, Italy) for nutrient management based on literature review and on case studies.

2.b.1 Example 1: Nutrient governance in five EU countries (the Netherlands, Flanders in Belgium, Lower Saxony in Germany, Denmark, Ireland and France)

The different governance approaches to the nutrients problem are analysed by Wiering et. al (2020) and Wiering et. al (2023) specifically focuses on the relationship between the nature of governance and the nature of measures taken. In Wiering et. al (2020) five member states and regions were studied (the Netherlands, Flanders in Belgium, Lower Saxony in Germany, Denmark and Ireland) which have been chosen as they are most similar in terms of the problem pressures and the general legal framework conditions, but different in their governance structures. In their paper, the type of measures that member states generally take in the practical implementation of the Water Framework Directive (WFD) related to diffuse agricultural pollution by nutrients were analysed. In Wiering et. al (2023) the list of the analysed countries was complemented by France and the analysed governance structures and policy outputs were also complemented. We summarised their main results of the studies regarding the governance structure and policy measures of the countries as follows.

They examined the **governance structures**, as the national approach of the countries to problem solving: how agricultural nutrient management and water quality management are connected, whether a consensual way (joint policy formulation and co-responsibility) or antagonistic way (conflicting relationships), as well as how the countries have implemented – organizational and/or program integration or segregated agricultural and environmental policies. The authorities' planning capacity was

analysed as well: human resources (i.e., the existence of sufficiently skilled personnel in public authorities to plan relevant measures) and financial resources (i.e., enough funding for planning under complex conditions, including relevant information gathering). And the width of stakeholders involved, their degree of involvement, and their negotiation power were involved in the analyses as stakeholder participation.

The **type of measures** (the nature of intervention) is categorised as source based (preventive measures mostly deal with (organic) fertilizer policies or structural measures for agriculture e.g. Eutrophication policies, stricter standards) or effect–based measures (reactive and come after the actual application of (organic) fertilizers e.g. buffer zones, wetlands, heliofyten-filters) and voluntary or mandatory measures.

The used **policy instruments** were examined as well: 'sermons' (knowledge exchange, communication campaigns, voluntary guidance programs, social incentives), 'carrots' (subsidies, levies, financial and economic incentives), 'sticks' (regulation, formal rules, strict standards, increased enforcement), and an additional instrument of 'physical architecture' (e.g., de-phosphatising and 'cleaning up' water bodies or soils).

They concluded that while governance approaches varied significantly, the kinds of basic (connected to the Nitrates Directive) and secondary (additional programs for the WFD related to nutrition policy) measures implemented were not that different. The majority of countries place a strong focus on farmer-friendly, voluntary measures and policy instruments connected to knowledge sharing and guidance programs (sermons), mostly in effect-based policies, in conjunction with national and European subsidy programs, such as funding from the CAP's Rural Development Programs (carrots). The agents involved in the majority of the investigated countries often avoid using mandatory instruments for more stringent source-based interventions (such as modifying organic fertilizer standards). Stronger regulations only implemented in rare circumstances.

Reducing nutrient use (as a source-based measure) can result in lower yields and higher manure disposal costs, so finding a balance between implementing source-based measures and accommodating the difficult circumstances farmers frequently find themselves in is a major challenge in many countries. Therefore, the compensation of farmers for lower yields and higher costs of manure disposal is a very important challenge for countries.

The governance features of the six Member States are summarised below.

1. Table: Governance features, types of measures and policy instruments in six Member States

Source: Wiering et. al (2020) and Wiering et. al (2023)

	Ireland	Flanders	The Netherlands	Lower Saxony	Denmark	France
Governance structures	Strongly consensuality, strong on capacities	Consensuality, strong on capacities	Less consensual in water quality management and agriculture, strong on capacities	Less consensuality - antagonism is mostly on federal level, and more consensuses on regional or local level, mixed in capacities	Less consensuality, strong on capacities	Less consensuality, strong on capacities
-Integration on ministry level	No formal organizational integration on minister level	No formal organizational integration on minister level	Separated ministries	Separated ministries	Initially there were two ministries, which merged into one	Separated ministries
-Integration on program level	Integration at program level	Integrated water policies	Separated policy programs	Not well integrated programs	Integrated programmes	Rather a high program integration
-Involvement	Middle degree of involvement, rather high number of stakeholders, rather balanced negotiation positions	High number of stakeholders, a middle degree of involvement, balanced negotiation position	Middle in number of stakeholders, middle degree of the involvement, partly unbalanced negotiation power	Middle in number of stakeholders, middle degree of the involvement, partly unbalanced negotiation power	Middle in number of stakeholders, middle degree of the involvement, partly unbalanced negotiation power	Middle in number of stakeholders, middle degree of the involvement, partly unbalanced negotiation power
Nature of measures	Both source- and effects based measures. Technical (physical) architecture does not have strong role.	Both source- and effects based measures, including technical measures related to physical structure (mainly installed by farmers).	Both source- and effects based measures,including technical measures related to physical structure.	Both source- and effects based measures.	Both source- and effects based measures, including technical measures related to physical structure.	Both source- and effects based measures.
Policy instruments	Focus on voluntary and financial instruments.	Overall, voluntary and financial instruments; mandatory measures in focus areas where the nutrients problem is most pressing.	Focus on voluntary and financial instruments, in part mandatory measures.	Focus on voluntary measures, in part incentives and obligatory measures.	Mandatory measures at first, and later voluntary and financial instruments.	Focus on voluntary instruments, in part mandatory measures.

2.b.2 Example 2: Case studies in Austria, Czech Republic, Germany, Italy, the Netherlands and in Spain

In the framework of Circular Agronomics Project, a governance analysis was carried out with the contribution of the project's case study partners placed in Austria, Czech Republic, Germany, Italy, the Netherlands and in Spain. In framework of the governance analysis the identification of relevant stakeholders involved in the development of a circular economy for agriculture was carried out, and they analysed the interactions between them. Stakeholders were classified according to six categories, with the following roles (Franceschi and Rose, 2020):

- Policy makers: decision making power (e.g. Ministry of Agriculture, Ministry of Environment, Regional Authorities);
- National agencies: interest in innovation, support of associations and farmers (e.g. Spanish Research Council, Agriculture and Environment agencies);
- NGO/Associations: consumers, farmers and environment interest (e.g. Farmers Associations, Environmental NGO);
- Institutions/Research: scientific interest (e.g. Universities, research centres);
- Agricultural suppliers and services: economic interest (e.g. fertiliser sales, food retail industries);
- Farmers and farmers cooperatives: interest in agriculture

In their conclusion the significance of the interactions between the stakeholders in each category were highlighted. Decisional flow has one direction only from the decision-makers to the farmers, instead the informative flow can have different directions. In order to create the ideal environment for the development of agriculture and the circular economy, all stakeholders must cooperate to identify cross-cutting issues, common goals, and barriers. Three approaches that stand out for improving stakeholder support and communication were identified.

2. Table: Approaches for improving stakeholder support and communication

Source: Franceschi and Rose, (2020)

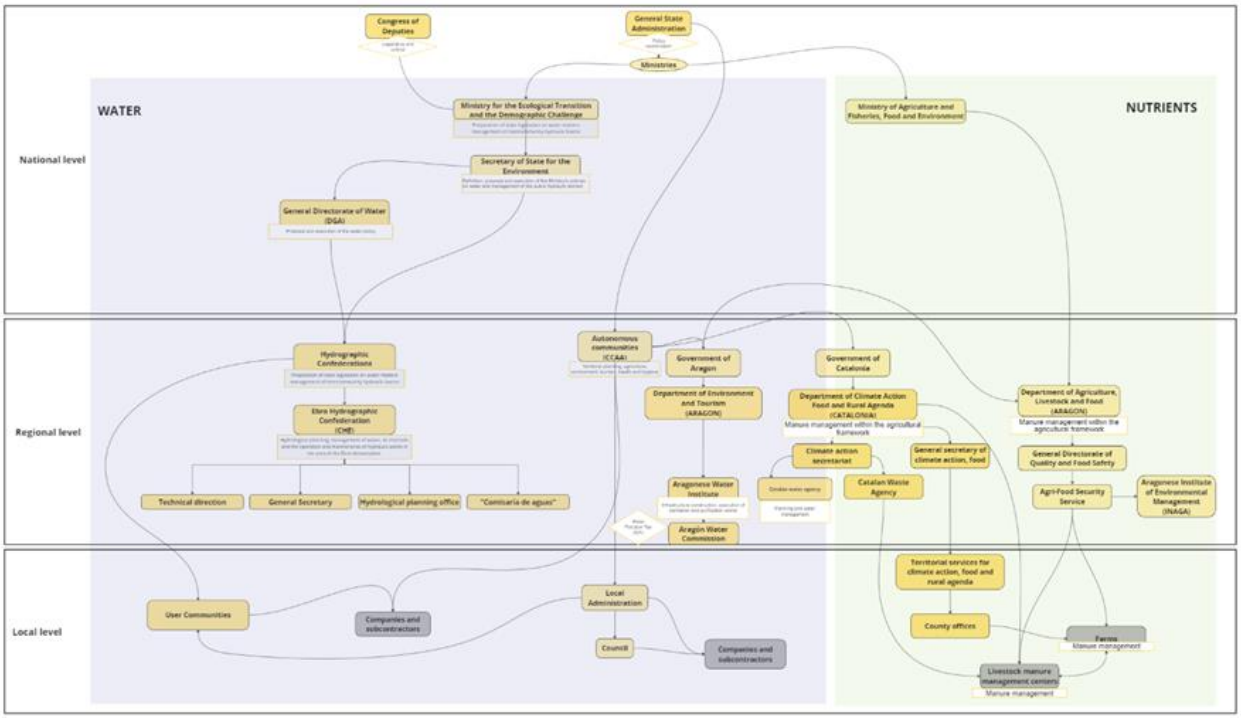
Top-down approach	Policy makers should harmonise policies and respective definitions and concrete measures implemented by farmers at the regional level. Besides, the implementation of incentives for sustainable farming and circular economy in agriculture is necessary. The access to additional funding, loans for organic farming practices and for investments in nutrient recycling technology needs to be both simplified and facilitated. It is required a comprehensive facilitation by law and policies, but also by human and financial resources and, in general, more institutional capacities to implement and enforce the existing and future policies or regulations. The complexity of the “green decision-making processes” could be addressed and ways to simplify the paperwork and bureaucratic procedures could be suggested.

Bottom-up approach	The interest and priorities of the various stakeholder groups is different. Through the share of knowledge and individual needs can lead to the development of common solutions for implementing more sustainable practices. It is necessary to create and transmit the necessary policy modifications to policymakers.
Equal approach	To facilitate communication amongst agricultural stakeholders, roundtables or public conventions should be organised. Transparent value chains and products, public government campaigns, and comprehensive information are good starting points for paradigm shifts.

2.b.3 Example 3: Spanish example of water governance

The Spanish example of water governance is a framework that involves many actors with responsibilities for different aspects of water management and water service provision. It is based on integrated management, articulated around the principle of unity of management of the river basin district, consideration of the single hydrological cycle that includes all inland waters, and a transitional and coastal waters framework that provides the necessary legal coverage for water management and the protection and conservation of water bodies.

The current administrative model has resulted in a division of responsibilities, whereby the General State Administration has taken over the management of the public water domain and water supply services, either through the basin organisations in the inter-municipal districts, through agents providing upstream services and through agents financing infrastructure. The Hydrographic Confederations are responsible for water management in the basins and the user communities, which are public law entities, depend on them, all under the supervision of the General Directorate of Water, which manages most of the investment budgets allocated to water by the national government.



1. Figure: Water and nutrients governance structure in Spain. UVIC-UCC own elaboration based on bibliography consulted

2.b.4 Example 4: Nutrient governance at Baltic Sea region

The Baltic Sea region a large number of governmental organizations and regulatory frameworks related to the regulation of eutrophication. International governance is dominated, the most notable aspects of this are EU legislation and Helsinki Commission (HELCOM) action plans and recommendations. The Baltic Sea Action Plan (BSAP) approved by the nine littoral states in 2007 aims to restore the Baltic Sea and involved an update of the nutrient management provisions of the Helsinki Convention, to be implemented by parties in national legislation (Andersen et. al, 2022). The European Union Strategy for the Baltic Sea region (2009) is a macro-regional strategy with one of its objectives being to save the sea. The goals are complimentary and relate to many different kinds of policies. The European countries involved in this action plan are Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, and Sweden, but it is also open for cooperation with EU-neighbouring countries, such as Belarus, Iceland, Norway, and Russia.

Although the implementation of some approaches within the Helsinki Convention resulted significant reduction of phosphorus discharge in the Baltic Sea in the last decades, eutrophication is still the biggest problem for the Baltic Sea environment. Governance is mostly a top-down process because of the important role of international entities, due to the needs of several different countries in the region, complexity of both the environmental and legislative context making it a complex issue to find the right governance framework to reduce eutrophication and nutrient recovery. Although there is not a common solution in the Baltic Region due to a lack of legal and economic motivations, a number of initiatives have been implemented to address the problem of sustainable nutrient management.

- At the national level, several countries—including Finland, Germany, and Poland—have already accepted certain strategies and practices in the framework of circular economy action plans. Nevertheless, the specific acts of these strategies vary throughout nations.
- Governmental funding schemes supporting the development of innovative technologies in the field of CRM recovery exist in each of the Baltic Sea countries. In Estonia, national funding initiatives already exist: (i) The Environmental Investment Center supports the implementation of environmental initiatives at the national level. (ii) The Circular Economy Program encourages activities that lead to a more effective use of resources (P-recovery program); (iii) The P-recovery program, which is part of the circular economy program, encourages actions.
- In Poland there are many projects related to nutrient management and a large number of scientists have been working on P-recovery solutions for many years.
- There are three installations for P recovery from different waste streams in the Baltic Sea: one is being built in Poland, one is in Denmark (4), and Germany (5).
- The obligatory recovery of P from selected waste streams (sewage sludge and sewage sludge ash) generated in the municipal WWTPs is adopted only in Germany and not in the other Baltic countries.
- It is currently not required to assess the environmental effects of new or upgraded technologies (or their products), either in the Baltic region or in the majority of other nations. This would require reliable data at national and international level.
- InPhos project studied the sustainable management of phosphorus in Baltic countries, with the application of a holistic approach. It can be said as a summary of the research that there are both possibilities and obstacles for the Baltic Sea region's phosphorus management policies to be implemented. This requires not just the development of innovative technology, finance strategies, business models, and policies, but also systemic changes in people's awareness and behaviour.
- Jetoo (2018) explored the role of non-governmental actors in ecosystem resilience. Governance innovations have led to international scientific collaborations in the form of the Association for the Advancement of the Baltic Studies (AABS). Besides, leadership at national level has led to innovative funding and management mechanisms to reduce phosphorus loads into the Baltic Sea. At the municipal level, cities have built networks around projects to reduce nutrient loads. At local level, innovative crowdsourcing has been used to engage the local public and raise funds.

Andersen et. al (2022) provide a comparative synthesis and assessment of national policy and the governance capacity of the nine coastal states (Russia, Poland, Germany, Sweden, Finland, Denmark, Estonia, Latvia, Lithuania) to implement the nutrient emission reduction provisions of the Helsinki Convention. National policy styles reflect countries' capacities for governance and implementation. Its two dimensions: the predominant approach to problem solving and the relationship between government and other actors, in other words consensus ability and strategic proficiency. The distribution of administrative competencies, as well as the patterns of administrative coordination and control, have both a vertical and horizontal dimension: vertically the degree of centralization/decentralization and horizontally the degree of fragmentation/concentration. They concluded that governments which are strongly concentrated vertically, while fragmented horizontally, lack capacity including with respect to informal institutions that can leverage the implementation of nutrient emission reduction provisions of the Helsinki Convention. Table 3. summarise the formal and informal institutions of the studied countries.

3. Table: Formal and informal institutions at the domestic level impacting implementation of the Helsinki Convention's agricultural measures

Source: Andersen et. al (2022)

	Formal institutions		Informal institutions
	Horizontal	**Vertical**	**National policy style**
Russia	Fragmented +++	Deconcentrated; disempowered regional and local level	Top-down imposition with arbitrariness
Poland	Fragmented ++	Hybrid of decentralized and deconcentrated	Reactive legalism with multiple veto-points
Germany	Fragmented +	Multi-level with empowered Länder	Legalistic imposition; weakly anticipatory
Sweden	Concentrated +++	Decentralized; empowered local level	Expert-led consensus; anticipatory
Finland	Concentrated ++	Decentralized; empowered local level	Farmer-biased consensus; anticipatory
Denmark	Concentrated ++	Decentralized; empowered local level	Conflict prone consensus; anticipatory
Estonia	Concentrated +	Deconcentrated; disempowered local level	Reactive with consensus-building
Latvia	Concentrated	Deconcentrated; disempowered local level	Reactive; conflict prone
Lithuania	Concentrated	Deconcentrated; disempowered local level	Reactive; legalistic imposition

The strength of concentration or fragmentation of environmental authority is indicated by the number of '+'.

Germany, Poland, and Russia are three nations with legalistic cultures of governance that are reluctant to adopt and put into practice the Helsinki Convention's nutrition management requirements. In these countries often lack informal organizations that may enable agreements with target groups to encourage practical implementation and financial compensation, and their environmental authorities are weakly positioned within the official institutional system. Furthermore, there is a comparatively significant concentration of resources and powers both vertically and horizontally.

While some of the smaller countries, such as **Estonia and the Scandinavian countries**, has a thoughtful and progressive governing culture, not all of them have the capacity of implementing comprehensive nutrient management policies. The asymmetric priority given to agricultural organizations and the high degree of conflict over material interests tend to diminish the capacity of governance, for example by gradually displacing environmental authorities with other institutions.

The administrations of the **Baltic countries** are relatively small, with many key actors having "multiple identities", which makes it easier to incorporate ideas and personnel from NGOs and academia into state activities. While this may facilitate the formal transposition of supranational regulations, there is a lack of professional dialogue on nutrient challenges and solutions due to weak advisory services and fragmented agricultural unions. In the Baltic States, the environmental governance system is centralized. The level of efforts related to nutrient management differs, with Latvia's approach to compliance being more restrained than Lithuania's, while Estonia's official legislation is more in line with the Helsinki Convention (Andersen et. al 2022).

2.b.5 Example 5: Nutrient governance and related initiatives in Visegrad Four (V4) countries

According to Schmol et. al (2023 a) there is currently a study gap regarding the identification of P recovery potential and best practices for P recovery in V4 countries, for which comprehensive data are not accessible. Besides, primary-source fertilizers continue to be less expensive than secondary-source fertilizers what is hinder the situation. However, in the V4 countries' current imports can be replaced by raw materials from secondary sources, such as industrial wastewater, biomass, industrial waste and other materials, but large secondary P resources are wasted, because P is not recovered and directed to make fertilizers. Unfortunately, P usage in V4 countries results in losses at every point of the resource's lifecycle due to the lack of knowledge of amount and recovery potential of P-rich waste sources, know-how, lack of action plan, financial resources or low awareness on P importance for people's lives. In V4 countries, municipal wastewater treatment plants (WWTPs) have the greatest potential for P recovery because P can theoretically be recovered at every stage of the treatment process. However, so far, there is no industrial plant in the V4 countries recovers P from sewage sludge. Therefore, further initiatives (economic, environmental, legal or social) should be developed to support the implementation of P recovery technologies. However, V4 nations have made efforts to increase societal awareness of P raw resources. Organizations that support creative approaches to P extraction and sustainable management or international projects involving P raw materials are examples of initiatives that spread knowledge about P raw materials.

