



Impact of explicit consent to data protection rules on the stakeholder landscape in transdisciplinary Nexus research projects

Tamara Avellán^{a,*}, Andrea B. Müller^a, Daniella Kristensen^b,
Chrysaida-Aliki Papadopoulou^c, Maria P. Papadopoulou^c, Ingrida Bremere^d,
Stefania Munaretto^e, Florentina Nanu^f, Malgorzata Blicharska^g

^a Tamara Avellán Consulting, Dresden, Germany

^b Jones & Wagener (Pty) Ltd Engineering and Environmental Consultants, Johannesburg, South Africa

^c School of Rural, Surveying and Geoinformatics Engineering, National Technical University of Athens, Athens, Greece

^d Baltic Environmental Forum, Latvia

^e KWR Water Research Institute, Nieuwegein, The Netherlands and Copernicus Institute of Sustainable Development, Utrecht University, The Netherlands

^f Business Development Group, Bucharest, Romania

^g Natural Resources and Sustainable Development, Department of Earth Sciences, Uppsala University, Uppsala, Sweden

ARTICLE INFO

Keywords:

Stakeholder engagement
Co-creation of knowledge
GDPR
Stakeholder analysis

ABSTRACT

Transdisciplinary Water-Energy-Food-Ecosystem (WEFE) Nexus projects intend to engage stakeholders from a broad base. European Union funded projects must adhere to General Data Protection Regulations (GDPR) that govern the way in which personal data of stakeholders is gathered, stored, and used. In the H2020 project NEXOGENESIS, WEFE nexus interlinkages are assessed in five river basins, four in Europe and one in Southern Africa. This work is carried out in a participatory manner and stakeholder engagement plays a central role. Stakeholders were asked to actively consent to the collection, storage, and use of their information through a privacy policy consent form. Active engagement with stakeholders occurred in the first half of the project (2021–2023) through stakeholder workshops via different modalities in each of the five case studies, and targeted stakeholder interviews and focus group discussions. We show that the stakeholders that actively consent to the use of their information are not evenly distributed across all sectors but are generally from the water sector and have high interest and rather low power. Our study provides evidence that the need to sign a consent form reveals biases in the stakeholder landscape. Results also show that consent rates increased with active engagement situations and were relatively high through face-to-face interactions but were the highest in absolute terms through hybrid events. Using consent forms not only helps increase the transparency of how personal data of stakeholders is used, but also helps show the biases that are present in the active stakeholder base.

1. Introduction

Natural resources are limited in their abundance and accessibility, and, thus, for human consumption and use. Multiple key planetary boundaries for Earth's system stability have been or are close to being surpassed (Rockström et al., 2009; Richardson et al., 2023). The Water-Energy-Food (WEF) Nexus is a framework through which resource management can be mapped and assessed, with the purpose of optimizing resource use for multiple needs and assuring the triple

securities of water, food and energy for humanity (Hoff, 2011). The WEF Nexus approach builds on inter- and transdisciplinary methods to assess resource use synergies and trade-offs.

Transdisciplinarity is “a facilitated process of mutual learning between science and society that relates a targeted multi-disciplinary or inter-disciplinary research process and a multi-stakeholder discourse for developing socially robust orientations about a specific real-world issue (either a problem or a case)” (Scholz and Steiner, 2015). Interaction with stakeholders (SHs) helps with co-creation and exchange of knowledge and

* Corresponding author.

E-mail addresses: tamara.avellan@posteo.de (T. Avellán), mueller.andreab@gmail.com (A.B. Müller), daniella@jaws.co.za (D. Kristensen), xpap@survey.ntua.gr (C.-A. Papadopoulou), mpapadop@mail.ntua.gr (M.P. Papadopoulou), ingrida.bremere@bef.lv (I. Bremere), stefania.munaretto@kwrwater.nl (S. Munaretto), florentina.nanu@bdgroup.ro (F. Nanu), malgorzata.blicharska@geo.uu.se (M. Blicharska).

<https://doi.org/10.1016/j.envsci.2025.104029>

Received 3 February 2024; Received in revised form 16 December 2024; Accepted 28 February 2025

Available online 7 March 2025

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supports capacity and consensus building for social transformation (Scholz and Steiner, 2015; Moser, 2016). SH participation can also give scientists access to novel information while increasing responsiveness of the scientific work to SH needs to support a desired transition or transformation (Brombal et al., 2018).