BIOEAST initiative was born by the countries of the Visegrád Cooperation - the Czech Republic, Hungary, Poland and Slovakia – and extended by Bulgaria, Croatia, Latvia, Lithuania, Estonia, Romania, and Slovenia. The aim of the BIOEAST is to develop a knowledge-based, sustainable and circular biomass-based economic strategy and to develop a macro-regional research and innovation strategy programme for the Central and Eastern European macro-region, identifying common research and innovation priorities. The initiative provides a common research and innovation strategic framework for the development of sustainable biomass-based economies in Central and Eastern European countries. Under BIOEAST, 5 specific thematic areas have already been identified at macro-regional level, where Thematic Working Groups (TWGs) have been set up to identify common research and innovation priorities and to develop a strategic research and innovation agenda. The thematic working groups are the following: Working Group on Freshwater and Biomass-based Economy; Bioenergy and High Value-Added Products Thematic Working Group; Agroecology and Sustainable Yields Thematic Working Group; Food Systems Thematic Working Group; Thematic Working Group on Forest Value Chains. Two projects funded by Horizon Europe are based on the aims of BIOEAST: the BIOEASTsUP and the BOOS4BIOEAST (bioeast.eu).

The following table summarizes some of the good practices, projects and initiatives related to circular economy and nutrient management in the V4 countries.

4. Table: Examples of good practices, initiatives, projects for circular economy and nutrient management in V4 countries

Source: based on Schmol et. al (2023a)

<table>
<tr><td colspan="4">BIOEAST - BIOEASTsUP, BOOST4BIOEAST</td></tr>
<tr><td colspan="4">Project PhosV4: Project aims to increase knowledge and awareness of importance of Phosphorus (P) raw materials for food production in Visegrad Group</td></tr>
<tr><th>Czech Republic</th><th>Slovakia</th><th>Hungary</th><th>Poland</th></tr>
<tr><td rowspan="2">Czech Phosphorus Platform (CPP): an organization that gathers individuals, academic institutions, government organizations, and private companies due to the growing emphasis on sustainable agriculture, waste management, recycling, and the circular economy.</td><td rowspan="2">Project Drinking water supply, sewerage and wastewater treatment: project contributed to reducing pollution and improving wastewater collection.Improvements to current infrastructure included simplifying the process of eliminating P and nitrogen from the water.</td><td colspan="2">Project Nutri2Cycle: the project use an integrated approach to enable the transition from the current, suboptimal nutrient household in European agriculture, it will help closing nutrient loops.</td></tr>
<tr><td>Genezis: The leading Hungarian fertiliser partner network includes five large companies. The company places emphasize the use of innovative, environmentally friendly technologies.</td><td>Project ‘Modernisation and Extension of WWTP Jarocin’: the construction of a station for the recovery of raw materials, (such as N, P and biogas), at the sewage treatment plant in Cielcza.</td></tr>
<tr><td>Lake Brno’ is Brno's largest reservoir project: the project aims to reduce the impact of excessive eutrophication on water.</td><td rowspan="3">Slovak Grant Agency for Science (Grant No. 1/0563/15): project focused, inter alia, on the biochemical treatment of sewage sludge and phosphogypsum under conditions reducing sulphates with the release of P.</td><td rowspan="2">Nutrient Reduction Project: The project aims at improving the water quality of the Danube River and the Black Sea by reducing nutrient discharge from Budapest, and by increasing the nutrient trapping capacity of the Gemenc and Beda-Karapancsa wetlands, situated in the lower Hungarian part of the Danube River.</td><td>Project InPhos: Sustainable management of phosphorus in the Baltic region</td></tr>
<tr><td>Fosfa: greatest processor of yellow P in Europe, an innovative Life Science company, which company strongly keeps principles of sustainable development and footprint reduction.</td><td>Project LEX4BIO: Optimising bio-based fertilisers in agriculture – Providing a knowledge basis for new policies</td></tr>
<tr><td rowspan="3">Lovochemie: largest producer of fertilisers in the Czech Republic, trying to find long-term sustainable sources of P to replace current raw materials in future</td><td rowspan="3">Circular Economy Platform: So far, 101 companies and organizations have joined the Platform, the purpose of which is to accelerate the transition to a circular economic model by sharing knowledge, creating joint projects and collaborations.</td><td>Project PhosForce: Market ready technologies for P-recovery from municipal wastewater</td></tr>
<tr><td>Project CEPhosPOL: Towards Circular Economy in wastewater sector: Knowledge transfer and identification of the recovery potential for Phosphorus in Poland</td></tr>
<tr><td>PolFerAsh: Polish Fertilizers form Ash</td></tr>
</table>

2.b.6 Example 6: Example from the dairy sector (The Netherlands)

Hoes and Aramyan (2022) examined the case of the sustainability transition in Dutch dairy production. Although environmental policies for agriculture have been developed and implemented for decades, nitrogen and greenhouse gas emission levels have not decreased significantly. These policies have mostly targeted a larger group of dairy farmers who need to take steps to become more sustainable but have ignored pioneering alternative dairy farmers. However, ignoring innovative farmers makes it more difficult to develop sustainable alternatives to the status quo, which should be a central aspect of the transition, as it is not only a matter of breaking down and phasing out unsustainable practices, but also of scaling up sustainable alternatives. In addition, market-based instruments and policy interventions that reward sustainable management will also foster the transition. In order to achieve a more responsible and inclusive sustainability transition, it is important to implement personalised policies that support pioneering alternative farmers who are already taking steps towards sustainable economies. However, the study has limitations due to the lack of available data on alternative farmers. The authors therefore draw attention to the importance of data collection and the availability of accurate information in the development of responsible policies.

3. Success factors and barriers of governance structures

This chapter aims to enhance main success factors and barriers of governance structures: capacities, frameworks, and structures. Based on the literature, the following are reviewed: what success and limiting factors can be identified that support or hinder the implementation of successful governance solutions? Which elements and frameworks are suitable or perhaps missing, what does currently limit the operation of governance models?

Under international law, states are entitled to control the natural resources located on their territory and maritime areas. Ensuring all farmers (in particular, on small-scale farms in less economically developed countries) have access to sufficient P to grow crops and are buffered from fertiliser price fluctuations is a global responsibility and requires international cooperation by exploring models of governance driven by a benefit-sharing approach (Brownlie et al. 2022). Based on Nathaniel (2023), the need to deal with increased change and uncertainty in natural resource management has led to more adaptive forms of governance.

Existing governance approaches to the nutrients problem specifically focuses on the relationship between the nature of governance and the measures taken. A great variety of governance approaches exist, e.g. source-based and effect-based measures (Wiering et al. 2023, Corelje et al. 2007). There are interesting differences in the consensual or antagonist discourses and differences in the use of mandatory instruments or area-based policies.

The major challenge in choosing the right governance approach in nutrient management problem is to adopt right source-based measures to compensate farmers for lower yields and higher costs of e.g. manure disposal.

EU member states adopt different governance strategies in addressing the wicked issue of nutrients from diffuse agricultural sources. Based on Wiering (2023), the governance structures of environmental and agricultural policies consist of national approach, organizational and program integration, participatory governance, and the capacities of public authorities are related to the substance of practical measures taken (effect- vs. source-based measures) and the choice of policy instruments (e.g., sermons, carrots, sticks).

The effectiveness of implementing a new governance model depends on how its functional and structural elements are interrelated and whether they meet basic criteria, such as decision legitimacy. Decision legitimacy is influenced by transparency and accountability in policy processes, as well as the consensus generated around them.

The text discusses the importance of representativeness in decision-making processes. This involves effectively incorporating a broad spectrum of stakeholders and their values, knowledge, and interests. It also highlights the need for political will and social leadership to carry out necessary reforms in legal, jurisdictional, socio-economic, and institutional frameworks and patterns of water use.

3.a Institutional framework

Institutional framework can vary along a scale of integration, including two dimensions: first, organizational integration is key, referring to the formal integration of water and agricultural organizations, through joint institutions or other forms of institutionalized collaboration, varying from the clear separation of responsibilities between ministries to the existence of institutionalized exchange and the responsibility for nutrient pollution within one joint ministry. Second, program integration is considered, referring to the qualitative integration of organizations through the existence of joint programs on water management and agriculture in which instruments are decided upon together, varying from separated programs to the existence of joint programs of water management and agriculture.

Ahlström and Cornell (2018) investigated the structural properties of governance regarding global nitrogen and phosphorus cycles, which are part of the planetary boundaries framework (based on Rockström et al., 2009 and Steffen et al., 2015). They found that governance of global N and P cycles is characterized by a loosely interconnected network among principal institutions and actors. Legal instruments of the European Union were identified as key cross-scale and cross-sectoral 'gateways' within this network. Overall, there is a recognized gap in governance at the global level for regulating N- and P-related issues. The study highlights the need for stronger governance of nutrient element flows at the international level, suggesting that current 'top-down' and 'bottom-up' institutions may not adequately address the complex, large-scale environmental systems involved. The lack of a unified global governance framework is reinforced by Morseletto (2019) who focused on the governance of excessive anthropogenic nitrogen.

Sharma (2020) investigated the challenges of addressing diffuse nutrient pollution from agriculture, focusing on the European Union's regulatory framework. Current EU approaches to mitigating diffuse pollution primarily involve command-and-control regulation under the Nitrates Directive and the Water Framework Directive. These approaches fail to adequately address the problem's complexity, often overlooking the multi-faceted and site-specific nature of agricultural practices and environmental impacts. Despite their intentions, these directives struggle to effect significant change due to their reliance on broad, top-down regulatory measures that do not fully accommodate the local knowledge and specific conditions of individual agricultural settings.

The study of Belinskij et al. (2019) critically examines the existing top-down regulatory frameworks within the EU and Finland, identifying their limitations in addressing the complex issue of nutrient loading. These frameworks lack the adaptive capacity to effectively support new, bottom-up solutions for nutrient management. The need for integrated and participatory approaches in nutrient management that include various stakeholders beyond farmers, aiming for a systemic change in the agri-food sector within the Baltic Sea region, has been expressed by Larsson and Granstedt (2010) too.

Andersen et. al (2022) concluded in their comparative synthesis that governments which are strongly concentrated vertically, while fragmented horizontally, lack capacity with respect to informal institutions that can leverage the implementation of nutrient emission reduction provisions of the Helsinki Convention. In Norway, two systems of compensation for environmental measures in agriculture aim to encourage farmers to reduce erosion and P-losses. One such system is meant to solve specific regional environmental challenges (Regional Environmental Programme, RMP) and the other system is for special measures requiring more long-term investments and maintenance (Bechman et al. 2016). In 2005, the agricultural environmental programme was changed from national to regional level, the regional environmental programme for the agricultural sector. The county governor authorities can adjust

measures to suit regional conditions like the agricultural production system, the main environmental problems in the county, i.e. erosion risk and pollution level. Since 2005, the agri-environmental programme has been regional in nature, which means that the county governor is responsible for the management of these schemes and has the freedom to choose the level of payments, adjust measures and implement new measures (Bechman et al. 2016).

Existing joint commitments, to ensure all farmers to have access to sufficient P resources, international law is also relevant. International trade obligations prohibit export bans on products, unless this is justified on good grounds, e.g. environmental considerations. It is recommended that progress in P sustainability by the establishment of an appropriate United Nations body entrusted with making a global assessment of all P reserves (Nedelciu et al., 2020) and developing harmonised criteria for 'sustainable P mining and trading'. The climate change negotiations could provide a suitable model for addressing common but differentiated responsibilities and the parties with more means (e.g., high-income countries) might take the lead in promoting nutrient security and equitable access to phosphorus (Brownlie et al. 2022).

Danielle et al (2014) formulate key obstacles of determining how to manage international law on national level, on how could meet the requirements of Europe's Directives, including the Water Framework and Floods Directive in Bulgaria. Bulgarian water sector under the new multi-level governance regime is multi-faceted and include improving urban and industrial water systems, as well as improving the Bulgarians' capacity to cope with floods and droughts. Many innovations for current practice are required to counter the widespread pollution legacy left by heavy industry and the reliance on centralised infrastructure (Carpenter et al., 1996; Hare, 2006) that were developed and managed by the country's technocratic and hierarchical bureaucracy. For successful plantation of international governance structure in a technocratic environment, the country includes education programmes, insurance, preparedness planning, early warning systems and local management groups that could work at a local level to build capacity to cope with flood and drought risk impacts. A capacity-building and collaborative approach to exploring the risks of floods and droughts in the Sofia region was the mechanism used by EU researchers to raise awareness of non-technical options, as well as alternative technical options, for improving water management. In the stakeholder engagement the only group with a strong will to facilitate the innovation's uptake was researchers from the EU project, the rest of the groups were neither strongly facilitating nor blocking the innovation's uptake, but some were naturally predisposed to more technical or non-technical risk management options.

Another good example for program integration is Czech Phosphorus Platform, which is an organisation that brings together private companies, government agencies, academic institutions, and individuals. The organisation creates conditions for various activities of members in recycling, circular economy, waste management, sustainable agriculture, and water management to reduce dependence on imports and to recycle P from waste, from crop and animal production in agriculture, from industrial and municipal wastewater (Smol et al. 2023).

Smol et al. (2023) report projects "How to stay alive in V4? Phosphorus Friends Club builds V4's resilience", whose main goal is to increase the knowledge and awareness of the importance of P raw materials for food production in the V4 countries. The project also aims to develop a strategy for the sustainable management of P, which will contribute to ensuring enough P for food production. It also includes various awareness-raising events such as a workshop and a follow-up conference.

The Livestock Environmental Assessment and Performance Partnership (LEAP), a multi-stakeholder initiative aimed at improving the environmental performance of livestock supply chains, are composed by

experts committed to developing science-based guidance and methodologies. The International Dairy Federation, which develops science-based standards for the dairy sector, or the International Meat Secretariat, which represents the global meat and livestock sector, could participate equally in the definition of targets related to livestock. The International Livestock Research Institute (ILRI) can also contribute to this process (Smol 2023).

Turkey had started to adapt the national policies to the EU Nitrate Directive by 2005, while the knowledge gap and disinformation released: The common belief of having more yields by using more fertilizer and irrigation of farmers is one of major problem that institutions are dealing with. To raise the awareness of farmers on this illegitimate belief coming from the past, the agricultural government broadcasting institutions regularly release educational broadcasts with scientific support to enhance knowledge transfer (JRC 2014).

Institutionalised collaboration exists in Slovenia, where water protection zones are protected by municipal and governmental regulations, aim of protection water bodies for public drinking water from pollution. Almost one fifth of the territory of Slovenia (345,000 ha), is water protection area, of which more than 7,000 hectares in under strictest protection regime. To reduce pollution of groundwater restrictions on stocking rates per ha of agricultural land and environmentally friendly methods of fertilization. Important role is also played by agri-environmental measures of the Rural Development Programme under CAP. Within the framework of the Rural Development Programme launched in 2004 the adaptation measures to Nitrate Directive in agriculture were set. Under these measures all farmers were obligated and financially awarded for building new storage facilities for animal manure on farms, which will certainly contribute to a better state of groundwater (JRC, 2014).

Certain governance structure can exist barely developed legal framework. The fundamental regulations are established through the legislative body of the Republic of Uzbekistan, namely the Oliy Majlis, as well as by the President and the Cabinet of Ministers. The enforcement of these regulations is predominantly executed by three ministries and affiliated entities within their organizational structure. During the research of Kolodrov et al. (2023), it was observed that there is a lack of legal acts that clearly define the responsibilities and authorities of ministries and agencies in soil management. However, it was discovered that a bill has been prepared to address this gap (Kolodrov et al. 2023). Nathaniel et al. (2023) reports similar shortcomings in governance framework. Sweden lacks a formal fertilizer classification, which currently renders legislation and regulations undefined.

The Green Paper on Water Governance in Spain identifies five main types of difficulties (MITECO, 2019):

- Legal and institutional, structural elements that include existing water regulation and any related regulations. It involves the legislative and administrative processes and associated financial resources. Lack of clear responsibilities of key actors could lead to coordination problems.
- Financial constraints, such as budget and funding, are also a factor.
- Political and cultural issues, including acceptability concerns and resistance from pressure groups, can also impact the implementation of change processes.
- Practical and technological aspects related to available information and technology.
- Insufficient human resources or training for the development of functions. This encompasses the capacity of organizations and their leaders to perform their functions adequately.

5. Table: Barriers and success factors of institutional framework

Barriers and weak points of existing institutional frameworks	Success factors and recommendations toward better institutional framework
Transboundary challenges of nutrient problem	
• Interconnected network of actors, lack of unified global governance framework • Sovereignty of international trade obligation • Determining international law on national level in countries with technocratic and hierarchical bureaucracy	• Stronger international governance to adequately address the complex, large-scale environmental systems • International body for global assessment of nutrient resources • Education, insurance and local management groups on local level to build capacity • Water protection zones protected by municipal and governmental regulations
Institutional system, path of current legislation	
• Command-and-control regulation of diffuse pollution • Critics of existing top-down regulatory frameworks within the EU and members • Strongly vertically concentrated and horizontally fragmented governments lack capacity with informal institutions • Lack of legal acts that clearly define the responsibilities and authorities of ministries and agencies in soil management. • Lacks a formal fertilizer classification, which currently renders legislation and regulations	• Accommodation of the local knowledge and specific conditions of individual agricultural settings • Integrated and participatory approaches that include various stakeholders beyond farmers • County governor authorities can adjust measures to suit regional conditions (eg. freedom to choose the level of payments, adjust measures and implement new measures)
Demand for innovation, knowledge and collaboration	
• Lack of mineral deposits of phosphate rock in V4 • The common belief of farmers of having more yields by using more fertilizer and irrigation	• Czech Phosphorus Platform brings together private companies, government agencies, academics and individuals, creates conditions to reduce dependence on imports • The International Dairy Federation, develops science-based standards improving the environmental performance • Collaborative approach to environmental governance, aims to socialize accountability and the use of nutrient modelling

3.b Width of stakeholder participation

In terms of participation, the width of stakeholders involved, their degree of involvement, and their negotiation power traditionally play a role. Stakeholders are here defined as all those being affected by decisions, but we will mostly focus on the water and agricultural stakeholders involved in the implementation. In terms of the width of stakeholders, representative stakeholders could not be involved, partly be involved, or be mostly involved. Their degree of involvement in planning can vary from pure information sharing, via the possibility to share recommendations to co-decision-making. Finally, negotiation power describes the actual power in negotiations, varying from a weak to a strong power position.

Balanced stakeholder participation in negotiations is necessary to ensure P security and avoid 'regulatory capture' by industry. The concept of 'regulatory capture' has been introduced to reflect situations where the decisions of regulatory agencies are dominated by the industries or interests, they are charged with regulating. There is also a need to recognise socio-political power differences between different stakeholders, both nationally and internationally (Brownlie et al. 2022).

Nutrient management being internationally affected, the global action is required. Smol in 2022 formulate the first motive of failure, which is the existence of global transboundary impacts, which are reciprocal cross-border consequences that are not unilaterally manageable. Nitrogen impacts can be global, in relation to atmospheric emissions; regional for water; and local for soil. Some countries could therefore hinder a framework convention and not consider nitrogen impacts to be "global enough". Further cause for aborted regimes relates to the shared consequences of impacts, and shared benefits of international policy coordination at the global level. UN-Water shows a weak point: the absence of an intergovernmental governing body exerting direct control and formal decision-making power (Morseletto 2023). A holistic solution can be built in a step-by-step manner by upgrading the current system and creating further links, or enforcing existing interlinkages, such as those between CLRTAP and WHO, and between the Water convention and FAO. A facilitating role can be played by an organisation that builds consensus on relevant issues such as targets and indicators, while providing guidance for the elaboration of response strategies. According to Bull et al. (2011) and Sutton et al. (2013), this role can be played by the Global Partnership on Nutrient Management, which includes governments, industry, science community, NGOs, UN agencies, and international and regional organisations. The following table describes the barriers and success points of holistic and origin-based governance structures.

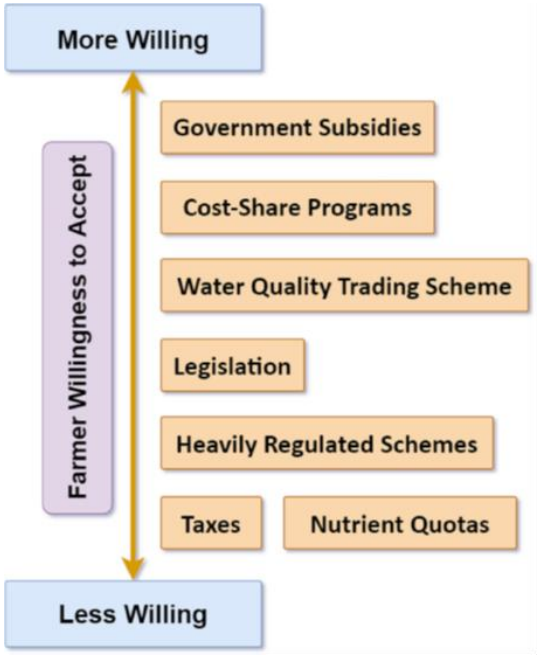
6. Table. Policy evaluation criteria — holistic versus origin-based.

Source: Morseletto 2023

CRITERIA	HOLISTIC	ORIGIN-BASED
Achievability	more difficult because of the high number of actors involved	easier because of cohesive groups that can reach consensus
Manageability	more complex to manage because of diversity of programmes and the number of participants	simpler to manage because the decision process can be leaner and focused

Effectiveness	higher because of wider application and expected comprehensive results	lower, but high on single-issue area because of lesser broad results, however effective on specific issues
Efficiency	equal under best possible conditions	equal under best possible conditions
Responsiveness	lower because of diversity of programmes and the number of participants	higher because of its simple structure and agile decision making process
Coherence	lesser because of the number of actors and multi-focus policies	higher because of the synergies among targets and policies
Coordination	more difficult because of the articulation of actors and organisations	easier because of the higher homogeneity of groups and relatively low number of actors

Stakeholders accepts governmental structures and its instruments differently. Bratt (2004) emphasise that there is a greater need to promote policy and a consistent framework that regulates nutrient runoff in a manner that provides support at all levels of governance. In Sweden, this was successfully trialled at a municipal level, though globally, and even nationally, such a coordinated system still doesn't exist, causing the disconnection between different stakeholders and levels of government and an effective framework that includes comprehensive stakeholder engagement is vital to ensure success at all organisational levels (Juncal et al. 2023).



2. Figure: Farmer willingness to accept different policy types.
Source: JRC 2014

Adoption willingness of nutrient policies is another key barrier to implementation, with political and governmental influence and decision-making being a significant driver of how farmers react to different instruments. Unsurprisingly, farmers were also more likely to prefer subsidies or cost-share programs as policy incentives, rather than taxes or quotas, which act more as punishments for poor farming practices (Arbuckle, 2013). However, this alone is not enough to determine policy success, with the age, farm size, farmer education level and socio-economic status among some of the factors that influence willingness of adoption relating to different policy types (Akkari and Bryant, 2017). More localised policy, general legislation (such as those created by federal governments), which can target the most critical factors that tend to account for farmer willingness to adopt different strategies (Akkari and Bryant, 2017).

In line with above findings, narrowing down the focus and providing more personal support to farmers has yielded positive results in small-scale studies, where environmental damage can be mitigated and stakeholders can maintain their economic standing (Arbuckle, 2013; Bratt, 2004).

7. Table: Barriers and success factors of stakeholder engagement

Barriers in width of stakeholder engagement	Success factors and recommendations toward stakeholder involvement
• Socio-political power differences between different stakeholders, both nationally and internationally • Global transboundary impacts of international policy coordination • Stakeholders accepts governmental structures and its instruments differently • Adoption willingness of nutrient policies being a significant driver of how farmers react to different instruments • Farmers were also more likely to prefer subsidies or cost-share programs as policy incentives, rather than taxes or quotas, which act more as punishments for poor farming practices	• Balanced stakeholder participation in negotiations is necessary to ensure P security and avoid 'regulatory capture' by industry • Enforcing existing interlinkages, such as those between CLRTAP and WHO • Facilitating role can be played by an organisation that builds consensus on relevant issues • Effective framework that includes comprehensive stakeholder engagement is vital to ensure success at all organisational levels • Narrowing down the focus, providing more personal support to farmers and stakeholders can maintain their economic standing has yielded positive results in small-scale studies

3.c Planning capacity and resources (human and financial)

Authorities' capacities, refer to the planning capacity of public authorities, and more specifically to the resources for planning. Resources to vary along a scale of resource availability, including human resources (i.e., the existence of sufficiently skilled personnel in public authorities to plan relevant measures) and financial resources (i.e., enough funding for planning under complex conditions, including relevant

information gathering). The planning capacity can vary from a low degree (i.e., frequently discussed as not having enough resources), to a middle degree (i.e., some lack of human or financial resources for planning), to a high degree (e.g., enough skilled personnel, and funding for planning).

Bakalár et al. (2022) highlight lack of governmental support in field of nutrient management in agriculture cause the main barriers. Slovakia depends on the import of P, however stakeholders face lack of governmental support, lack of state policy, lack of initiatives, lack of investments, lack of major research projects, etc., concerning all the aspects of P management.

Question of managing nitrogen and phosphorus load to water bodies in Montenegro does not belong to the systemic solved issues. In the government structure the competence is divided between two ministries: Ministry of Sustainable Development and Tourism (competence for environmental protection and utilities) and Ministry of Agriculture and Rural Development (competence for water management, monitoring of water regime, water issuing permissions), in its structure also the Directorate for Water and the Directorate for Forests. However, the complete water sector is characteristic by a lack of staff and weak commitment to address this issue (JRC, 2014).

European commission point out to the Slovenian government major obstacles and bottlenecks in the implementation of the policies and in the achievement of targets. They point at absence of real analysis of cost effectiveness - Individual cost-effectiveness studies should be carried out on certain practices. They point out that analyses of future development of water quality are missing and that there is a lack of methodologies and lack of appropriate modelling tools (JRC, 2014).

Vignola et al. (2013) declares that regulatory and scientific stakeholders are little represented at sub-national scales (i.e. watershed and local), in contrast to actors directly involved in soil regulation services. Thus, scientific, and regulatory organizations require the bridging capacity of organizations such as ASA-Pacayas at the intermediate scale of the watershed to provide them information, gathered from field visits to farmers, useful to create or adjust norms on soil management or design new research to identify soil management feasible solution. Similarly, farmers also require this bridging capacity to transfer information on rules, incentives and technical solutions to improve their soil management practices.

In line with Vignola et al. (2013) recommendations, Boudoin-Gittins highlight how width of financial capacity of stakeholder involvement influences ecological outcomes. Collaborative governance is “a governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented and deliberative and that aims to make or implement public policy or manage public programs or assets”. For example, the agricultural representatives are elected by regional agricultural councils, while NGO representatives are proposed by their corresponding national federations. In French river basins, basin committee members have been taking part in deliberations only if they attend the meetings. Attendance has been a concern in river basin committees, as meetings require time and technical expertise. Members are not paid to participate but are compensated for their travel expenses. A decree was published in 2014 to try to rein in absenteeism. In case of absence, a member can give their voting right to another member. A present member can receive the voting right of maximum two other members. Regarding financial capacity, higher agency income was linked to lower concentrations of 5-day biochemical oxygen demand, total phosphorus, whilst this was not the case for NO3. In the case of Diffuse Water Pollution from Agriculture, the involvement of agricultural stakeholders alone is not enough to yield desirable ecological outcomes. Previous research hints that the most effective pattern of stakeholder involvement is not necessarily a broad and inclusive

approach but rather a smaller selection of key actors (Ulibarri and Scott 2017). Collaborative processes playing out at a smaller geographical scale than the basin could also yield better results (Baudoin-Gittins, 2021).

Danielle et al. (2014) points out that in Australia the water bureaucracy within the local government was subject to substantial delays in planning. A key argument from the water authority and appointed consultants was that a similar amount of traditional infrastructure should be built regardless of the local reductions in water demands, wastewater discharges and stormwater runoff. Thus, the ''headworks'' charges paid by developers, a large amount of money, could be used to build the local infrastructure, rather than be paid to the water authority and eventually to the State Government as dividends. This perceived loss of revenue was a main driver for the water bureaucracy.

In China the state bureaucracy resulted barriers for implementation of Myun watershed restoration project proposal. In the project's broader meetings, both county and provincial representatives whole-heartedly supported the proposals of this official, whom they greatly respected. Yet, they were ignored by central government agencies, in large part as they cut across existing rigid jurisdictions and responsibilities. The last proposal remains politically sensitive (Danielle et al. 2014).

Sweden administrative planning requirements faces barriers in scheme design in beachcast governance and management (Nathaniel et al. 2023). Farmers were not consulted in the decision-making process. Instead, the responsibility of complying with this rule complicated the process due to farmers' overall lack of interest in using beachcast. Hence, farmers are formally required to be a part of the scheme at the level of execution, but in practice operate in. While agriculturally related environmental aspects were mentioned by stakeholders at all levels of governance, the positive environmental aspect of curbing eutrophication was mainly mentioned by top-level and ground-level planning. Moreover, concerns of unknown marine or coastal ecosystem effects were almost solely mentioned at top-level planning. At all levels of governance, knowledge gaps regarding the environmental effects of harvesting and using beachcast were perceived to be the cause of conflicting or lacking rules and regulations as well as administrative load and bureaucracy. Altogether, stakeholders at all levels wished to acquire and access environmental knowledge of beachcast harvesting and use this knowledge to improve management processes. In response to the administrative load and bureaucracy, top-level planning sought to centralize management (Nathaniel et al. 2023).

8. Table: Barriers and success factors of capacity

Barriers of planning capacity	**Success factors and recommendations of planning capacity**
Capacity of human resources	
• The lack of staff and weak commitment to address the nutrient problem • Regulatory and scientific stakeholders are little represented at sub-national scales in legislative planning • Involvement of agricultural stakeholders alone is not enough to yield desirable ecological outcomes	• Actors directly involved in soil regulation services by field visit useful to create or adjust norms on soil management • A governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented and deliberative.

• State bureaucracy resulted barriers for implementation of watershed restoration project • Farmers were not consulted in the decision-making process	• The agricultural representatives are elected by regional agricultural councils, while NGO representatives are proposed by their corresponding national federations
Capacity of financial resources	
• The absence of real analysis of cost effectiveness • A large amount of money, could be used to build the local infrastructure	• Individual cost-effectiveness studies should be carried out on certain practices • Agri-environmental aspects were mentioned by stakeholders at all levels of governance • Stakeholders at all levels wished to acquire and access environmental knowledge

3.d Governance structures

Ahlstrom (2018) suggest that new policies and techniques should derive success factors and barriers to nutrient cycle governance structures. Polycentric governance, which involves "many centres of decision making that are formally independent of each other", is often mentioned as a possible alternative with a number of proposed benefits.

The decision-making process of the European Union involves three institutions: The Commission, the European Parliament and the Council. The Commission promotes general interests and oversees the application of EU law under the control of the European Court of Justice. The Commission has the power of legislative initiative: it prepares legislative acts to be submitted to the European Parliament and Council for evaluation and approval. The European Parliament fully shares the role of co-legislator with the Council: the main proposals put forward by the European Commission are being reviewed by the Parliament and the Council, which they approve or reject the proposal. If the European Parliament is an important seat of decision-making at the EU level, the Council of the European Union is the community institution that represents the governments of each country (Franchesci-Rose 2018).

According to the agriculture legislative process, there are some important lessons learned in past of European legislative processes:

- The European Commission regularly consults civil dialogue groups and agricultural committees to best shape law and policies governing agriculture. Expert groups provide input to the European Commission, for example the agricultural market task force (AMTF) on unfair trading practices.
- The European Commission carries out impact assessments when planning, preparing and proposing new European legislation, examining a need for EU action and the possible impacts of available solutions. They are a key part of the EU's better regulation agenda. Impact assessments for agriculture and rural development took place in 2008 (health check – SEC(2008) 1885), 2011 (CAP towards 2020 – SEC(2011) 1153 final).

- The European Commission regularly publishes the public opinion reports (also called Eurobarometer) on Europeans, agriculture and the CAP. The Eurobarometer surveys, run in all EU countries, provide valuable information on citizens' perception of CAP. This includes awareness of the support provided through the CAP, its performance, quality matters, environment, importance of the CAP and much more.

EU aims to transform Europe into a modern, resource-efficient and competitive economy with no net emissions of greenhouse gases by 2050. Bethwell et al. (2022) highlighted the success factors of well-functioning EU governance structures. Hierarchical approaches are based on a system of command, where decision-making power rests with the top level, and is then further passed down to subordinate levels. Examples include the European Union's Natura 2000 programme, which aims to maintain natural and semi-natural valuable habitats, and rare or threatened species, and the Water Framework Directive. It can also be understood as payments for ecosystem services, where the government pays on behalf of the beneficiaries, e.g. greening measures. Later, the European Green Deal was designed as the EU's compass to achieve clean, resource-efficient, and competitive economy goals. It aims to ensure zero emissions by 2050, making Europe the first climate-neutral continent in the world. The European innovation partnership for agricultural productivity and sustainability (EIP-AGRI) works to foster competitive and sustainable farming and forestry that 'achieves more from less'. EIP Operational Groups are local innovative projects funded by the common agricultural policy that bring farmers, researchers, advisers and other stakeholders to advance innovation in the agricultural and forestry sectors to achieve Sustainable Development Goals.

Market-based approaches are based on voluntary exchange between two parties: the product market and the factor market, i.e. factors that are used in the production process (e.g. labour, machinery, fertiliser). Example: sale of high-quality regional products.

Collaborative approaches are based on cooperation among stakeholders, often at the local community level, following a set of selfdefined rules. These approaches are often initiated by local civil society initiatives and are driven by exogenous factors, such as finance gaps (García-Martín et al., 2016). In Europe, they typically aim to tap into additional financial resources for cultural landscape management and to encourage information sharing and cooperation.

The interplay between nutrient management practices in agriculture, specifically dairy farming, and the collaborative governance model in Canterbury, New Zealand was explored by Hale et al. (2022). This governance model, designed to address water quality issues, incorporates various stakeholders, including government representatives, water management experts, farmers, and non-farming community members, into committees that develop water management plans. At the same time, significant feature of the water management plans is the establishment of nitrogen loss thresholds for farms within a catchment, implemented through nutrient modelling – according to the authors, the latter can undermine the collaborative intent of the governance model by isolating responsibility to individual farms and detracting from a more integrated, community-wide approach to environmental management. So, tension can be observed between the collaborative approach to environmental governance, which aims to socialize accountability among various groups, and the use of nutrient modelling, which in practice can desocialize accountability.

Morseletto (2023) defined structural differences regarding the type of environmental problems. Only 30–50% of applied nitrogen fertiliser is taken up by crops, however, there are enhanced efficiency fertilisers in the product portfolio. These products can be promoted in different policy structures, though a

hierarchical state-led model of governance, or as multi-stakeholder partnerships (Pattberg, 2016). The Forest Stewardship Council is a successful model of this kind of nonstate governance.

Franchesci-Rose (2018) highlights barriers driven by governance structures in market of fertilising products. Commercial fertilisers still appear to be more attractive by law to the current market conditions. Additional administration challenges, such as construction permission for nutrient recovery facilities or product registration, prevent the establishment of new sustainable and circular technologies. Further on, the market prices for agricultural/dairy products are very competitive. Profit margins are so small that farmers often depend on the direct payments of the CAP and cannot afford any investments or financial or production risk. In addition, food retailers and costumers are used to buy conventional products to a favourable price or pay only slightly higher amounts for organic products which cover not the real production costs.

9. Table: Barriers and success factors of governance structures.

Barriers and week points of governance structures	**Success factors of governance structures**
Existing governance approaches	
• Governance approaches are often initiated by local civil society initiatives and are driven by exogenous factors, such as finance gaps • Structural differences regarding the type of environmental problems • Different products can be promoted in different policy structures, though a hierarchical state-led model of governance, or as multi-stakeholder partnerships	• EU regularly consults civil dialogue groups and agricultural committees to best shape law and policies • EU carries out impact assessments when planning, preparing and proposing new legislation, examining a need for EU action and the possible impacts of available solutions • The European Commission regularly publishes the public opinion reports (also called Eurobarometer) on Europeans
Market driven governance considerations	
• Some agricultural products are more attractive by law to the current market conditions (eg. fertilisers) • The market prices for agricultural/dairy products are very competitive. Profit margins are so small that farmers often depend on financial supports • Food retailers and costumers are used to buy conventional products to a favourable price or pay only slightly higher amounts for organic products	• Collaborative approaches are based on cooperation among stakeholders, often at the local community level, following a set of self defined rules. • These approaches are often initiated by local civil society initiatives and are driven by exogenous factors, such as finance gaps

4. Survey on current practices at the demo-sites

The first part of the study is a literature review. This included a mapping of the characteristics of governance models, with a particular focus on nutrient pollution. A thematic analysis of the literature was carried out to identify the factors that hinder and those that facilitate the development of well-functioning governance structures. In this work we analyse how the policy styles, the existing operative programmes, the success factors of applied policies, participatory governance, and the capacities of public authorities are related to the choice of policy instruments regarding the N and P nutrient cycle. This thematic literature review laid the foundation for the next step of the research, which involved the compilation of a structured interview aimed at identifying the governance structures of the demo-sites involved in the project.

4.a Methodology of survey

In compiling the structured interview, we sought to understand the factors that shape the governance structures of each demo-site. In doing so, we focused on the knowledge that each partner had about nutrient pollution and the framework that governs it. In particular, what other stakeholders they work with, what factors influence this and what they would need to develop a more effective governance system specific to each demosite. By this structured interview, we address specific problems of governance characteristics, general patterns of policy styles, types of intervention and governance structures, which can support the planning of effective nutrient management measures.

Following this basic work, a structured interview was compiled and completed for all the demosites participating in the project. The aim was to ensure that the structured interview was completed by a partner from the field, a company and an organisation (university, integrator, other professional organisation) with a greater insight into the policy side.
In order to get a broader view on the characteristics of nutrient pollution management systems, the survey was complemented by two semi-structured interviews with a representative of an international organisation (FAO) and a related international project (BIOEAST). The results of these semi-structured interviews are also presented in the following chapter. The table below shows the organisations that completed the structured interview and the semi-structured interview participants.

10. Table: Participants in the data collection

Structured interview	
Region	**Organisation**
Ebro region	
Spain	
Catalonia region	BETA Technological Center (UVIC-UCC)
Aragon region	CIRCE- Technology Centre
	CAYC – Comunidad General de Regantes Canal de Aragón y Cataluña

Danube region	
Hungary	
	SZE (University)
	TEBIKE (demosite)
Slovakia	
	SUA
	SUA-UF, University farm (field test for demosite will take place)
Lielupe region	
Latvia	
	Latvian Water and Wastewater Works Association
	ZSA, NGO "Farmers Parliament"
Lithuania	
Semi structured interview	
BIOEAST	BIOEAST
FAO	FAO (Food and Agricultural Organization of the United Nations (UNFAO)

In the questionnaire, we included topics on existence of nutrient cycle tracking mechanisms at demo site, nutrient management regulatory environment, partner's cooperation, policy instruments and governance structures.

4.b Results of interviews

The main findings from the semi-structured and structured interviews are summarised below. The general findings from policy stakeholders are also summarised below. The detailed responses to the structured interviews, structured by demo-sites and themes, are presented as a case study description in the Annex 2. At the end of each demo-site case study, we have compiled a list of strengths and weaknesses specific to the governance system of that demo-site.