SH engagement processes have grown into broadly used methods to support social inclusion and public participation in a range of decision-making processes across problems and sectors. Engagement approaches (e.g. Focus Groups, Expert Panels, World Café, Delphi) are considered important in enhancing common understanding, mutual learning, trust building, knowledge generation, conflict resolution, trade-off management, collaborative network and synergy establishment, and the design of widely accepted solutions and policies (Reed, 2008; de Vente et al., 2016; Reed et al., 2018). They are often adopted to address problems related to policy making, urban planning, ecosystem preservation and resource management (Kujala et al., 2022).

SH engagement processes vary and are not necessarily standardized across disciplines, research, and practice. The Project Management Handbook dedicates an entire chapter to SH mapping and engagement (The Project Management Institute, 2017), and international trans-disciplinary societies have started a methods inventory for SH mapping and engagement (Toolbox, n.d.). Participatory processes intend to include the widest SH base possible, needed to address the issue at hand, to address many different viewpoints and interests (Reed et al., 2018). SH mapping intends to capture this breadth, whereas SH analysis looks at categories of SHs and/or their relationships or role within project (Reed et al., 2009). SH engagement intends to engage diverse actors through a variety of actions, with the intent of 'real' engagement, i.e., empowering SHs to decide and take action (Arnstein, 1969; Barreteau, Bots, and Daniell, 2010; Reed et al., 2018; de Vente et al., 2016). A multi-SH process often results in participatory processes that pursue (1) top-down communication through information-sharing and consultation of opinions and/or (2) bottom-up modes such as deliberations, co-design, co-production and co-decisions (Reed et al., 2018).

For Nexus research, a balanced representation of actors across targeted sectors and resources, disciplines, and practices (from technical experts to policymakers) is important. This wide range of actors enables researchers to gather sufficient data to run bio-physical and socio-economic models, and to understand governance and policy changes needed to enhance coherence and cohesiveness of resource use across sectors.

Since 2018, gathering information on, about and from SHs in European research is governed by the General Data Protection Regulation (GDPR), which mandates transparency for SH-data storage, analysis and use for research purposes (EUR-Lex - 02016R0679-20160504 - EN - EUR-Lex, n.d.). However, while SH engagement has become a prominent feature in European research (Regulation (EU) 2021/695), the literature on GDPR and its relation to and influence on SH identification and engagement is limited (Andersen et al., 2021).

In the European Horizon-2020-funded Nexus Project NEXOGENESIS (NXG), to comply with GDPR SHs are asked to complete a form – either online or in printed format – where they explicitly consent to their personal data being used for research. In the first two years of the project (2021 – 2023) a low response rate of consent forms, covering about 20 % of identified SHs was found. We, thus, wonder, does the need for consent alter the project's SH landscape towards reduced actor diversity, hampering the inclusiveness of the participatory process? In this article, we intend to find out (1) to which degree active consenting biases or limits the SH diversity in terms of sectors, types of actors engaged, and their power and interest, and (2) which kind of SH engagement activities influence consent rates and in which way. In the spirit of trans-disciplinarity, this article is co-authored by researchers and practitioners. It intends to provide insights and recommendations both on scientific methods to make use of GDPR compliance for better understanding of SH landscapes in nexus research projects and on practical implications on SH identification and engagement to foster nexus

thinking.

This article first introduces the project and the SH identification process, categorization, and differentiation, as well as the engagement activities. It then presents the SH landscape before ('overall') and after consent ('official') and the relative effect that engagement activities had on consent rates. Lastly, it discusses the results and provides recommendations for GDPR compliant SH engagement.

2. Background

2.1. Description of the project

NXG is a four-year European Union (EU) funded research and innovation action (2021 – 2025) involving 20 partners across the natural sciences, economics, policy and governance, computer sciences and modeling fields. The project focuses on the Water-Energy-Food-Ecosystems (WEFE) Nexus in five case studies (CSs); four CSs in Europe, namely the Nestos/Mesta river basin between Bulgaria and Greece (Case Study 1, CS1), the Lielupe river basin between Latvia and Lithuania (CS2), the Jiu river basin in Romania (CS3) and the Adige river basin in Italy (CS4). Outside of Europe is the Inkomati-Usuthu river basin in South Africa (CS5). All NXG CSs face issues with sustainable and fair resource management and allocation under climate change. All CSs go beyond current WEF Nexus studies by integrating ecosystem components as a major novelty. Each CS has designated responsible project partners that possess in-depth area knowledge, problems faced and stakeholders, forming the CS leading team (CS leads).