As regards the regulatory and implementation issues, it can be noted that there is a problem of inadequate communication and coordination between the various ministries concerned within a given country when applying a directive. At the policy level, it would be very important to ensure proper communication and cooperation between ministries. An example of this could be the establishment and operation of inter-ministerial expert groups. For example, the issue of nutrient pollution affects water management, soil, environmental protection and agriculture, and there may be conflicts of interest between the different policies and areas.

The policy background in these areas is usually in different ministries. Properly addressing these issues will require cooperation between the ministries concerned. It is common for one ministry to make a law or a decision that usually has a national scope, while another ministry has another decision that contradicts it. In other words, the harmonisation of laws is not done properly. But even if the

harmonisation of the law is correct, the implementation structure of the law, the practice of applying the law, is not harmonised.

Ministries should be responsible for ensuring the effective flow of information on the various directives and objectives to farmers. For example, proper communication of why each regulation or directive is needed. The ministries should prepare farmers and stakeholders in good time before the introduction of a regulation and soften the impact of any changes. For example, communicating in a timely and appropriate manner why nutrient pollution reduction and related environmental standards need to be met. Communication should focus on the willingness to compromise, the importance of building partnerships and the appropriate presentation of new scientific findings. This is important to ensure that individual stakeholders understand why a particular regulation or directive needs to be implemented and are able to understand the long-term effects of each directive or the consequences of not doing so.

4.b.1 Lack of knowledge and knowledge transfer

There is a lack of general knowledge and understanding among farm managers about what exactly nutrient pollution is, why it is important to address it, what the impacts are on the environment, and what the economic and financial impacts can be if the problem is not addressed. They have a superficial knowledge of nutrient pollution, of environmental problems, but many farm managers do not have a deep understanding of causality.

Despite a good regulatory system and harmonisation of EU law, it is very difficult for farmers themselves to change, to apply and introduce new practices. They trust primarily in their own knowledge and experience and find it difficult to accept new approaches from outside. It is difficult to persuade many people to provide the data necessary for the implementation of the regulation, to carry out the necessary data collection and measurements. There is a fundamental lack of knowledge at European Union level among farm managers, which makes it difficult to understand and accept new scientific results and why new regulation is needed. This is borne out by the fact that in 2020 10.2 % of the EU's 9.1 million farm managers had received full agricultural training. By contrast, 17.5 % had followed a basic level of training, with an overwhelming majority (72.4 %) relying on practical experience (Eurostat, 2023).

Both soil and water pollution lack a basic understanding of the interrelationships, one consequence of which is that farmers' decisions favour short-term profit-making over long-term planning and thinking. This lack of understanding of the basic context makes it very difficult to persuade farmers to apply the regulations properly, and in the long run, they face serious environmental and other challenges to farming that are much more difficult to address and solve.

4.b.2 Networking

The next major challenge is the lack of properly functioning networks of advisors and the knowledge and efficiency gaps of existing advisors. Another problem is the financing of the maintenance and operation of these networks. The solution to this would be to have a well-functioning agricultural system where farmers could pay for a professionally qualified independent adviser who could provide appropriate support to the farmer's manager a few times a year. This is necessary because a farm manager cannot be expected to have the breadth and up-to-date knowledge, the latest market intelligence, to make the right

decisions and apply the right standards. This requires not only the proper establishment and maintenance of this advisory network, but also the formation of farmers' attitudes. The fundamental problem is therefore whether a properly functioning advisory system is in place, whether it is accessible to all farmers and whether there is a public debate on nutrient pollution issues.

The problem is that even if there is a system, such as a chamber of agriculture or a network of advisors, there is often no effective system for the flow of information. The organisation of professional days and information forums is not enough in itself, because only those stakeholders who are open and interested and want to develop themselves go there. One of the big problems in agriculture is that farmers who have been running their farms for ten or twenty years according to a particular practice or approach find it hard to believe that there might be a more effective solution than the one they have been following. This is a serious barrier when introducing a new practice.

What can work well in these cases is to develop cooperation with farmers who are open to change and to create a so-called "demonstration space" on their farms, to give an example to other farmers through their practices. The aim of such demonstration spaces is to give farm managers a practical experience of how to apply a new practice. It is important to find a well-known, respected farmer who can serve as an example to other local farmers.

Alongside a good practice, there is always a need to demonstrate an economic and financial return for farmers. It is important to quantify the benefits and consequences of a given practice in financial terms. Another solution could be to show how, if a farmer does not convert to best practice, the failure to do so can be quantified. This is necessary in order to introduce a best practice in a given area, because farmers are very sensitive to the economic return. To be precise, you have to show the best practice on the farm, you have to demonstrate and quantify why this best practice works well, why it is effective. What is important, however, is that you cannot say that there is only one possible solution and that everyone must follow it. Because conditions and opportunities vary not only between countries, but also within countries. A crop farm and a livestock farm are different, but even between farms in the same area different solutions may work because of the different opportunities available to farmers.

4.b.3 Data collection

Another problem is that the **collection of statistical data is incomplete**, and there is inadequate IT harmonisation, linking and handling of information between the various organisations and agencies collecting data and information. This makes it difficult for stakeholders to access the necessary data.

Avoiding centralisation, but it is important to have an actor or body that has an overview of all elements of the system related to nutrient pollution and governance.

4.b.4 Needs for a good governance structure

A **neutral platform** is needed to connect the different actors in the system and facilitate communication between stakeholders.

The **cohesive power of communities** is missing. It would be important to have effective communication and outreach between stakeholders. This could be open days, forums, events. There are very few

platforms and opportunities for stakeholders to meet face to face, to talk, to build relationships. Such networks can be formal or informal meetings. This only works at local level. It is also important that there is always someone through whom stakeholders can be reached. A local actor who is known and recognised by the stakeholders.

A **good example** could be to bring together stakeholders around a technical issue, which is a completely practical issue, and to go around the issue in a series of events. At such events, participants could also bring up their own experiences and problems and discuss with each other what solutions they could envisage.

It is also very important that **stakeholders feel involved** in the process. It is not an external organisation that wants to tell them from the outside how to develop their own practices, but the stakeholders themselves, based on dialogue and communication between themselves, can develop the best solution for them. It is important that the right governance solution is not driven by an external force but by an internal motivation. Only then can it be accepted by them, and only then will it be an effective system.

A stakeholder analysis is needed to identify the actors who could be involved in the governance system. Mapping of all stakeholders who are present in the area in any position but have different priorities and roles. Establish a problem tree: what are the challenges that stakeholders face.

Mapping existing practice - situation analysis. Who is already doing the practice and who is not doing it, why they are not doing it (different opportunities, personal conflicts, size differences, etc.). This process can help to identify stumbling points that can be addressed in the next steps to develop a common solution.

Based on the experience of the semi-structured interviews, the following points outline the steps that can be taken to facilitate the development of an effective governance model.

11. Table: Success factors of an effective governance model

Success Factors
Policy level
Good communication between the ministries involved
Legislative harmonisation between the ministries concerned
Establish an appropriate implementation structure
Establish a well-functioning network of advisers with a well-functioning information flow system
Shaping attitudes and promoting a cooperative social culture
Transfer of knowledge on the latest scientific advances
The legal framework should be analysed and created at national level, but the practical implementation of the governance model should be developed at local level, specific to the problem at hand
"Catalyst" organisation
Creating demonstration spaces
Demonstrate economic and financial returns

Avoiding centralisation, but it is important to have an actor who has an overview of all the elements of the system related to nutrient pollution and governance and who plays a guiding and organising role.
"Key actor": We need a catalyst actor who manages the whole process, who is the intellectual owner of the process. An actor who has an intrinsic motivation, an internal drive to develop the right governance system and through whom stakeholders can be reached. A local actor who is known and recognised by stakeholders.
Effective communication and outreach to stakeholders
A neutral platform that links the different actors in the system and promotes communication between stakeholders.
Establish networks of contacts.
The legal framework should be analysed and created at national level, but the practical implementation of the governance model should be developed at local level, specific to the problem at hand.
Stakeholder mapping
Establishment of a problem tree.
Mapping existing practice - situation analysis
Solution to the problem, developed by local stakeholders

5. Conclusions

The aim of our study was to analyse how different governance strategies can be applied to improve nutrient management. The analysis was based on both the literature on governance solutions and practical examples from the literature. This analysis was extended by a structured interview analysis of the demo-sites participating in the Nenuphar project and the experience of semi-structured interviews with representatives of the sectoral side. In doing so, we sought to identify the main success factors and barriers to governance structures along the lines of capacities, frameworks, and structures, and how these could be improved in order to develop an effective governance system.

On the basis of the literature review, it is first worth clarifying the distinction between the concepts of governance and government, where the governance can be defined as the decentralized and horizontal devolution of power, contrasting with government, which is a centralized and vertical exertion of power. However, the traditional governance solution seems less appropriate and there is a growing emphasis on developing a new form of governance, based on decentralisation and broad stakeholder cooperation rather than centralised governance.

Based on the literature review, we conclude that a new governance model for nutrient pollution reduction could be effective where a wide range of actors and sectors are involved, including public and private policy makers, practitioners and all kinds of related organisations, such as a mix of NGOs, companies and cooperatives. The key to a successful governance solution is the active participation of these actors in decision-making and implementation processes, which are based on cooperation and consensus rather than on traditional governance approaches.

The different governance approaches to the nutrient problem are analysed by Wiering et. al (2020) and Wiering et. al (2023) focus specifically on the relationship between the nature of governance and the nature of the measures taken. In their work, they have examined the role that different governance structures play in problem solving in different countries. Specifically, whether agricultural nutrient management and water quality management are linked in a consensual way (joint policy-making and joint ownership) or in an antagonistic way (conflicting relationships), and how countries have implemented - organisational and/or programme integration or separate agricultural and environmental policies. It is concluded that, although management approaches differ significantly, the types of measures implemented are not different between primary (related to the Nitrates Directive) and secondary (related to the Water Framework Directive, complementary programmes related to the Nutrient Policy). The majority of countries put a strong emphasis on farmer-friendly voluntary measures and policy instruments linked to knowledge sharing and guidance programmes (preaching), mostly in impact-based policies, together with national and European support programmes, such as funding for CAP rural development programmes (carrots). In the majority of the countries surveyed, stakeholders often avoid the use of mandatory instruments for more stringent resource-based interventions (e.g. modification of manure standards). More stringent regulations are rarely implemented. Reducing nutrient inputs (as a resource-based measure) can lead to lower yields and higher manure application costs, and it is therefore challenging in many countries to find a balance between implementing resource-based measures and taking account of the difficult circumstances of farmers. Compensating farmers for lower yields and higher manure application costs is therefore a very important challenge for countries.

The effectiveness of implementing a new governance model depends on how its functional and structural elements are interrelated and whether they meet basic criteria, such as decision legitimacy. Decision

legitimacy is influenced by transparency and accountability in policy processes, as well as the consensus generated around them.

Scientific community enhanced frameworks, participation, capacities, and structures of governance constructions. Based on the literature review, the success and limiting factors can be identified that support or hinder the implementation of successful governance solutions.

Organizational integration refers to the formal integration of organisations, while program integration is considered, referring to the qualitative integration of organizations through the existence of joint programs (e.g. Czech Phosphorus Platform, The International Dairy Federation, collaboration approaches). Transboundary challenges of nutrient problem the institutional system and path of current legislation and demand for innovation, knowledge and collaboration are main barriers of integration. In terms of participation, the width of stakeholders involved, their degree of involvement, and their negotiation power traditionally play a role, where power indicates the level of investment, knowledge, and commitment required of participants. Authorities' capacities, refer to the planning capacity of public authorities, and more specifically human resources and financial resources.

New policies and techniques should derive success factors and barriers to nutrient cycle governance structures, where existing governance approaches and market driven governance considerations indicate possibilities for innovative models. The main barriers of existing institutional frameworks are interconnected network of actors, lack of unified global governance and legislative framework, strongly vertically concentrated models, the incorrect socialist common beliefs and bureaucracy, fact that farmers more likely to prefer subsidies or cost-share programs as policy incentives, lack of staff and lack of agricultural stakeholders in decision making, ignoring market conditions when decision were made etc.

The success factors, may contribute to a better nutrient cycle management are international body for global assessment of nutrient resources, education, insurance and local management groups to accommodate local knowledge, bringing together different stakeholders (researchers, policy makers, farmers, NGOs, chamber, etc.), modelling of nutrient flow, enforcing existing interlinkages as CLRTAP and WHO, impact assessments when planning, preparing and proposing new legislation, civil dialogue groups and agricultural committees to best shape law and policies, collaborative approaches involving local civil society etc.

Based on the responses to the semi-structured interviews and the structured interviews assessed in the demos, it emerges that there is a very wide range of stakeholders involved in the design of the governance solution to nutrient pollution - from the national level regulator to the stakeholders who apply the legislation in practice - whose cooperation is the basis for successful implementation. The processing of the semi-structured interviews shows that there is a wide range of problems that stakeholders face when implementing nutrient pollution reduction. The structured interview survey reveals that the following areas play a key role in creating a more effective governance structure:

- Legislative environment: - governmental/regional/local government activities
- Finance
- Communication/Networking
- Knowledge, knowledge transfer
- Key or catalyst actor
- Existing good practices - demosites

5.a Factors contributing to a successful governance model based on survey results

The processing of the semi-structured interviews and the structured interviews surveyed in the demos gives a very multifaceted picture of the problems that stakeholders are facing in implementing nutrient pollution reduction. Of course, the role of a regulatory actor at national level is different from that of a regulator who applies the legislation in practice.

On the regulatory and enforcement side, good communication and coordination between the different ministries involved within a country is the most important factor in developing a successful governance model. At policy level, this can be facilitated, for example, by the establishment and operation of inter-ministerial expert groups. For example, the issue of nutrient pollution affects water management, soil and environmental protection, and agriculture, which have different interests and therefore may have conflicts of interest between different policies and areas. These can only be resolved through joint dialogue and cooperation.

The policy background in these areas is usually in different ministries and often there is insufficient harmonisation of legislation between ministries. Therefore, there is a need for appropriate harmonisation of legislation between ministries and for the development and harmonisation of appropriate implementation structures and enforcement practices. On the policy side, the effective flow of information to farmers on the different policies and objectives is important for successful implementation. Before a regulation is introduced, it is important to inform and prepare farmers and other stakeholders in a timely manner and to mitigate the effects of changes - for example, why nutrient pollution reduction and compliance with related environmental standards are needed. Communication should focus on the willingness to compromise, the importance of building partnerships and the appropriate presentation of new scientific results.

Good cooperation between stakeholders is based on networking, where they can get to know each other and each other's activities. A good example of how this can be done is for farmers who are open to change to work together and create a 'demonstration space' on their farm to set an example for other farmers. In addition to good practice, it is always necessary to be able to demonstrate an economic and financial return for farmers. Successful implementation requires the availability of adequate financial support, incentives and a financial payback period, preferably less than 5 years.

Most countries have different levels of statistical data collection, but the availability of data to stakeholders and the harmonisation and interoperability of data collected by different authorities and agencies is a necessary condition for a successful governance solution.

As a general experience, a key condition for successful governance is that the legal framework should be analysed and established at national level, but the practical implementation of the governance model should be developed at local level, specific to the problem at hand, with broad stakeholder involvement. The key success factors are summarised in the table below:

12. Table: Factors that help to develop an appropriate governance model

Legislative environment - governmental-regional-municipal activities	A European Union and national legislative environment that adequately supports the implementation of circular nutrient management.
	The institutional structure, policy development, implementation, monitoring and milestones are in adequate.
	Existence of nutrient-related strategy(s) for the area.
	The nutrient-related strategy(s) for the area are reflective of the issue and refer to potential regulatory measures.
	Stakeholders are aware of nutrient-related strategies for their area.
	The governmental/regional/municipal institutions support their activities on nutrient cycling with incentives. These activities could include, for example, the organisation of stakeholder networks for material chains, the collection of data and information on the nutrient cycle, and the creation of incubators to promote circular economy projects.
	Regarding the 'national approach' of governance there is a consensual placement of EU law on sufficient.
	An appropriate level of cooperation between stakeholders and public authorities on the development of nutrient management policy.
	The establishment of a "nutrient platform" based on the competences of autonomous administrations, with the aim of participating in the development and implementation of the strategy. This platform is a cluster of organisations involved in nutrient management, with the aim of improving nutrient management.
Finance	The return on investment in circular nutrient management should not exceed 5 years.
	Availability of appropriate financing - grants, soft loans, tax incentives, etc.
Communication-Networking	Connecting entrepreneurs with a wide range of stakeholders (including public authorities, policy makers, research institutes and farmers) through various activities.
	Appropriate cooperation with farmers' cooperatives and other professional organisations.
	There is an appropriate number of stakeholders involved and an appropriate level of multi-stakeholder negotiation.

	The degree of involvement and the degree of negotiation power within the 'Participation' are on adequate level. The level of integration of the participating organisations is adequate.
Knowledge	An appropriate level of knowledge of circular economy among stakeholders.
	Easy access to the right knowledge and technology for agriculture-related elements.
	Training programmes, data and information collection and open-source data are available and published. Voluntary practices for the implementation of N and P management are available in the area.
	Associations concerned have guidance, knowledge transfer, shared learning exercises on nutrient reduction. (For example: A code of practice and advisory system on fertilisation is available for the farmers' association and a communication campaign is in place for the water and wastewater association.)
Other	Trust in quality and safety of products, the knowledge of the nutrient cycles and the accessibility of the products.

As summarised in the table above, the legislative environment - governmental-regional-municipal activities; finance; communication-networking; and knowledge are the main areas that contribute significantly to the development of appropriate governance structures. Therefore, it is very important to analyse and map these areas in the preparation of an intervention and to develop an appropriate intervention plan.

6. Deviations

This deliverable has been prepared and submitted according to the workplan, with no relevant deviations.

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8.Annexes

ANNEX 1 - Additions to the conceptualization of governance

Definitions and descriptions of governance:

- Self-organizing, interorganizational networks characterized by interdependence, resource exchange, rules of the game, and significant autonomy from the state (Rhodes, 1997).
- Systems of rule at all levels of human activity – from the family to the international organization – in which the pursuit of goals through the exercise of control has transnational repercussions (Rosenau, 1999).
- Governance has been defined to refer to structures and processes that are designed to ensure accountability, transparency, responsiveness, rule of law, stability, equity and inclusiveness, empowerment, and broad-based participation. Governance also represents the norms, values, and rules of the game through which public affairs are managed in a manner that is transparent, participatory, inclusive, and responsive. Governance therefore can be subtle and may not be easily observable. In a broad sense, governance is about the culture and institutional environment in which citizens and stakeholders interact among themselves and participate in public affairs. It is more than the organs of the government (UNESCO-UNEVOC, n.a.).
- "At the most general level, governance refers to theories and issues of social coordination and the nature of all patterns of rule. More specifically, governance refers to various new theories and practices of governing and the dilemmas to which they give rise. (…) Governance as theory, practice, and dilemma highlights phenomena that are hybrid and multijurisdictional with plural stakeholders who come together in networks." (Bevir, 2011, p. 1-2).

Corporate governance

As defined by OECD (2004), "**corporate governance** involves a set of relationships between a company's management, its board, its shareholders and other stakeholders. Corporate governance also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined." According to the 2023 edition of the OECD Principles of Corporate Governance, the corporate governance framework should motivate companies and investors to make decisions and manage risks in ways that enhance the **company's sustainability and resilience**. Adhering to commitments like the Paris Agreement and Sustainable Development Goals, they must navigate changing regulations and policies across jurisdictions. Many are voluntarily moving towards sustainable development, which requires managing risks and opportunities associated with this shift. Investors are increasingly focused on how companies manage sustainability risks, prompting many jurisdictions to mandate or plan sustainability disclosures that aim to give investors insight into how companies govern and manage these risks, supporting informed financial and investment decisions. Sound corporate governance and transparent disclosures are key to fair markets, efficient capital allocation, long-term company growth, and resilience (OECD, 2023).

Project governance

Since the late 1990s, the concept of **project governance** has garnered significant interest and discussion in project management literature, as Bekker (2015) points out. Project management, aiming to achieve corporate objectives, covers similar functional areas as corporate organizations, thus adhering to corporate governance guidelines. Project governance can be defined as: "a set of management systems, rules, protocols, relationships and structures that provide the framework within which decisions are made for project development and implementation to achieve the intended business or strategic motivation." (Bekker & Steyn, 2009, p. 226). The drive to establish project governance stems from the increasing dissatisfaction with large capital project failures and the recognition that technical and operational project management needs strategic and institutional support. (Bekker, 2015)

Key challenges in collaborative environmental governance

Based on empirical evidence, Bodin (2017) highlights the success of collaborative governance in addressing environmental issues, yet there is no universal method for achieving success through collaboration. Success often depends on the participation and interaction of involved actors. Challenges include:

- Developing and sustaining networks that can tackle complex conflicts and efficiently coordinate simpler tasks.
- Encouraging social connections locally to form networks with beneficial global structures and alignment with environmental contexts.
- Involving actors in collaboration, including those uninterested, motivated by unsuitable reasons, or using collaboration to hinder change.
- Establishing networks that are both flexible and adaptable to change, yet stable enough to build trust and a shared sense of purpose.

ANNEX 2 - Results of structured interview survey

CASE STUDY: HUNGARY

Name of the organisation: "TEBIKE" and SZI Széchenyi István University

Type of the organisation: family enterprise

Name of the organisation: SZI Széchenyi István University

Type of the organisation: University

In the case of the Hungarian demosite partners, the structured interview was administered in person. The demosite partners in Hungary were present together when the structured interview was filling in. The reason for this was that it was also used to test the structured interview. We wanted to see how relevant and understandable the questions were for the demosite partners. Since for each demosite, each partner has a different insight and knowledge and experience of different elements of the management model, the company with practical experience (TEBIKE) and the University with a greater insight into the management model and regulatory issues related to nutrient pollution (SZI) were able to add different perspectives to the questions. In each case the partner who had the necessary information answered the question. At the same time, the completion of the structured interview also revealed if any questions were difficult to understand or not relevant.

ROLE IN THE NUTRIENT MANAGEMENT CYCLE

Széchenyi István University

Research and bsuiness activities. Project management of research and development, scientific and innovation projects. Development pf precision and sustainable crop production, horticulture, animal husbandry and feeding practices, as well as food industry technologies. Applied reproductive biology. Extensive exploration of the advanteges of ecological/organic farming. Development and trail of rapid testing methods in agriculture. Automation, digitization, robotization, and artificial intelligence in agriculture and the food industry.

TEBIKE: Operation as family business. Core activity: purchasing and processing of goat, sheep and cow milk. Products: cheese. yoghurt, cottage cheese, sour cream, cream cheese. Ultra-filtration equipment (to be replaced). Main product: fresh cheese (Ricotta).

KNOWLEDGE OF THE NUTRIENT MANAGEMENT CYCLE

Széchenyi István University

They have a fairly confident knowledge of the nutrient cycle. They have easy access to knowledge of the agricultural elements (soil, crop residues, fertilisers and soil improvers, harvested crops, livestock, livestock production, animal feed, animal products, manure) and partially easy access to knowledge of the processing elements (industrial processes).

TEBIKE

They have a fairly confident knowledge of the nutrient cycle in relation to the production process of the enterprise.

NUTRIENT MANAGEMENT OF THE DEMO SITE

Monitoring of N and P in nutrient fluxes has been partially implemented at the demonstration site. The main obstacle to monitoring nutrient fluxes is the availability of accurate data on the steps of each process. In addition, the legal environment for the new process they are using is still uncertain. They believe that it is difficult to measure the return on investment of circular nutrient management.

From the end-user side (e.g. farmers, consumers, society), the main difficulties in developing and promoting nutrient cycles are confidence in the quality of the products, food safety issues and the price of the products - which are considered to be quite problematic issues. Lack of knowledge, lack of environmental awareness, difficulties in sourcing products and inadequate marketing are seen as minor problems. Uncertainty about the regulatory environment and the need to identify and reach potential stakeholders is a serious problem.

NUTRIENT MANAGEMENT STRATEGIES AND REGULATORY ENVIRONMENT

It is considered that the legislative environment at EU level is neutral (not supportive but not obstructive) for the implementation of IWRM, but that legislation at national and regional level is not very supportive and there are several legal uncertainties surrounding the use of whey as fertiliser. However, if the whey is used as a rinse water, it can be discharged as wastewater without any obstacles.

They are covered by Nitrates Directive, Water Framework Directive.

COOPERATION WITH PARTNERS AND STAKEHOLDERS

They are in contact with a small group of stakeholders in relation to their activities and have no major difficulties in maintaining cooperation with them. However, cooperation with public authorities is rather difficult, mainly in the form of carrying out inspections on their part. There is a need for more interest in cooperation on the part of agencies and ministry officials.

They are in contact with authorities and policy makers for regulation and control.

For commercial and service activities, contacts are maintained with suppliers and service providers, funding/financing organisations and consultants. For commercial activities they liaise with farmers, suppliers and trade organisations, and for services they liaise with national agencies and consultants.

In terms of expertise and advice, contacts are maintained with a number of organisations, although this is seen as less effective, such as the Chamber of Agriculture, professional organisations and consultants. Cooperation with the Széchenyi István University is particularly good, both as a research centre and as a professional advisory organisation.

They do not really receive professional assistance from governmental/regional/municipal institutions, which rather only perform a monitoring and data collection function.

- The university has a relationship with the regulators, they have a lobbying power, albeit limited. The University is also approached by companies with R&D projects, because the tendering system is such that

a university partner is needed for implementation. The aim is to use the university's intellectual products in industry. The University has a so-called Science Park, where an incubation environment for businesses is created. There is also a model economy network, of which Tebike is a part.

The University has quite a strong advocacy capacity, because they have been able to get legislation amended.

Chamber of commerce, advocacy: they do not see much benefit in the functioning of chambers, apart from the compulsory payment of membership fees. There is personal contact with local chambers. There is no good relationship with the Dairy Product Council either, and they have not received any support or recognition for their PDO cheese. In the past, they were in contact with the Agricultural Marketing Centre, which gave them the opportunity to participate in exhibitions, but they no longer have any contact with them.

They believe that the following activities would be useful to support their nutrient cycling activities.

- Easier business administration of the nutrient cycle.
- Promoting public-private partnerships.
- Creating networks of stakeholders for research and development.
- Promote collaboration with educational institutions and research centres to enhance knowledge transfer.
- Publishing open source data.
- Organise training programmes on the nutrient cycle.
- Organise training programmes on corporate governance.

TYPES OF POLICY INSTRUMENTS AND GOVERNANCE STRUCTURES

The following mandatory policy practices apply to the implementation of N and P nutrient management:

- Reduction of water polluting nitrates from agricultural sources.
- Rules for nitrate vulnerable zones
- Common safety standards, quality requirements for dairy processing by-products and waste water.

There are no communication campaigns and they are not aware of any social incentives.

There are no financial instruments to support the implementation of N and P nutrient management. There are no subsidised loans, compensations, tax incentives, insurance, national subsidies available to them. If they are able to apply for something, the application process is very long and bureaucratic. What they have used is the national Agricultural Széchenyi Card.

THE GOVERNANCE STRUCTURES

They have little interest in regulating nutrient management. Larger organisations, integrators, chambers have an advocacy role. They have links with the National Chamber of Agriculture, but they don't feel they have much influence on any issues. They believe that the advocacy capacity of small businesses is weak.

All the elements of 'authority's capacity' (the number of stakeholders involved, the multi-player negotiations, the human or financial resources for planning) are not sufficient. The 'institutional integration' (integration of organisations, joint programmes between ministries and institutions) is on low level. The 'national approach' of the placement of EU law (either consensual or antagonistic) are at low level.

The power of different stakeholders to shape EU and national policy on nutrient management strategies and regulation

Tha Chamber of Agriculture primarily represents the interests of larger farmers and does not represent the interests of small farmers and small businesses. The influence of the Chamber of Agriculture, the Ministry of Agriculture and the larger integrating organisations in shaping national policy is mainly concentrated in the Chamber.

STRENGTHS AND WEAKNESSES OF THE HUNGARIAN DEMO SITE

Strengths

They have rather confident knowledge on circular management and access to knowledge is quite easy for them.

Tracing N and P in nutrient flow is implemented or partially implemented on the demo site.

They consider that **legislative environment at EU level** is neutral or not specifically unsupportive to the implementation of circular nutrient management.

The stakeholders seem to be at least partially aware of the nutrient-related strategies that apply for their area. The strategies are beneficial because of being reflective on the issue, implying potential regulative measures.

They maintain diverse relationships with a variety of stakeholders, including authorities, policymakers, research institutions, and farmers. The governmental/regional/municipal institutions do not really support their activities on nutrient cycling with **incentives.**

Weaknesses

They consider that the **legislative environment at national and the regional level** are not very supportive.

Tha Chamber of Agriculture primarily represents the interests of larger farmers.

Communication, financial considerations, and the lack of knowledge and confidence all hinder the cooperation between partners.

Ease of bureaucracy, networking, strengthening cooperation, and management trainings are not part of the governmental/regional/municipal support of activities related to nutrient cycling management.

Financial instruments related to implement N and P nutrient management are not clearly known for the stakeholders.

Most of the government structures along the attributes belonging to the authorities' capacities, participation, institutional integration, and national legislative harmonisation are on low level.

On both EU and national level, the lower the power and territorial level is, the less is the influence on policy design.

There is a lack of financial instruments to support the implementation of N and P nutrient management.

They consider that **governance structure of nutrient management** is basically not sufficient, including the 'authority's capacity', 'institutional integration' and the 'national approach' of the placement of EU law.

The **power of different stakeholders in EU/national/regional policy making** is perceived very differently. The power of most stakeholders in policy making is low or in case of the University is medium, other stakeholders have different levels of intensity at different levels of policy making.

CASE STUDY: SLOVAKIAN DEMO SITE

Name of the represented organisation: VYSOKOSKOLSKY POLNOHOSPODARSKY PODNIK SPU SRO/ HIGH SCHOOL AGRICULTURAL ENTERPRISE SPU LTD.

Type of the organisation:

ROLE IN THE NUTRIENT MANAGEMENT CYCLE

Animal breeder

KNOWLEDGE ON NUTRIENT MANAGEMENT CYCLE

They have **rather confident knowledge on circular management**. Access to knowledge and to proper technology in case of the agricultural related elements (soil, crop residues, fertilisers and soil conditioners, harvested crops, mineral supplements of animal, breeding, feeds, animal products, manure) and in case of processing (industrial processes) is easy for them.

THE NUTRIENT MANAGEMENT OF THE DEMO SITE

Tracing N and P in nutrient flow is implemented on the demo site. The main barrier of tracking nutrient flow are the restrictions in Nitrate Directive regarding the time and amount of applied N fertilizer. The bureaucracy in relation to tracking the amount and time of fertilizer application.

They believe, that the **investments** of circular nutrient management will **return in a medium term** (2-10 years).

The main **difficulties from the end-user** (e.g. farmers, consumers, society) side in the development and spread of nutrient cycles are the lack of environmental awareness and the insufficient marketing activities. The price of the products is moderately problematic, but the trust in quality and safety of products, the knowledge of the nutrient cycles and the accessibility of the products are not problematic.

NUTRIENT MANAGEMENT STRATEGIES AND REGULATORY ENVIRONMENT

They consider that the **legislative environment** at EU level is enough supportive to the implementation of circular nutrient management, and the national and the regional level legislation is neutral.

The following directives are applied to them: Nitrate Directive and Water Framework Directive.

Regarding **the nutrient management strategy of their area**, they are satisfied the goals of the strategy and the information provided to them, but the institutional arrangement, the policy design, the practical implementation, the monitoring, the milestones and timing are neutral for them.

They highlighted that the restrictions related fertilizer application date within Nitrate Directive are very limiting and often do not allow to apply fertilizer in more suitable weather and soil moisture conditions. Some level of fluctuation should be allowed to take into account wet and dry years.

COOPERATION WITH PARTNERS, STAKEHOLDERS

They keep contact related to their activities with some of stakeholders and they have no major difficulties in maintaining cooperation with them. The cooperation between them and the authorities related to nutrient management policy design is sufficient.

- They keep contact with chambers and other farmers and farmers cooperatives because **of regulatory reasons**.
- For **research activities** they can keep contact with research institutions or universities.
- They maintain relations for **services with** agricultural suppliers and services providers.

The governmental/regional/municipal institutions support them with the following activities, but they think, these activities are not really useful for them:

- Easier business administration related to nutrient cycling management.
- Promote public-private partnerships.
- Promote cooperation with educational institutions and research centres to increase knowledge transfer.

They think, the following activities would be useful to support their activities in nutrient cycling:

- Organise stakeholder networks for material chains.
- Create incubators to promote circular economy projects.
- Create stakeholder networks for research and development.
- Collect data and information regarding the nutrient cycling.
- Publish open-source data.
- Organise training programmes on nutrient cycles.
- Organise training programmes on company management.

TYPES OF POLICY INSTRUMENTS AND GOVERNANCE STRUCTURES

<u>Obligatory policy practices</u>

The obligatory policy practices apply to them to implement N and P nutrient management are the following:

- Tackling climate change/sustainable management of natural resources
- Reduction of water polluting nitrates from agricultural sources
- Limits for N fertilisers: 170 kg N/ha/year from livestock manure
- Promoting good farming practices
- Rules for nitrate-vulnerable zones
- Limited period for fertiliser application
- Specific agrotechnical practices

The limited use of organic inputs and their conditions are not mandatory.

They are not aware of mandatory regulations for the maintenance of rural areas and landscapes, and safety standards and quality requirements for fertiliser products.

The financial instruments to implement N and P nutrient management

There is a lack of financial instruments to support the implementation of N and P nutrient management: there are no EU direct income support, EU rural development support, EU sectoral support schemes, compensations, tax reliefs, insurances or national subsidy programmes.

They do not know if there is a subsidised loan available to them.

The governance structures

They think that most of the elements of nutrient management governance are sufficient.

Within the 'Authorities' capacity' the number of stakeholders involved, and the multi-player negotiations is on sufficient level, while the human or financial resources for planning is on low level.

The degree of involvement and the degree of negotiation power within the 'Participation' are on adequate level.

They have integration of the organisations on adequate level, but there are no joint programmes between ministries and institutions.

Regarding the 'national approach' of governance there is a consensual placement of EU law on sufficient level and not antagonistic placement of EU law.

The power of different stakeholders to shape EU policy on nutrient management strategies and regulation

They consider that national policy members, governmental policy members and environmental organisations have the most intense power to shape EU policies – they can participate in negotiations. Research organisations can aggregate their preferences and bargain. National chambers and advisors, local policy members and integrators can develop preferences. Agrotechnical and fertiliser companies can express their preferences. They consider that farmers and civil society has the weakest power to design EU policies – they are only listening as spectators.

The power of different stakeholders to shape national policy on nutrient management strategies and regulation

On national level governmental policy members and researchers or universities have the more intense impact on shaping nutrient management strategies and regulation – they can make negotiations. National chambers and advisors, local policy members, national policy members and integrators can develop preferences. On national level farmers, agrotechnical companies and fertiliser companies can express their preferences. The weakest influence to design national policies on national level are environmental organisations and civil society.

The power of different stakeholders to shape regional policy on nutrient management strategies and regulation

On regional level governmental policy members have the most intense power to shape strategies and regulation. National chambers and advisors, local policy members, and national policy members can aggregate their preferences and bargain, and integrators can develop preferences. Farmers, environmental organisations, agrotechnical and fertiliser companies, researchers and universities can express their preferences and civil society is only listen as spectators.

STRENGTHS AND WEAKNESSES OF THE SLOVAKIAN DEMO SITE

Strengths

They have rather confident knowledge on circular management and access to knowledge and to proper technology in case of the agricultural related elements is easy for them.

They believe, that the investments of circular nutrient management will return in a medium term (2-10 years).

Trust in quality and safety of products, the knowledge of the nutrient cycles and the accessibility of the products are not problematic.

Legislative environment at EU level is enough supportive.

They are satisfied the goals of the strategy and the information provided to them, but the institutional arrangement, the policy design, the practical implementation, the monitoring, the milestones and timing are neutral for them.

They keep contact related to their activities with some of stakeholders. The cooperation between them and the authorities related to nutrient management policy design is sufficient.

The number of stakeholders involved, and the multi-player negotiations is on sufficient level.

The degree of involvement and the degree of negotiation power within the 'Participation' are on adequate level. They have integration of the organisations on adequate level.

Regarding the 'national approach' of governance there is a consensual placement of EU law on sufficient level.

Weaknesses

The bureaucracy in relation to tracking the amount and time of fertilizer application.

The main difficulties from the end-user (e.g. farmers, consumers, society) side in the development and spread of nutrient cycles are the lack of environmental awareness and the insufficient marketing activities.

National and the regional level legislation is neutral.

They highlighted that the restrictions related fertilizer application date within Nitrate Directive are very limiting and often do not allow to apply fertilizer in more suitable weather and soil moisture conditions.

The governmental/regional/municipal institutions support them with activities, but they think, these activities are not really useful for them.

Human or financial resources for planning is on low level.

CASE STUDY: SLOVAKIAN DEMO SITE

Name of the organisation: Slovak University of Agriculture in Nitra, Slovakia

Type of the organisation: University

ROLE IN THE NUTRIENT MANAGEMENT CYCLE

The interviewee is policy expert, project leader on related topic knowledge transfer (Danube demosite), Expert guarantor of the Agro-environmental-climatic measure project at Institute of knowledge-based agriculture and innovation.

KNOWLEDGE ON NUTRIENT MANAGEMENT CYCLE

Very confident level of knowledge in circular nutrient management was expressed by the interviewee. The access to adequate knowledge and to proper technology was assessed as easy in the themes of soil, fertilisers and soil conditioners, harvested crops, mineral supplements of animal breeding, manure and produce processing, industrial process, while partial in case of crop residues, feeds and animal products. The difficulty is putting knowledge into practice.

THE NUTRIENT MANAGEMENT OF THE DEMO SITE

At the company's level, P and N in the nutrient flow are traced. The difficulty is that the right technology to manage elements of the nutrient cycle must be linked to the transfer of other elements and substances. In Europe, they have a bad example of Cd from African sources of phosphorus, which were subsequently banned. They do not know the content of medicines and other chemical substances from animal feed in animal products.

As regards to the return of financial and time investment to implement the circular nutrient management, the medium-term (2-10 years) return expectations was indicated by the interviewee.

In terms of the difficulties in the development and spread of nutrient cycles, the difficulty to trust in quality of products, food security questions and the price of products were identified as big problems, while the the lack of knowledge, and lack of environmental awareness and the not enough marketing activites as rather problematic issues. The difficulty of obtaining such products was identified as a minor problem.

NUTRIENT MANAGEMENT STRATEGIES AND REGULATORY ENVIRONMENT

The legislative environment is enough supportive on EU level, regarding its contribution to the realisation of circular nutrient management. At the same time, the national environment was found neutral and the regional environment was found not very supportive. Conflicts of interest and legislation (final use of the manure, treatments, sludges) do not put legislative barriers in place to maintaining circular nutrient management activities.