Effectively managing the WEFE nexus to improve resource efficiency is a challenging process at modeling and policy level due to the complexity of the bio-physical system and the fragmentation in policy formulation. In this project, partners develop methodologies and approaches to better understand WEFE Nexus bio-physical interlinkages (Sušnik et al., 2021), policy coherence across sectors (Papadopoulou et al., 2020; Mooren et al., 2024) and governance systems' capacity to support cross-sectoral policy making (Mooren et al., 2024). The project also develops tools to facilitate SH dialogue for WEFE cross-sectoral policy making. These tools are the NEXOGENESIS Nexus Policy Assessment Tool (NEPAT) and the WEFE Nexus Footprint to visualize the effect of policies on the WEFE resources availability in a synthesized way (Simpson and Jewitt, 2019). A better understanding of the impacts of sectoral WEFE policies on the Nexus can help SHs across sectors and scales in developing more coherent policies, achieving multiple sectoral goals while managing cross-sectoral trade-offs and exploiting synergies.

2.2. Stakeholder engagement process

SH engagement is a fundamental element in NXG and aims to involve SHs in the co-design and use of project approaches and tools. SHs were engaged for insight on their perceptions of problems in resource management and solutions, their policy preferences and to harness their expert knowledge on nexus interlinkages.

To maximize SH knowledge and apply a coherent and comparable process across all CSs in NXG, a 5-step SH engagement process was applied (Fig. 1). The first step referred to SH engagement CS-specific aims. While the overarching goals of SH engagement were defined in the project proposal, the team considered it important to define specific goals for each case. The second step was SH mapping and analysis, where SH sectoral belonging, a tier system and specific professional backgrounds were used for categorization and power-interest mapping to assess actors' project relevance. This is the key step that this article addresses, since this is the beginning of applying GDPR rules. In the third step, a SH management plan was developed, where activities to foster SH engagement for knowledge generation were defined based on results of the previous steps. Therefore, the type of activities to be carried out were largely dependent on the pool of actors that the project could work with given the limitations of GDPR (and other factors). These activities

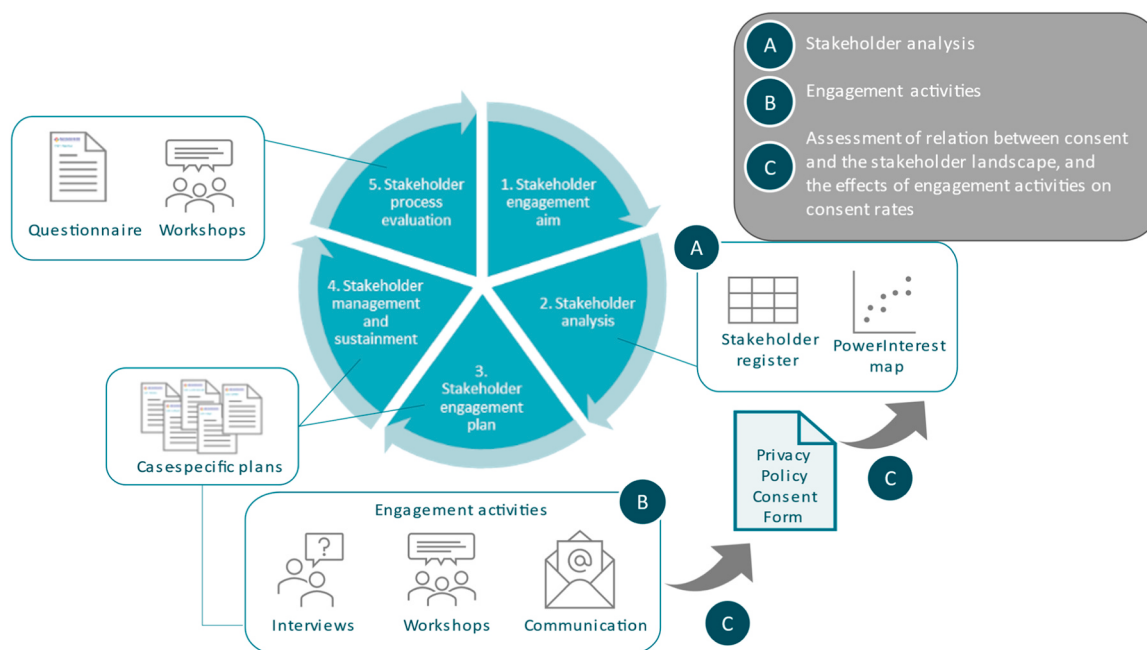


Fig. 1. 5-step stakeholder engagement process in NEXOGENESIS and assessment process on the effects of consenting.

follow Arnstein's ladder of participation and are based on Bojovic et al. (2021) definition of co-production, ranging from 'Engagement' for awareness raising through 'Involvement' for knowledge exchange to 'Empowerment' for co-development. Activities include communication with SHs such as emails, newsletters, and phone calls, SH workshops (six are planned throughout the project) and SH interviews. The fourth step focused on SH sustainment, defined by SH groups that can take up and carry the work on post-project. Lastly, in the fifth step, the SH engagement process was continuously evaluated for the quality of the process and outcome.

3. Methodological approach

The first two years of the project (i.e., September 2021 to September 2023) set the timeframe for this analysis. While the results presented on engagement activities span the entire timeframe, the analysis of the effect of consent on the SH landscape is a snapshot from March 2023. At this point, the project had carried out several important engagement activities and showed a consolidated SH landscape with a fairly stable number. We define SH landscape as the composition of SHs by categories, sectors, and their power-interest. The SHs that have consented to being placed in the SH register are termed here as the 'official' SH landscape in contrast to the 'overall' SH landscape that holds all SHs identified – consented or not.

The main aim of this article is to assess the effect of GDPR on the SH landscape, i.e. the change of the composition between the 'overall' and the 'official' SH landscape, and, thus, its potential effect on participation. Simultaneously, engagement activities influence SH engagement and, thus, consent. The following sections describe (A) the SH analysis undertaken, (B) the two major engagement activities, namely CS interviews and CS workshops, and (C) the analysis of the effect of actively consenting to privacy policies, its effect on the SH landscape, and the effect of the engagement activities on the consent form response rate (Fig. 1).

3.1. Stakeholder analysis: identification, categorization and differentiation

The stakeholder analysis followed Reed et al. (2009), involving three

steps: (a) SH identification, (b) SH categorization and differentiation, and (c) investigation of SH relationships (Fig. 2). As the focus is on understanding the effect of GDPR on SH categorization and differentiation, this article encompasses the first two steps.

3.1.1. Identification: stakeholder register

Preliminary identification of potential project SHs was carried out by CS leads by listing, collecting, and storing basic information – largely publicly available – about people, entities or organizations that may be affected by or may affect the project. SHs from the register were contacted, informed about the project, and invited to introductory meetings and workshops to explain the project goal as well as the aim and importance of their participation. During events and as part of the SH engagement evaluation process, SHs were asked to provide suggestions for further SH contacts (snowballing). SH data is stored in a protected document – the SH register – accessible only to consortium members. CS leads are responsible for modifying the data as needed over time. Results are then presented either anonymized (using identification codes) or in an aggregated manner.

To comply with GDPR and other applicable policies (e.g., Protection of Personal Information Act (POPI) for South Africa), SHs were asked to, voluntarily, complete a Privacy Policy Consent Form (PPCF) stating their willingness to be formally added to the SH register of the project, when SHs were added to the register and at every engagement activity. This form (Supplementary Material SM1) was developed in English, translated into the respective CS-relevant languages (Greek, Bulgarian, Latvian, Lithuanian, Romanian, Italian and German), and published online via the EUSurvey tool (supported by the European Commission's DEP-Interoperability program). Consent is recorded in the EUSurvey tool and exported to the register for the record. The PPCF includes a short project description and the CS context, privacy policy considerations, followed by a checkbox that requests SHs to consent actively and consciously. Additionally, SHs can provide input on matters such as their position, sex or gender, the type of SH they are (see tiers below), project expectations, and their interest and power. In this article, none of this additional information was used for analysis. The privacy policy refers to local policies whenever applicable (e.g., POPI for South Africa), explicitly mentions data that is collected and stored, why and where it will be used, SH rights (e.g., access, deletion), and designated