The nutrient management strategy for the area highlighted were the Strategic plan of the CAP of Slovakia 2023 – 2027, Decree no. 215/2016 Coll. of the Ministry of Agriculture and Rural Development of the Slovak Republic, which establishes details on the management of agricultural land in vulnerable areas Document CIRCULAR ECONOMY – THE FUTURE OF THE DEVELOPMENT OF SLOVAKIA.

Related to the practical feasibility of the nutrient management strategy for the respondent's area, they were neutral towards practical implementation and monitoring, while they were satisfied with the institutional arrangement, policy design, the strategy's goals, the information provided and the milestones and timing.

The strategy addresses the water quality, lower costs for crop production, good fruits and vegetable quality. Control and economic interests of farmers for good incomes were identified as weaknesses.

COOPERATION WITH PARTNERS, STAKEHOLDERS

In the organisation's nutrient management activities, the following relationships are maintained with the different stakeholders:

- Regarding regulatory issues, there is contact with authorities, policymakers and chambers.
- In research, they are in connection with authorities, policymakers, research institutions/universities, agricultural suppliers and services and farmers, farmer cooperatives.
- Expertise and consultancy relationships are relevant in case of authorities, policymakers and chambers.
- Services connect them to national agencies and NGOs/ Associations, federations.
- There is commercial relationship with advisors, network of advisors, buyers from industry and farmers, farmer cooperatives.

Difficulties in cooperating with partners are experienced in terms of financing. Specific support from the Ministry of Agriculture for research projects aimed at solving current problems would help to develop cooperation.

Cooperation between the organisation and authorities related to nutrient management policy design is considered as sufficient cooperation.

The existing governmental/regional/municipal supports that are useful: for promoting public-private partnerships, creating stakeholder networks for research and development, promoting cooperation with educational institutions and research centres to increase knowledge transfer, data collection and information regarding the nutrient cycling, organising training programmes on nutrient cycles, organising

training programmes on company management and training for farmers using ECO schemes is containing part about nutrient schemes. Easier business administration related to nutrient cycling management, organise stakeholder networks for material chains, create incubators to promote circular economy projects and publish open-source data would be useful.

TYPES OF POLICY INSTRUMENTS AND GOVERNANCE STRUCTURES

Obligatory policy practices

The obligatory policy practices applying to them to implement N and P nutrient management are the following:

- Maintaining rural areas and landscapes
- Tackling climate change/sustainable management of natural resources
- Reduction of water polluting nitrates from agricultural sources
- Limits for N fertilisers: 170 kg N/ha/year from livestock manure
- Promoting good farming practices
- Rules for nitrate-vulnerable zones
- Limited period for fertiliser application
- Common safety standards, quality requirements for fertiliser products
- Limited use and conditions for organic farming inputs
- Limits for sewage sludge use in agriculture as fertiliser

Voluntary policy practices

In the interviewed organisation's area, guidance, knowledge transfer, code of best practices and advisory system on fertilizing are voluntary policy practices to implement N and P nutrient management.

The financial instruments to implement N and P nutrient management

There are financial instruments related to the implementation of the following N and P nutrient management in the area: EU Direct income support, EU Rural development support, EU Sectoral support schemes, national subsidy programmes, subsidised loans, compensations, tax reliefs and insurances.

The governance structures

Of the governance structures in the field of nutrient management regulation, the ones related to authorities' capacity (number of stakeholders involved, multi-player negotiations, human or financial resources for planning), stakeholder's degree of involvement, stakeholder's degree of negotiation power, integration of organizations and consensual placement of EU law were assessed to be on sufficient level. While joint programmes between ministries and institutions and antagonistic placement of EU law were on a low level.

The power of different stakeholders to shape EU and national policy on nutrient management strategies and regulation

In the EU and national policy design on nutrient management strategies and regulation, governmental policymakers, agrotechnical companies and fertiliser companies are able deploy technique and expertise. National chambers, advisors and environmental organisations are able to deliberate and negotiate. National, governmental and local policy members, national environmental organisations and researchers, universities can develop preferences. Farmers can only listen as spectators, according to the interviewee.

STRENGTHS AND WEAKNESSES OF THE Slovakian DEMO SITE

Strengths

The interviewed stakeholders have a very confident level of knowledge in circular nutrient management. The fields in which it is generally easier to access adequate knowledge and proper technology are the themes of soil, fertilisers and soil conditioners, harvested crops, mineral supplements of animal breeding, manure and produce processing and industrial process.

P and N flows are fully traced at company level.

The legislative environment is enough supportive on EU level, regarding its contribution to the realisation of circular nutrient management.

Related to the practical feasibility of the nutrient management strategy for the respondent's area they were satisfied with the institutional arrangement, policy design, the strategy's goals, the information provided and the milestones and timing.

The strategy addresses the water quality, lower costs for crop production, good fruits and vegetable quality.

Cooperation between the organisation and authorities related to nutrient management policy design is considered as sufficient cooperation.

The existing governmental/regional/municipal supports that are useful: for promoting public-private partnerships, creating stakeholder networks for research and development, promoting cooperation with educational institutions and research centres to increase knowledge transfer, data collection and information regarding the nutrient cycling, organising training programmes on nutrient cycles, organising training programmes on company management and training for farmers using ECO schemes is containing part about nutrient schemes.

In the interviewed organisation's area, guidance, knowledge transfer, code of best practices and advisory system on fertilizing are voluntary policy practices to implement N and P nutrient management.

Of the governance structures in the field of nutrient management regulation, the ones related to authorities' capacity (number of stakeholders involved, multi-player negotiations, human or financial resources for planning), stakeholder's degree of involvement, stakeholder's degree of negotiation power, integration of organizations and consensual placement of EU law were assessed to be on sufficient level.

Weaknesses

Limited access to adequate knowledge and proper technology in the fields of crop residues, feeds and animal products. The difficulty is putting knowledge into practice.

At the company's level, P and N in the nutrient flow are traced but the difficulty is that the right technology to manage elements of the nutrient cycle must be linked to the transfer of other elements and substances.

In terms of the difficulties in the development and spread of nutrient cycles, the difficulty to trust in quality of products, food security questions and the price of products were identified as big problems, while the lack of knowledge, and lack of environmental awareness and the not enough marketing activites as rather problematic issues.

The national environment was found neutral and the regional environment was found not very supportive.

Control and economic interests of farmers for good incomes were identified as weaknesses.

Difficulties in cooperating with partners are experienced in terms of financing.

Of the governance structures in the field of nutrient management regulation, the ones related to joint programmes between ministries and institutions and antagonistic placement of EU law were on a low level.

In the EU and national policy design on nutrient management strategies and regulation farmers can only listen as spectators.

CASE STUDY: SPAIN

Name of the organisation: "BETA Technological Center"

Type of the organisation: research institute

ROLE IN THE NUTRIENT MANAGEMENT CYCLE

The interviewee is project leader at the organisation. In terms of nutrient management, relates to the knowledge transfer aspects.

KNOWLEDGE ON NUTRIENT MANAGEMENT CYCLE

A rather confident level of knowledge in circular nutrient management was expressed by the interviewee. The access to adequate knowledge and to proper technology was assessed as easy in the themes of soil, fertilisers and soil conditioners, feeds, and manure, while partial in case of animal products and industrial processing. Crop residues, harvested crops, and mineral supplements of animal breeding were not assessed. The difficulties experienced are due to the fact that farmers have little time to access information, and the possible limitations of the nutrient cycle products' competitiveness.

THE NUTRIENT MANAGEMENT OF THE DEMO SITE

At the company's level, P and N in the nutrient flow are only partially traced. The barriers to the tracking systems are the lack of legislation on the monitoring of P, while tracking N is compulsory by law and includes the transfer of information from the user (farmer) to the administrative body that controls it.

As regards to the return of financial and time investment to implement circular nutrient management, there was a medium-term (2-10 years) return indicated by the interviewee.

In terms of the difficulties in the development and spread of nutrient cycles, the lack of knowledge, the difficulty to obtain such products, as well as the unsatisfactory level of marketing activities were identified as rather problematic issues. All the other issues (trust in quality, price of products, lack of environmental awareness, and, specifically mentioned by the respondent, the type of equipment were evaluated as neither problematic, nor unproblematic.

NUTRIENT MANAGEMENT STRATEGIES AND REGULATORY ENVIRONMENT

The legislative environment is neither supportive, nor unsupportive on EU and regional levels, regarding its contribution to the realisation of circular nutrient management. At the same time, the national level legal environment was found not very supportive. The EU-level RENURE initiative is currently trying to change the 170 kg/ha N fertiliser top-up. On the national level, legal framework to promote organic fertilisers, including compensation for environmental benefits of their use is missing. Difficulties can be observed in using raw materials (sewage sludge) for fertilisers, and the lack of legal framework that differentiates between the categories of sewage sludge (quality classification).

The nutrient management strategies that apply for the organisation's activity are the Nitrate Directive mainly affecting the level of restrictions and vulnerable areas, and, without exact knowledge of the details, the Water Framework Directive, the Catalonian Bioeconomy Strategy, and the Circular Economy Strategy.

Related to the practical feasibility of the nutrient management strategy for the respondent's area, they were satisfied with the information provided about the strategy and dissatisfied with the monitoring, while being neutral to the institutional arrangement, policy design, the strategy's goals, the practical implementation, and the milestones and timing. Catalan Nutrient Platform, a future cluster of entities related to the management of nutrients to improve their management, was established to be involved in the designing and implementation of the strategy (based on the competences of autonomous administrations). The respondent misses a strategy for global nutrient management, in addition to the existing regulations.

COOPERATION WITH PARTNERS, STAKEHOLDERS

In the organisation's nutrient management activities, the following relationships are maintained with the different stakeholders:

- Regarding regulatory issues, there is contact with authorities, policymakers, national agencies, advisors and their networks, and farmers or their organisations.
- In research, they are in connection with research institutions/universities, authorities, policymakers, financial/funding organisations, national agencies, agricultural suppliers and service providers, and farmers or their organisations.
- Expertise and consultancy relationships are relevant in case of advisors and their networks, NGOs, agricultural suppliers, farmers, authorities, policymakers, and national agencies.
- Suppliers, chambers and NGOs, and used by industrial buyers and farmers provide/use services.

Difficulties in cooperating with partners are experienced in terms of communication, financing (specifically: for research purposes and services), the lack of knowledge and confidence. Improving communication and knowledge transfer with the primary sector would improve cooperation in nutrient management.

Cooperation between the organisation and authorities related to nutrient management policy design is considered sufficient (e.g. involvement to Catalonian digestate strategy).

The existing governmental/regional/municipal supports that are useful for nutrient cycling management are promoting public-private partnerships, collecting data and information, publishing open-source data, and organising training programmes on nutrient cycles. The interviewee did not really find the organisation of stakeholder networks for material chains useful, as there are not enough of these kinds of initiatives. Of the yet non-existing support activities, easier business administration related to nutrient cycling management and the creation of incubators to promote circular economy projects would be useful. Creating stakeholder networks for research and development would only be useful with including both private and public sectors.

TYPES OF POLICY INSTRUMENTS AND GOVERNANCE STRUCTURES

Obligatory policy practices

The obligatory policy practices applying to them to implement N and P nutrient management are the following:

- Maintaining rural areas and landscapes
- Tackling climate change/sustainable management of natural resources
- Reduction of water polluting nitrates from agricultural sources
- Limits for N fertilisers: 170 kg N/ha/year from livestock manure
- Promoting good farming practices
- Rules for nitrate-vulnerable zones
- Limited period for fertiliser application
- Common safety standards, quality requirements for fertiliser products
- Limited use and conditions for organic farming inputs
- Specific agrotechnical practices

Regarding mandatory policy measures related to nutrient cycling, in Catalonia the regulation 153/2019 on the management of soil fertilization and livestock grazing and approval of the action program for vulnerable areas in relation to nitrate contamination from agricultural sources is in power.

Voluntary policy practices

In the interviewed organisation's area, there is guidance (e.g., PAS, PI, eco), communication campaigns, knowledge transfer, code of best practices, advisory system on fertilizing, shared learning practices on

nutrient reduction, and social incentives (i.e., product certification) are voluntary policy practices to implement N and P nutrient management.

The financial instruments to implement N and P nutrient management

Related to N and P nutrient management, EU direct income support, EU rural development support, EU sectoral support, national subsidy programmes and compensations are available, while the respondent did not know about subsidies loans, tax reliefs or insurance schemes in this regard.

The governance structures

Of the governance structures in the field of nutrient management regulation, the ones related to authorities' capacity (number of stakeholders involved, multi-player negotiations, human or financial resources for planning) and participation (stakeholder's degree of involvement, stakeholder's degree of negotiation power), as well as the integration of organizations were assessed to be on sufficient (neither high, nor low) level, while joint programmes between ministries and institutions, as well as consensual placement of EU law operate on a low level.

The power of different stakeholders to shape EU and national policy on nutrient management strategies and regulation

In both EU and national policy design on nutrient management strategies and regulation, farmers, local and governmental policymakers, and environmental organisations are able to deliberate and negotiate, and environmental organisations can also express preferences. Agrotechnical and fertiliser companies, researchers and universities, and national chambers, advisors provide technical expertise. National chambers and advisors can develop preferences. Civil society is still determined to be listening as spectator only.

CASE STUDY: SPAIN

Name of the organisation: "CAYC"

Type of the organisation: research institute

ROLE IN THE NUTRIENT MANAGEMENT CYCLE

The interviewee is advisor at the organisation. In terms of nutrient management, takes care about the water in the system of the firm.

KNOWLEDGE ON NUTRIENT MANAGEMENT CYCLE

A rather confident level of knowledge in circular nutrient management was expressed by the interviewee. The access to adequate knowledge and to proper technology was assessed as easy in the themes of soil, fertilisers and soil conditioners, feeds, and manure, while partial in case of crop residues, animal products, and industrial processing. (There was no information on the knowledge regarding harvested crops and mineral supplements of animal breeding.) The difficulties experienced are due to the fact that farmers have little time to access information, the rather elderly age of the farmers, and the lack of aid to obtain technology.

THE NUTRIENT MANAGEMENT OF THE DEMO SITE

At the company's level, P and N in the nutrient flow are both traced. The barriers to the tracking systems are that it is not possible to differentiate the origin of the contaminants, the nitrogen limits in irrigation returns have become increasingly stricter, so there are more vulnerable areas, and no action is taken in the really contaminated ones. Also, there is no regulation on phosphorus. Water sampling is expensive.

As regards to the return of financial and time investment to implement the circular nutrient management, there was a medium-term (2-10 years) return indicated by the interviewee.

In terms of the difficulties in the development and spread of nutrient cycles, the lack of knowledge and the nature of political and legal frameworks represent a major problem, while the price of products, lack of environmental awareness, the lack of knowledge, the difficulty to obtain such products, as well as the type of equipment as specifically mentioned by the respondent were identified as rather problematic issues. Trust in quality and the unsatisfactory level of marketing activities turned out to be neither problematic, nor unproblematic.

NUTRIENT MANAGEMENT STRATEGIES AND REGULATORY ENVIRONMENT

The legislative environment is neither supportive, nor unsupportive on EU and regional levels, regarding its contribution to the realisation of circular nutrient management. At the same time, the national level legal environment was found not very supportive. The interviewee mentioned the EU-level RENURE initiative that is currently trying to decrease the 170 kg/ha N fertiliser top-up. It was also claimed that there are areas where many organic fertilizers are produced and cannot be applied to the soil due to the restriction of vulnerable areas. The legal framework to promote organic fertilisers is missing, the authorization of technology to carry out the circular economy (compost plants, etc.) is slow.

The Water Framework Directive was only mentioned by the respondent as a nutrient management strategy that applies for the organisation's activity.

Related to the practical feasibility of the nutrient management strategy for the respondent's area, they were dissatisfied with the institutional arrangement, policy design, the strategy's goals, the practical implementation, monitoring, and the milestones and timing, while being neutral to the information provided about the strategy. Strengths of the strategy are showing the population the problems of diffuse pollution and implying specific regulations for those areas. At the same time, the strategy requires overly ambitious objectives (25 mg/l) and does not focus on places with very poor water quality (>50 mg/l). The water samples taken by the administration were told to be insufficient. There is also a lack of information on phosphorus. The use of organic nutrients is not encouraged. It is expensive for the users to have analytic controls.

COOPERATION WITH PARTNERS, STAKEHOLDERS

The organisation's relationships in nutrient management activities exist with almost all the types of stakeholders in the fields of regulatory issues, research, and expertise/consultancy, except chambers and buyers from industry. No commercial and service relationships were defined by the respondent.

Difficulties in cooperating with partners are experienced in terms of financing, the lack of knowledge and confidence, and due to the incompatibility of the concerned partners with manure production.

Policies encouraging the use of organic fertilizers, the second use to livestock waste, as well as subsidies for technologies and streamline procedures would help them to improve cooperation.

Cooperation between the organisation and authorities related to nutrient management policy design is missing.

The existing governmental/regional/municipal supports that are useful for nutrient cycling management are collecting data and information, publishing open-source data, and organising training programmes on nutrient cycles. Of the yet non-existing support activities, easier business administration related to nutrient cycling management, the organisation of stakeholder networks for material chains, creating incubators to promote circular economy projects, promoting public-private partnerships, creating stakeholder networks for research and development, promoting cooperation with educational institutions and research centres to increase knowledge transfer, and organising training programmes on company management would be useful.

TYPES OF POLICY INSTRUMENTS AND GOVERNANCE STRUCTURES

Obligatory policy practices

The obligatory policy practices applying to them to implement N and P nutrient management are the following:

- Maintaining rural areas and landscapes
- Tackling climate change/sustainable management of natural resources
- Reduction of water polluting nitrates from agricultural sources
- Limits for N fertilisers: 170 kg N/ha/year from livestock manure
- Promoting good farming practices
- Rules for nitrate-vulnerable zones
- Limited period for fertiliser application
- Common safety standards, quality requirements for fertiliser products
- Limited use and conditions for organic farming inputs
- Specific agrotechnical practices

The 170 kg threshold of N in vulnerable areas is a mandatory, source-based policy measure to apply for nutrient cycling.

Voluntary policy practices

In the interviewed organisation's area, guidance, communication campaigns, knowledge transfer, code of best practices, advisory system on fertilizing, shared learning practices on nutrient reduction, and social incentives are voluntary policy practices to implement N and P nutrient management.

The financial instruments to implement N and P nutrient management

Related to N and P nutrient management, the financial instruments that are available are national subsidy programmes and – exemplified by Nenuphar project – research grants.

The governance structures

According to the interviewee, all the parameters related to the governance structures' main attributes, i.e. authorities' capacity, participation, institutional integration, and national approach in the field of nutrient management regulation were evaluated to operate on a low level.

The power of different stakeholders to shape EU and national policy on nutrient management strategies and regulation

In EU policy design on nutrient management strategies and regulation, farmers, national chambers, local policy members, civil society, agrotechnical and fertiliser companies, and academia are only seen as spectators, yet integrators and environmental organisations can express preferences. National policy members are able to develop preferences, and also to deliberate and negotiate, while, in addition to these, governmental members have the ability to aggregate and bargain, plus deliberate and negotiate.

Regarding national policy design, the situation is very similar, national and governmental policy actors being capable of expressing power on higher levels.

CASE STUDY: SPAIN

Name of the organisation: "CIRCE"

Type of the organisation: research institute

ROLE IN THE NUTRIENT MANAGEMENT CYCLE

The interviewee is project leader at the organisation. In terms of nutrient management, relates to the knowledge transfer aspects.

KNOWLEDGE ON NUTRIENT MANAGEMENT CYCLE

A rather confident level of knowledge in circular nutrient management was expressed by the interviewee. The access to adequate knowledge and to proper technology was assessed as easy in the themes of fertilisers and soil conditioners, feeds, and manure, while partial in case of soil, crop residues, animal products and industrial processing, and difficult in terms of harvested crops and mineral supplements of animal breeding. The difficulties experienced are due to the fact that there are a lot of treatment technologies but not really useful as not being efficient and not techno-economically feasible. Also, farmers do not have all the information or the capacity to apply these technologies.

THE NUTRIENT MANAGEMENT OF THE DEMO SITE

At the company's level, P and N in the nutrient flow are only partially traced. One of the barriers to the tracking systems is the current focus only on N, but not on other nutrients such as P or K as there is no legislation about them. In addition, the legislation related to N is focused on the organic part, while the inorganic part is not always considered.

As regards to the return of financial and time investment to implement the circular nutrient management, there were both a medium-term (2-10 years) or long-term (>10 years) return expectations indicated by the interviewee.

In terms of the difficulties in the development and spread of nutrient cycles, the difficulty to obtain such products and CAPEX (equipment costs) were identified as major problems, while the trust in quality of products (food security considerations), the price of products, the lack of knowledge, and lack of environmental awareness as rather problematic issues. The dissatisfactory level of marketing activities was evaluated as neither problematic, nor unproblematic.

NUTRIENT MANAGEMENT STRATEGIES AND REGULATORY ENVIRONMENT

The legislative environment is enough supportive on EU level, regarding its contribution to the realisation of circular nutrient management. At the same time, the national and regional level legal environment was found not very supportive. Conflicts of interest and legislation (final use of the manure, treatments, sludges) put legislative barriers in place to maintaining circular nutrient management activities.

The nutrient management strategy for the area highlighted was the NITRACHE Strategy, the aim of which is to control the N pollution in groundwater, surface water and river basin (Ebro). There were new limitations mentioned for livestock producers related to residues treatment and nitrogen application on soil.

Related to the practical feasibility of the nutrient management strategy for the respondent's area, they were dissatisfied with the information provided about the strategy and its practical implementation, while neutral towards the institutional arrangement, policy design, the strategy's goals, the monitoring, and the milestones and timing.

The strategy addresses the amount of organic residues in the region and its high nutrient content. A weakness is that the legislations focus only on the organic resources, and the monitoring is poor due to the lack of control mechanisms to follow-up the application of the legislation.

COOPERATION WITH PARTNERS, STAKEHOLDERS

In the organisation's nutrient management activities, the following relationships are maintained with the different stakeholders:

- Regarding regulatory issues, there is contact with authorities and policymakers.
- In research, they are in connection with research institutions/universities and national agencies.
- Expertise and consultancy relationships are relevant in case of advisors and their networks, research institutions/universities, NGOs, agricultural suppliers, and farmers.
- Services connect them to suppliers, chambers, and farmers.
- There is commercial relationship with financing/funding organisations, and buyers from industry.

Difficulties in cooperating with partners are experienced in terms of communication, financing (specifically: for research purposes and services), the lack of knowledge and confidence. Proper funding, less conflictive legislation, cooperation between end users and residue producers (training, knowledge

transfer, exchenge of best practices), as well as open-minded for new strategies would improve cooperation in nutrient management.

Cooperation between the organisation and authorities related to nutrient management policy design is considered existing but not enough, with the potential for improvement.

The existing governmental/regional/municipal supports that are useful for nutrient cycling management are easier business administration related to nutrient cycling management promoting public-private partnerships, organisation of stakeholder networks for material chains, creation of incubators to promote circular economy projects, promoting public-private partnerships, cooperation with educational institutions and research centres to increase knowledge transfer, and organising training programmes on nutrient cycles. Of the yet non-existing support activities, creating stakeholder networks for research and development, collecting data and information, publishing open-source data, and organising training programmes on company management would be useful.

TYPES OF POLICY INSTRUMENTS AND GOVERNANCE STRUCTURES

Obligatory policy practices

The obligatory policy practices applying to them to implement N and P nutrient management are the following:

- Reduction of water polluting nitrates from agricultural sources
- Limits for N fertilisers: 170 kg N/ha/year from livestock manure
- Rules for nitrate-vulnerable zones
- Limited period for fertiliser application
- Common safety standards, quality requirements for fertiliser products
- Limited use and conditions for organic farming inputs

Voluntary policy practices

In the interviewed organisation's area, guidance, communication campaigns, knowledge transfer, code of best practices, advisory system on fertilizing, and social incentives are voluntary policy practices to implement N and P nutrient management.

The financial instruments to implement N and P nutrient management

The respondent did not know about any financial instruments related to the implementation of N and P nutrient management in the organisation's area.

The governance structures

Of the governance structures in the field of nutrient management regulation, the ones related to authorities' capacity (number of stakeholders involved, multi-player negotiations, human or financial resources for planning), stakeholder's degree of negotiation power, and joint programmes between ministries and institutions were assessed to be on low level, while stakeholder's degree of involvement,

integration of organizations as well as the consensual and also the antagonistic placement of EU law operate on a sufficient (neither high, nor low) level.

The power of different stakeholders to shape EU and national policy on nutrient management strategies and regulation

In the EU and national policy design on nutrient management strategies and regulation, governmental policymakers are able to deliberate and negotiate, national policy members can develop preferences, while quite many groups, including local policy members, national chambers and advisors, integrators, environmental organisations, agrotechnical and fertiliser companies can express preferences, and the latter three also provides technical expertise. Farmers and civil society actors can only listen as spectators, according to the interviewee.

STRENGTHS AND WEAKNESSES OF THE SPANISH DEMO SITE

Strengths

The interviewed stakeholders have a rather confident level of knowledge in circular nutrient management. The fields in which it is generally easier to access adequate knowledge and proper technology are fertilisers and soil conditioners, feeds, and manure, while animal products and processing are partially covered.

P and N flows are fully or partially traced at company level.

Considering the realisation of circular nutrient management, EU (and somewhat regional) level legislative environments are not specifically unsupportive.

The stakeholders seem to be at least partially aware of the nutrient-related strategies that apply for their area. The strategies are beneficial because of being reflective on the issue, implying potential regulative measures.

Catalan Nutrient Platform, a future cluster of entities related to the management of nutrients to improve their management, was established to be involved in the designing and implementation of the strategy (based on the competences of autonomous administrations).

They maintain diverse relationships with a variety of stakeholders, including authorities, policymakers, research institutions, and farmers.

Training programmes, data and information collection, and publication of open-source data are commonly experienced governmental/regional/municipal support.

A wide set of voluntary practices related to the implementation of N and P management are available in the area.

Weaknesses

Limited access to adequate knowledge and proper technology in the fields of harvested crops and mineral supplements of animal breeding. Lack of time and capacity from farmers to access information on technologies.

No regulation on elements other than nitrogen (e.g., phosphorus, potassium).

Origin of contaminants, especially inorganic part is not properly addressed and differentiated.

The payback could be up to 10 years in the implementation of circular nutrient management investments.

There are numerous end-user attitudes that can cause difficulties in the development and spread of nutrient cycles, especially the lack of knowledge and adequate political and legal frameworks.

National legislative environment does not contribute to the realisation of the circular nutrient management in a supportive manner.

Using sewage sludge as fertilizer faces challenges including a lack of legal frameworks for its classification and application, legislative conflicts, and restrictions in vulnerable areas. Furthermore, slow authorization of technologies necessary for organic fertilizers and circular economy practices hampers progress.

In terms of practical feasibility, nutrient management strategies perform in a slightly dissatisfactory level in their design and implementation. The absence of a comprehensive global nutrient management strategy and notes the existing regulations' focus on organic resources with inadequate monitoring and control mechanisms were highlighted. Strategy's ambitious goals are misaligned with areas of extremely poor water quality. Additionally, water sampling and information on phosphorus are insufficient, the high cost of required analytic controls discourage the use of organic nutrients.

Communication, financial considerations, and the lack of knowledge and confidence all hinder the cooperation between partners.

Cooperation between the interviewed organisations and authorities related to nutrient management policy design are rather not satisfactory (or even not existing).

Ease of bureaucracy, networking, strengthening cooperation, and management trainings are not part of the governmental/regional/municipal support of activities related to nutrient cycling management.

Financial instruments related to implement N and P nutrient management are not clearly known for the stakeholders.

Most of the government structures along the attributes belonging to the authorities' capacities, participation, institutional integration, and national legislative harmonisation are on low, or medium level at highest.

On both EU and national level, the lower the power and territorial level is, the less is the influence on policy design.

LATVIAN DEMO SITE

Name of the organisation: "Farmers Parliament"

Type of the organisation: NGO

ROLE IN THE NUTRIENT MANAGEMENT CYCLE

Participates in several international projects mostly as agricultural **expert** or a **disseminator of knowledge** and project results on plant nutrient circulation. Several of the organization's experts are also farmers, so they have **very close contact with farmers.**

KNOWLEDGE ON NUTRIENT MANAGEMENT CYCLE

They have rather confident knowledge on circular management. Access to knowledge in case of the agricultural related elements (soil, crop residues, fertilisers and soil conditioners, harvested crops, mineral supplements of animal, breeding, feeds, animal products, manure) are easy for them and partially easy in case of processing (industrial processes).

(Note: „Circular nutrient management is a very broad term, it should be specified which specific processes we include in the question.")

THE NUTRIENT MANAGEMENT OF THE DEMO SITE

Tracing N and P in nutrient flow is partially implemented on the demo site. The main barrier of tracking nutrient flow is the availability of accurate data from each sewage sludge producer because it is very expensive to do analysis, so only average values are available.

They consider it is difficult to measure the **return of investments** of circular nutrient management.

The main **difficulties from the end-user** (e.g. farmers, consumers, society) side in the development and spread of nutrient cycles are the trust in the quality of products, food security questions and the price of the products – they consider these as rather problematic issues. They consider as minor problems are the lack of knowledge, lack of environmental awareness, the difficulty in obtaining the products, and the insufficient marketing activities.

NUTRIENT MANAGEMENT STRATEGIES AND REGULATORY ENVIRONMENT

They consider that the **legislative environment** at EU level is neutral (not supportive, but not obstructive either) to the implementation of circular nutrient management, but the national and the regional level legislation are not very supportive. Problem for example, that the developed sewage sludge management strategy must be accepted at the national level, allocating funding for investment, but this has not yet been done.

Several strategies apply to them, because the use of sewage sludge in the cycle of plant nutrients is in all of the strategies (e.g. Nitrate Directive, Water Framework Directive, Bioeconomy Strategy, Circular Economy Strategy etc.).

Regarding the **practical feasibility of the nutrient management strategy**, they consider the policy design problematic, and they also dissatisfied with the institutional arrangement, the monitoring, the milestones and the timing. They think that the provided information and the practical implementation of the strategy are appropriate, and they satisfied with the goals of the strategy.

COOPERATION WITH PARTNERS, STAKEHOLDERS

They keep contact related to their activities with wide range of stakeholders and they have no major difficulties in maintaining cooperation with them. Although, they consider that cooperation with the authorities is sufficient, but more interest from ministry officials would facilitate cooperation.

- They keep contact with authorities and policy makers because **of regulatory reasons**.
- They maintain relations for **commercial and service activities** with agricultural suppliers and service providers, financing/funding organisations and with advisors. They also maintain contact for commercial activities with farmers or farmers cooperatives and with buyers from industry and for services with national agencies and with advisors.
- For **expertise and consultancy,** they keep contact with several organisations, (this shows the easy availability of appropriate knowledge what was mentioned above): national agencies, NGOs/associations, federations, research institutions/universities, chambers, advisors/network of advisors, agricultural suppliers and services.
- For **research activities** they can keep contact with research institutions/universities, chambers and NGOs/ Associations, federations.

The governmental/regional/municipal institutions support them with the following activities:

- The organisation of stakeholder networks for material chains.
- Collecting data and information regarding the nutrient cycling.
- There is also incubator to promote circular economy projects, but they are not considered very useful.

They think, the following activities would be useful to support their activities in nutrient cycling.

- Easier business administration related to nutrient cycling management.
- Promotion of public-private partnerships.
- Creating stakeholder networks for research and development.
- Promote cooperation with educational institutions and research centres to increase knowledge transfer.
- Publish open-source data.
- Organise training programmes on nutrient cycles.
- Organise training programmes on company management.

TYPES OF POLICY INSTRUMENTS AND GOVERNANCE STRUCTURES

Obligatory policy practices

The obligatory policy practices apply to them to implement N and P nutrient management are the following:

- Reduction of water polluting nitrates from agricultural sources
- Limits for N fertilisers: 170 kg N/ha/year from livestock manure
- Promoting good farming practices
- Rules for nitrate-vulnerable zones
- Limited period for fertiliser application
- Common safety standards, quality requirements for fertiliser products

There are no mandatory policy practices on the maintenance of rural areas and landscapes and on climate change management/sustainable management of natural resources.

They don't know whether they have any obligatory policy practices on the limited use and conditions for organic farming inputs and specific agrotechnical practices.

Voluntary policy practices

There are **several voluntary policy practices** available on their area: guidance, knowledge transfer, code of practice, advisory system on fertilizing, shared learning practices on nutrient reduction.

There are no communication campaigns, and they don't know about any social incentives.

The financial instruments to implement N and P nutrient management

There is a lack of financial instruments to support the implementation of N and P nutrient management: there are no EU direct income support, EU rural development support, EU sectoral support schemes, subsidised loans, compensations, tax reliefs, insurances.

They do not know whether they have national subsidy programmes.

The governance structures

In nutrient management regulation they consider that only the 'stakeholders' participation' is sufficient: the degree of the involvement and the degree of stakeholder's negotiation power.

All the elements of 'authority's capacity' (the number of stakeholders involved, the multi-player negotiations, the human or financial resources for planning) are not sufficient. The 'institutional integration' (integration of organizations, joint programmes between ministries and institutions) is on low level and the 'national approach' of the placement of EU law (either consensual or antagonistic) are on low level.

The power of different stakeholders to shape EU policy on nutrient management strategies and regulation

Only environmental organisations can express their preferences to shape EU policies, all the others (farmers, chambers and advisors, civil society, agrotechnical companies, fertiliser companies, researchers and universities) are only listen as spectator.

The power of different stakeholders to shape national policy on nutrient management strategies and regulation

Farmers, agrotechnical companies and fertiliser companies also listen as spectators in the shaping of national policy, but national chambers and advisors, and civil society can express their preferences. Only environmental organisations can develop their preferences.

LATVIAN DEMO SITE

Name of the organisation: "LATVIAN WATER AND WASTEWATER WORKS ASSOCIATION"

Type of the organisation: NGO

ROLE IN THE NUTRIENT MANAGEMENT CYCLE

Representative (NGO) of municipal sewage sludge producers and promoter of nutrient cycling in agriculture. Policy expert.

KNOWLEDGE ON NUTRIENT MANAGEMENT CYCLE

They have confident knowledge on circular nutrient management. They consider it is easy to access adequate knowledge regarding the soil, fertilisers and soil conditioners and regarding industrial processing. Only partially easy to access knowledge for them in case of crop residues and harvested crops and manure.

> *Note: "The nutrient chain is long across economic sectors. As a representative of municipal water management, it is not entirely clear to us what interactions should be considered in this issue.*
>
> *Also, the responsibilities regards the activities in the nutrient circularity is not clear. For us as a water and wastewater services providing companies the main focus is to ensure our primary services and circularity of nutrients is just additional activity (sewage sludge treatment and recirculation). Our income and duties are related to water and wastewater tariffs – to maintain them in affordable level by ensuring all the requirements of environmental protection.*
>
> *The chain and responsibilities between water services and farmers must be short, clear and simple."*

THE NUTRIENT MANAGEMENT OF THE DEMO SITE

Tracing P and N is solved in the nutrient flow at their company level.

They highlighted that it is difficult to ensure a stable quality and quantity of sewage sludge product for agricultural use. This depends on the habits of water users, the presence of industries and their responsibility for pollutant emissions.

The difficulty in tracing is the analysis of the treated sludge or compost that are set by the national legislation regards water sector and not understandable by the farmers and agriculture sector (the forms of P and N used in water and agriculture sectors are different). Thus, the tracking of the results requires multiple calculations and transposes. The analysis requirements and methodology must be improved to satisfy the needs of both sectors, consequently the tracking of N and P will be more transparent.

They think that the **return of investments** of circular nutrient management is profitable economically only with financial support.

The main difficulties in the development and uptake of nutrient cycles are lack of knowledge, lack of environmental awareness and insufficient marketing activities **on the part of the end user** (e.g. farmers, consumers, society). The price and availability of products is not a problem, nor is the lack of confidence in the quality of the product a real problem.

NUTRIENT MANAGEMENT STRATEGIES AND REGULATORY ENVIRONMENT

They consider that the **legislative environment** at EU level is enough supportive to the implementation of circular nutrient management, but the national and the regional level legislation are not very supportive.

On problem, that in the water sector, on the topic of wastewater, there is a growing concern about the presence of different types of pollutants in sewage sludge, potentially leading to future restrictions on its further use. This lacks adequate scientific substantiation and evaluation of emerging substance impact on land of products where wastewater sludge compost is applied.

Several strategies apply to them – all the related EU strategies (e.g. Nitrate Directive, Water Framework Directive, Bioeconomy Strategy, Circular Economy Strategy etc.) and a national strategy the 'Sewage Sludge Management Plan in Latvia 2024-2027'.

Regarding the **practical feasibility of the nutrient management strategy**, they are satisfied with the monitoring of the strategy, the goals and the information provided are neutral for them, but they are dissatisfied with the institutional arrangement, the policy design, the practical implementation and the milestones and timing of the strategy.

The benefit of the strategy is the possibility of ensuring a high-quality, sustainable sewage sludge management process and creating a quality soil fertiliser product from sewage sludge and its appropriate use in agriculture. The compost gained from the wastewater sludge is relatively safe (proved in situation evaluation in the national sewage sludge management plan) due to the lack of industry in the country.

The barriers of implementing the strategy that, there is a lack of political and practical understanding between different sectors of the economy, such as agriculture, water and waste management. Lack of communication between the policy makers from different sectors, e.g. Ministry of Agriculture and Ministry of Environmental Protection and Regional Development. Missing a common view and cooperation in nutrient recycling.

COOPERATION WITH PARTNERS, STAKEHOLDERS

They keep contact related to their activities with wide range of stakeholders, but they have difficulties in collaboration due to communication, financial difficulties, lack of confidence and lack of knowledge. They are in the lack of the discussion and cooperation between the involved policy makers – nutrient production (recovery) and nutrient application sides.

Awareness-raising, policy promotion and funding would help them in improving cooperation.

In **regulatory issues** they keep contact with authorities, policy makers and national agencies, and farmers and farmer's cooperatives.

They maintain relations for **commercial and service activities** with chambers, agricultural suppliers and services, buyers from industry, farmers, farmer cooperatives.

For expertise and consultancy, they keep contact with financing/funding organisations, national agencies, NGOs/ Associations and federations, research institutions or universities and advisors.

They **cooperate in research** with research institutes or universities, as well as with NGOs/associations, federations.

The governmental/regional/municipal institutions support them with the following incentives and they find the activities useful.

- Organise stakeholder networks for material chains.
- Create incubators to promote circular economy projects.
- Collect data and information regarding the nutrient cycling.
- Organise training programmes on company management.

They think the following incentives would help them in their nutrient cycle management activities.

- Easier business administration related to nutrient cycling management.
- Promote public-private partnerships.
- Create stakeholder networks for research and development.
- Promote cooperation with educational institutions and research centres to increase knowledge transfer.
- Publish open-source data.
- Organise training programmes on nutrient cycles.

TYPES OF POLICY INSTRUMENTS AND GOVERNANCE STRUCTURES

Obligatory policy practices

The obligatory policy practices apply to them to implement N and P nutrient management are the following:

- Maintaining rural areas and landscapes
- Tackling climate change/sustainable management of natural resources
- Reduction of water polluting nitrates from agricultural sources
- Limits for N fertilisers: 170 kg N/ha/year from livestock manure
- Rules for nitrate-vulnerable zones
- Limited period for fertiliser application
- Common safety standards, quality requirements for fertiliser products

- Limited use and conditions for organic farming inputs
- Specific agrotechnical practices

They don't know weather they have obligation to promote good farming practices.