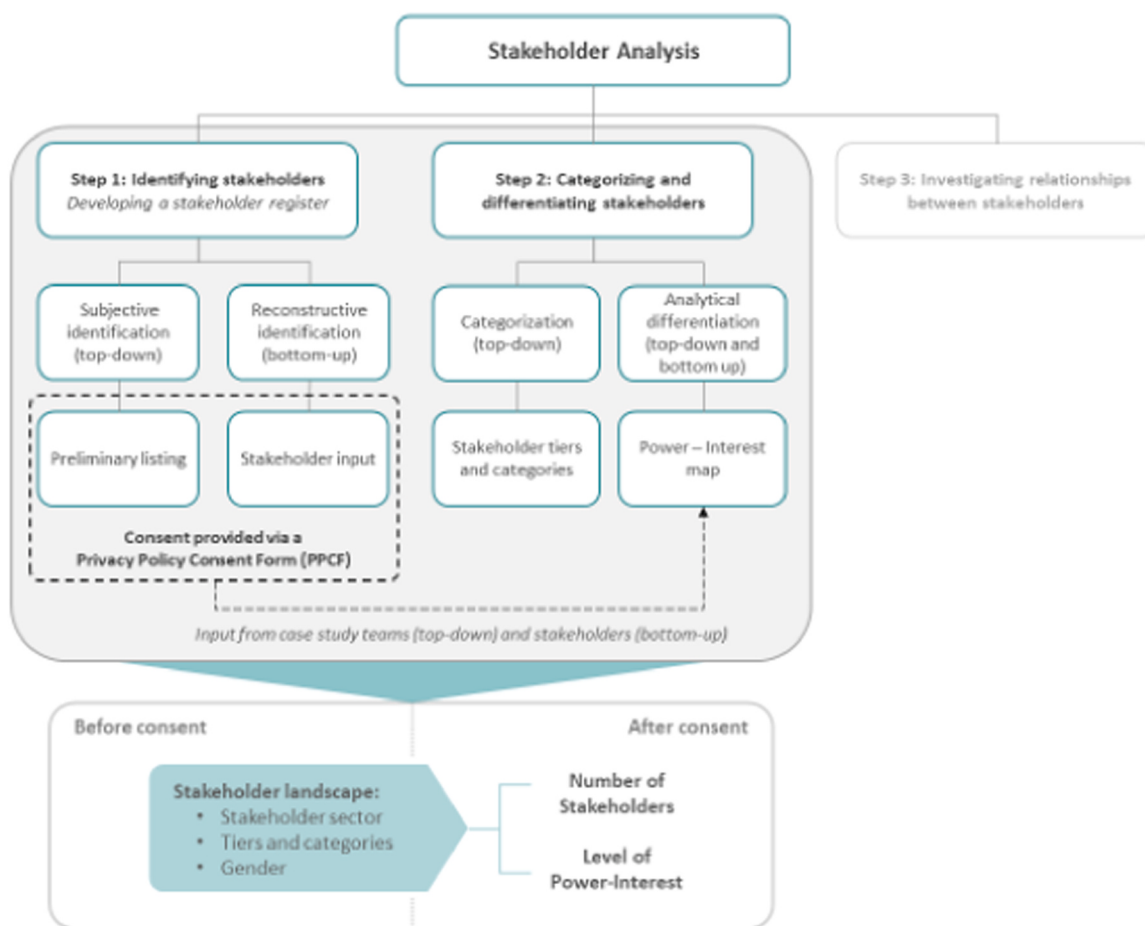


Fig. 2. Stakeholder analysis process adapted for the project following Reed et al. (2009).

responsible persons. SHs are also informed that they can withdraw consent at any time, and, thus, ask to be removed from the SH register via an email to the responsible persons.

3.1.2. Categorization: sectors and occupation

In NXG, three broad SH tiers were established to differentiate between the message levels:

- **Tier 1:** SHs that will be **directly engaged in the project implementation and/or outcomes** and are strongly case-specific (e.g., representatives of the local municipality, civil society organizations -CSOs-). SHs will potentially collaborate (they might be informed or consulted only) in the processes of development of the models and tools, and analysis and validation of policy suggestions.
- **Tier 2:** SHs with an **interest in the application of project results and products**. A wider constellation of interested SHs (e.g., local government, European policy departments -EC DGs-, SHs in different basins) who wish to utilize the NXG tools may be engaged.
- **Tier 3:** SHs with a **general interest in the project**. This is a wide group of SHs for the dissemination of outcomes which could include neighboring basin or country authorities, business or private enterprises, and national planning agencies.

For a more detailed characterization of the SHs, CS teams identified them as belonging to one or more WEF Nexus sectors and to one of the 13 SH categories according to their occupation or role within the project scope (more details in SM2). These categories assisted in analyzing SHs beyond their 'usual suspect' profiles and exploring potential roles outside sectoral silos with the intention of expanding SH identification.