Voluntary policy practices

They have voluntary policy practices as guidance, communication campaigns, knowledge transfer and shared learning practices on nutrient reduction, but they **don't have code of best practices**. They do not know if there is an advisory system or any social incentives.

The financial instruments to implement N and P nutrient management

They do not know any financial instruments to support the implementation of N and P nutrient management.

The governance structures

They consider that governance structure of nutrient management is not sufficient. The elements of governance 'authority's capacity' (the number of stakeholders involved, the multi-player negotiations, the human or financial resources for planning), the 'participation' (stakeholder's degree of involvement and the stakeholder's degree of negotiation power), the 'institutional integration' (integration of organizations, joint programmes between ministries and institutions) and the 'national approach' of the placement of EU law (either consensual or antagonistic) are on low level.

The power of different stakeholders to shape EU policy on nutrient management strategies and regulation

In developing EU policy on nutrient management strategies and regulation, farmers are seen as having the greatest influence and can apply technology and expertise. National policy members and governmental policy members can participate in negotiations, and environmental organisations can aggregate their preferences and bargain. Researchers and universities can develop preferences, while national chambers, advisors and agrotechnical companies can express their preferences. Local political members, integrators, civil society and fertiliser companies have the least influence on EU policies and are only spectators in the development of nutrient management strategies and regulations.

The power of different stakeholders to shape national policy on nutrient management strategies and regulation

On national level also farmers have greatest influence on designing nutrient management strategies and regulation. National policy members, governmental policy members and researchers, universities can develop preferences while local policy members, national chambers, advisors, and agrotechnical companies can express their preferences. They believe that integrators, environmental organisations, civil society and fertiliser companies have the least influence on national policies (they are only spectators) in the development of nutrient management strategies and regulations.

The power of different stakeholders to shape regional policy on nutrient management strategies and regulation

On regional level also farmers and besides agrotechnical companies have the greatest influence on designing nutrient management strategies and regulation. National policy members and governmental policy members can participate in negotiations, local policy members can aggregate their preferences and bargain. National chambers and advisors can develop preferences, integrators, environmental organisations, and researchers/universities can express their preferences. The leas influence on regional policies has the civil society, and fertiliser companies.

STRENGTHS AND WEAKNESSES OF THE LATVIA DEMO SITE

Strengths

They have rather confident knowledge on circular management and access to knowledge is quite easy for them.

Tracing N and P in nutrient flow is implemented or partially implemented on the demo site.

They consider that **legislative environment at EU level** is neutral or enough supportive to the implementation of circular nutrient management.

Regarding the **practical feasibility of the nutrient management strategy applied** goals and the information provided are neutral or beneficial to them.

They **keep contact** with **wide range of stakeholders** through a variety of activities. Farmers associations have no major difficulties in maintaining cooperation with them.

The governmental/regional/municipal institutions support their activities on nutrient cycling with **incentives** (e.g. with the organisation of stakeholder networks for material chains, collecting data and information regarding the nutrient cycling and there is also incubator to promote circular economy projects).

The are several obligatory policy practices apply to them to implement N and P nutrient management and many voluntary policy practices are available in their area. Both associations have guidance, knowledge transfer, shared learning exercises on nutrient reduction. A code of practice and advisory system on fertilisation is available for the farmers' association and a communication campaign is in place for the water and wastewater association.

Weaknesses

The **barriers of tracing N and P** on demo site level are the availability of accurate data from each sewage sludge producer and the legislation of the analysis requirements and methodologies in case of water sector and farmers is not harmonised.

The stable quality and quantity of sewage sludge product for agricultural use is is depends on the habits of water users, the presence of industries and their responsibility for pollutant emissions.

They consider that the **return of investments** of circular nutrient management is difficult to measure, or profitable economically only with financial support.

They consider that the **legislative environment at national and the regional level** are not very supportive.

Regarding the **practical feasibility of the nutrient management strategy applied to them:** they are dissatisfied with the institutional arrangement, the policy design and the milestones and timing of the strategy.

The Latvian Water and Wastewater Management Association highlighted the lack of a common position and cooperation on nutrient cycling due to the lack of political and practical agreement between the different sectors (water and waste management) and ministries (Ministry of Agriculture, Ministry of Environment and Regional Development).

Latvian Water and Wastewater Management Association have **difficulties in collaboration with their stakeholders** due to communication, financial difficulties, lack of confidence and lack of knowledge. They are in the lack of the discussion and cooperation between the involved policy makers.

There is a lack of financial instruments to support the implementation of N and P nutrient management: there are no EU direct income support, EU rural development support, EU sectoral support schemes, subsidised loans, compensations, tax reliefs, insurances. They do not know whether they have national subsidy programmes.

They consider that **governance structure of nutrient management** is basically not sufficient, including the 'authority's capacity', 'institutional integration' and the 'national approach' of the placement of EU law. (Only the 'stakeholders' participation' is sufficient according to the Framers Parliament.)

Basically different perceptions

The **difficulties arising from the perception of end-users** (e.g. farmers, consumers, society) were evaluated in different ways. According to Farmes Parliament the main difficulties are the trust in the quality of products, food security questions and the price of the products. According to the Water and Wastewater Association the difficulties are the lack of knowledge, lack of environmental awareness and insufficient marketing activities. The different perception may result from the different target groups (as end-users) of their products.

The **power of different stakeholders in EU/national/regional policy making** is perceived very differently. According to the Farmers' Parliament, the power of most stakeholders in policy making is low, including farmers. According to the Water and Wastewater Management Association, farmers have high levels of power at all levels of policy making, and other stakeholders have different levels of intensity at different levels of policy making.

CASE STUDY: LITHUANIA

Name of the organisation: Farm of Kęstutis Armonas

Type of the organisation: agricultural stakeholder

ROLE IN THE NUTRIENT MANAGEMENT CYCLE: plant producer

KNOWLEDGE OF THE NUTRIENT MANAGEMENT CYCLE

A rather confident level of knowledge in circular nutrient management was expressed by the interviewee. He expressed easy access to knowledge regarding to mineral supplements of animal breeding, manure, produce processing and industrial processes. However, the soil, fertilisers, and soil conditioners, harvested crops, feeds and animal products related knowledge was labelled as partially accessible. The Lithuanian farmer thinks that crop residues knowledge is poorly or nor accessible. Difficulties on knowledge depends on the conditions, scope and economic issues, being the research conditions expensive and there is a severe shortage of laboratories.

NUTRIENT MANAGEMENT OF THE DEMO SITE

At the company's level, P and N in the nutrient flow are both traced. The main barrier of tracking the nutrient cycle is that samples taken for testing may not always be accurate due to varying conditions. Samples are rare and may not be representative of the whole sample.

In terms of costs, return chances and time of investments needed to implement the circular nutrient management it seems that it is difficult to evaluate or measure the time of profitability.

As regards to the difficulties price of products and obtaining products were identified as huge problems, while the trust in quality of products, food security questions, lack of knowledge and not enough marketing activities as rather problematic issues. The lack of environmental awareness was identified as a minor problem.

NUTRIENT MANAGEMENT STRATEGIES AND REGULATORY ENVIRONMENT

The EU level legislative processes were identified very supportive, national level they see lack of support, however regional level policy planning is not supportive at all. The responder highlights fertilisation plans, which is part of an obligatory nutrient management strategy in area, with specific adaptation and risk management tools, which were identified a major barrier in spread of circular nutrient management activities.

Related to the practical feasibility of the nutrient management strategy for the respondent's area, they were satisfied toward goals of strategies and milestones and timing, while he was dissatisfied with policy design and strongly dissatisfied with practical implementation. Institutional arrangement, information provided, and monitoring remain neutral.

Fertilisation plans was identified as strengths of the existing strategy, but the lack of legal framework does not allow us to do this in a partial way, lack of control mechanisms, underestimation of risks, limited laboratories, costly research and all the other costs of the circular economy was addressed as barriers to implement the goals of the circular strategies.

COOPERATION WITH PARTNERS AND STAKEHOLDERS

In the organisation's nutrient management activities, the following relationships are maintained with the different stakeholders:

- Regarding regulatory issues, there is contact with authorities and policymakers
- In research, they are in connection with research institutions/universities, NGOs/ Associations, federations and farmers, farmer cooperatives.

- Expertise and consultancy relationships are relevant in case financing/funding organisations and national agencies.
- Advisors, network of advisors, farmers, farmer cooperatives and agricultural suppliers provide services.
- They maintain commercial relationships with NGOs/ Associations, federations.
- No connection in nutrient cycle with chambers and buyers from industry.

Difficulties in cooperating with partners are experienced in terms of communication, financing, and lack of confidence. Financial tools, awareness raising supports would help you to improve the cooperation between stakeholders of nutrient cycle problem.

There is no cooperation considered between organisation and authorities related to nutrient management policy design.

Governmental, regional or municipal supports that are useful for nutrient management do not exist in Biržai region, easier business administration related to nutrient cycling management, organisation of stakeholder networks for material chains, creation of incubators to promote circular economy projects, promotion of public-private partnerships, creation of stakeholder networks for research and development, promotion of cooperation with educational institutions and research centres to increase knowledge transfer, collection of data and information regarding the nutrient cycling, publishing open-source data, organising training programmes on nutrient cycles and organising training programmes on company management would be useful instruments.

TYPES OF POLICY INSTRUMENTS AND GOVERNANCE STRUCTURES

The obligatory policy practices applying to them to implement N and P nutrient management are the following:

- Maintaining rural areas and landscapes
- Tackling climate change/sustainable management of natural resources
- Reduction of water polluting nitrates from agricultural sources
- Limits for N fertilisers: 170 kg N/ha/year from livestock manure
- Promoting good farming practices
- Rules for nitrate-vulnerable zones
- Limited period for fertiliser application
- Common safety standards, quality requirements for fertiliser products
- Limited use and conditions for organic farming inputs
- Specific agrotechnical practices

The interviewed farmer highlighted the existing knowledge transfer and shared learning practices on nutrient reduction voluntary policy instruments, however lack of guidance, communication campaigns, code of best practices, advisory system on fertilizing and social incentives were also mentioned.

Related to implement N and P nutrient management in Biržai area no financial instruments were find.

In Lithuania there is one mandatory source-based policy instrument, called mini/max (A class 1 category).

THE GOVERNANCE STRUCTURES

The respondent consider that the integration of organizations, consensual placement of EU law and antagonistic placement of EU law are sufficient for nutrient management regulation. All the elements of 'authority's capacity' (the number of stakeholders involved, the multi-player negotiations, the human or financial resources for planning) and participation (stakeholder's degree of involvement and stakeholder's degree of negotiation power) are not sufficient. Joint programmes between ministries and institutions are on low level for completion of nutrient management.

The power of different stakeholders to shape EU policy on nutrient management strategies and regulation

National chambers, advisors, agrotechnical companies, fertiliser companies and researchers, universities deploy technique and expertise, and participation mechanisms exercise direct power to shape EU law. Environmental organisations deliberate and negotiate. Other institutions such local policy members, national policy members, governmental policy members, integrators and environmental organisations have a lower power to influence the legislative processes. However, farmers, civil society, researchers, and universities have no power and listen as spectator.

The power of different stakeholders to shape national policy on nutrient management strategies and regulation

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CASE STUDY: LITHUANIA

Name of the organisation: UAB "Biržų vandenys"

Type of the organisation: company

Role in the nutrient management cycle

A water management company in Lithuania, that composts wastewater sludge form 2011.

Knowledge on nutrient management cycle

They have rather confident knowledge on circular management. Access to knowledge and proper technology in case of harvested crops and manure is partially easy for them, but not easy in case of soil, crop residues, fertilisers and soil conditioners. They don't know the situation in case of mineral supplements of animal breeding, feeds, animal products and processing.

They highlighted the main reasons of their difficulties as follows:

There is a difficulty because the number of people who have an engineering education and can delve into technological processes is rapidly decreasing.

The other point is the complicated procedure of realizing the produced compost, many requirements must be fulfilled in order to use the compost.

Also, these procedures quite expensive and it become is an unattractive product for farmers.

The nutrient management of the demo site

Tracing N and P in nutrient flow is implemented on the demo site.

They consider that the return of investments to implement circular nutrient management can only be economically profitable with financial supports.

The main difficulties from the end-user (e.g. farmers, consumers, society) side in the development and spread of nutrient cycles are the lack of environmental awareness and the difficulty to obtain such products. The trust in the quality and the safety of the products, the price of the products and the inadequate marketing activities are also problematic. The lack of knowledge about sustainable nutrient cycles causes moderate difficulties.

NUTRIENT MANAGEMENT STRATEGIES AND REGULATORY ENVIRONMENT

They consider that the legislative environment at EU level is neutral (not supportive, but not obstructive either) to the implementation of circular nutrient management, but on regional level it is not very supportive and on national level is not supportive at all.

They claim, that at national level, it is very difficult to legalize and obtain a certificate that a product is suitable for use. It is a very complicated procedure.

There are strategies which apply to them, for example Circular Economy Strategy.

Regarding the practical feasibility of the nutrient management strategy, they strongly dissatisfied with the institutional arrangement and with the milestones and timing and also dissatisfied with the policy design. The goals, the practical implementation, the information provided, and the monitoring are neutral for them.

COOPERATION WITH PARTNERS, STAKEHOLDERS

They keep contact related to their activities with wide range of stakeholders. They have difficulties in the cooperation with their partners because of communicational and financial reasons. Technical and financial support would help the cooperation.

They keep contact with policy makers because of regulatory reasons.

They maintain relations for commercial activities with agricultural suppliers and service providers, financing/funding organisations, buyers from industry and farmers of farmers cooperatives.

They maintain relations with authorities to use their services.

For expertise and consultancy, they keep contact with several organisations: national agencies, NGOs/associations, federations, chambers, advisors/network of advisors.

For research activities they can keep contact with research institutions or universities.

There is no adequate cooperation between their organisation and the authorities related to nutrient management policy design.

The governmental/regional/municipal institutions support them with the following activities:

Create stakeholder networks for research and development.

Promote cooperation with educational institutions and research centres to increase knowledge transfer.

They think, the following activities would be useful to support their activities in nutrient cycling.

Easier business administration related to nutrient cycling management.

Organise stakeholder networks for material chains.

Organise training programmes on nutrient cycles.

Organise training programmes on company management.

Incubators to promote circular economy projects, the promotion of public-private partnerships, the collection of data and information on the nutrient cycle and the publication of open-source data would not be very useful for them.

TYPES OF POLICY INSTRUMENTS AND GOVERNANCE STRUCTURES

Obligatory policy practices

The obligatory policy practices apply to them to implement N and P nutrient management are the following:

Maintaining rural areas and landscapes

Tackling climate change/sustainable management of natural resources

There are no mandatory policy practices on the reduction of water polluting nitrates from agricultural sources, on the promoting good farming practices, on limited period for fertiliser application, common safety standards, quality requirements for fertiliser products, limited use and conditions for organic farming inputs, and on specific agrotechnical practices.

They don't know whether they have any obligatory policy practices on N fertiliser limits (170 kg N/ha/year from livestock manure) and rules for nitrate-vulnerable zones.

Voluntary policy practices

There are voluntary policy practices available on their area: guidance, communication campaigns, and social incentives.

There is no knowledge transfer and advisory system on fertilizing, and they don't know whether they have a code of best practices or shared learning practices on nutrient reduction.

The financial instruments to implement N and P nutrient management

EU sectoral support schemes and national subsidy programmes are existing in their area to help the implementation of nutrient management and there is also penalty for them.

There is a lack of EU direct income support, EU Rural development support, subsidised loans, compensations, tax reliefs and insurances related to nutrient management.

The governance structures

In nutrient management regulation they consider that most of the elements of governance structures are on low level. Regarding the authorities' capacity multi-player negotiations and human or financial resources for planning are on low level. The involvement and the negotiation power of stakeholders are also on low level. The institutional integration both on organisational level and on program level is low. They think that the placement of EU law is on sufficient level (consensual and also antagonistic approach).

The power of different stakeholders to shape EU policy on nutrient management strategies and regulation

They consider that integrators, fertiliser companies and researchers/ universities have the biggest power to shape EU policies – they can negotiate. National policy members, governmental policy members and environmental organisations can aggregate their preferences and bargain. Farmers, national chambers and advisors and agrotechnical companies can develop their preferences while local policy members can express their preferences. Civil society can only listen as spectator.

The power of different stakeholders to shape national policy on nutrient management strategies and regulation

They consider that fertiliser companies have the biggest power to shape national policies (they have the technique and expertise) and agrotechnical companies can negotiate. Farmers, national policy members, governmental policy members, environmental organisations, civil society and universities or researchers

can aggregate the knowledge and bargain. National chambers and advisors, local policy members and integrators can develop preferences.

The power of different stakeholders to shape regional policy on nutrient management strategies and regulation

Agrotechnical and fertiliser companies can make negotiations on regional level. National chambers, local policy members, national policy members and environmental organisations can aggregate knowledge and bargain. Farmers, governmental policy members, integrators and universities/ researchers can develop their preferences, while civil society can express their needs.

Strengths

The Lithuanian demosites' stakeholders have rather confident knowledge on circular management, although they have different views on the access to information.

Tracing N and P in nutrient flow is implemented in case of both stakeholders.

The legislation on EU level were identified neutral or supportive.

They keep contact related to their activities with wide range of stakeholders.

The governmental/regional/municipal institutions support them with creating stakeholder networks for research and development and with the promotion of the cooperation with educational institutions and research centres.

Guidance, communication campaigns, and social incentives were mentioned by the water management company as voluntary policy practices and knowledge transfer, shared learning practices were mentioned by the agricultural stakeholder.

EU sectoral support schemes and national subsidy programmes are existing in their area to help the implementation of nutrient management according to the water management company.

Weaknesses

Access to knowledge is only partially easy for them in case of some elements of the nutrient cycling. Stakeholders highlighted the reasons which make the access to proper knowledge difficult. The number of engineers who are specialist of technological processes is decreasing. There are many requirements of using compost, this is a very complicated and expensive procedure, which makes the product less attractive for farmers. The research conditions in the topic are also expensive and there is a severe shortage of laboratories.

The barrier of tracking P and N flow is that samples taken for testing are rare, and may not always accurate, and may not be representative of the whole sample.

They consider that it is difficult to evaluate or measure the return of investments need to implement circular nutrient management or it can only be economically profitable with financial supports.

The main difficulties from the end-user (e.g. farmers, consumers, society) side in the development and spread of nutrient cycles are the price of the products, the difficulty to obtain such products, the trust in the quality and the safety of the products, and the inadequate marketing activities, according to both stakeholders.

They consider that the national and regional level legislation are not very supportive. At national level, it is very difficult to legalize and obtain a certificate that a product is suitable for use.

The feasibility of the nutrient management strategy is only partly considered appropriate by the respondents, but different parts of it are considered problematic. The agricultural stakeholder claims, that fertilisation plans are part of an obligatory nutrient management strategy in the area, with specific adaptation and risk management tools, which were identified a major barrier in spread of circular nutrient management activities. The lack of legal framework, the lack of control mechanisms, underestimation of risks, limited laboratories, costly research and all the other costs of the circular economy was addressed as barriers to implement the goals of the circular strategies.

They have difficulties in the cooperation with their partners because of communicational and financial reasons and because of the lack of confidence. There is no adequate cooperation between their organisation and the authorities related to nutrient management policy design.

The agricultural respondent couldn't find any financial instrument which could help them in the implementation of nutrient management.

In nutrient management regulation they consider that most of the elements of governance structures are on low level, only the placement of EU law is on sufficient level.