3.1.3. Differentiation: power-interest analysis

While power-Interest maps (also known as influence-interest maps) are widely used in business they are commonly used in research to prioritize SHs for engagement (Reed et al., 2009; Franco-Trigo et al., 2020; Bendtsen et al., 2021; Hollmann et al., 2022). A review of Bendtsen et al. (2021) on SH analyses related to environmental management and regulations shows that influence and interest are commonly addressed but that clear guidelines are missing and definitions are needed to avoid misunderstandings. Therefore, we define power as the ability of an SH to change or stop achievement of CS aims, and interest as the SH's degree of intended involvement in project activities.

The level of power and interest was determined by the CS groups and ranges from 0 to 10, representing low and high power or interest, respectively. These results are presented in a scatter plot that classifies SHs in four categories: (i) High power – High interest (HP-HI), (ii) High power – Low interest (HP-LI), (iii) Low power – Low interest (LP-LI), and (iv) Low power – High interest (LP-HI). This differentiation is intended to help develop targeted communication and engagement strategies that reduce SH fatigue by adjusting engagement to SH needs (Hollmann et al., 2022). The project's aim is also determinant for prioritization of SHs; for instance, projects focused on SH empowerment may consider the LP SHs as key target group (Johnson et al., 2008; Mendelow, 1981). While these profiles were used as indicative guidance they were not strictly followed. As such all SHs were always invited to attend all project activities, irrespective of their position within the PI matrix. The project team rather used this classification to identify SH clusters and missing representation, such as marginalized SHs (HI-LP) in order to be able to reach out to them and actively engage them in project activities.

3.2. Engagement: activities with stakeholders

3.2.1. Case study workshops

The NXG project plans to carry out six SH workshops (Table 1). Each workshop aims to advance SH engagement by addressing information sharing, consultation, and some level of involvement, to co-development of the project outputs. Three SH workshops were organized by each CS during the first two years of the project (2022 – 2023) and three workshops are intended to take place within the last two years (2024 – 2025). The main goal of the early workshops was to establish a SH co-creation framework supporting future sustainable development of the regions located within the respective river basins.

To foster consent, SHs were repeatedly asked to sign the PPCF. Thus, at the workshops SHs were (1) provided with printed PPCF documents to sign, (2) given the link and/or QR code to the PPCF, or (3) both options. SHs were provided with links to the PPCF before and after workshops via email, in within workshop invitations or when thanked for their participation. Consent rates were monitored throughout the project using the SH register, and different strategies to obtain and increase consent were discussed across CSs. The importance of completing the PPCF was stressed in all communications with SHs (see the SM3). In addition, during workshops, SHs were asked to consent to the use of their shared information, knowledge, and perspectives for project purposes (example in SM1).

3.2.2. Case study interviews and focus groups

In addition to workshops, in-depth interviews and focus groups were held with selected SHs. The purpose of these activities was to better understand Nexus issues in the respective river basins, with a special focus on understanding existing governance structures and opportunities for change towards a WEF nexus-oriented governance in the CS regions. A team of project partners (policy and governance experts and geographers) supported by the local CS leaders planned and conducted field work in each CS region in year two of the project (see dates in Table 12). The field visits consisted of interviews with selected SHs from the SH register and beyond (using a snowballing method) to represent all nexus domains across national, regional and local scales in each CS country. The interviews lasted one and a half to two hours and were conducted mostly in English and when not possible, with the help of a translator, in the respective local languages. Interviews included one (in most cases) to three interviewees. Each interview started with a project introduction and interview goal, followed by a request to sign an interview specific printed consent form. The consent form was designed for the interviews and was different from the one used for workshops and the PPCF for the SH register. All interviewees signed the interview consent form and were additionally presented with and asked to voluntarily sign the PPCF for the SH register. The focus groups were held online, and participants were asked for verbal consent to record the meeting and for the use of information collected for anonymized research purposes.

3.3. Consent rates: distribution of stakeholders and engagement activities

3.3.1. Relation between consent and stakeholder landscape

Analysis of the relation between explicitly consenting to privacy policy rules and the overall SH landscape requires considering the latter before consenting and after. The “before” consent state (overall SH landscape) was determined using information from the register at month 18 of the project (March 2023) including all SHs in the register, whereas the “after” status (official SH landscape) pertains only to the subset of SHs that consented up to that point in time. All subsequent comparisons relate to the status of the SH landscapes between the two sample sizes, i. e. the distribution of SHs across the WEF sectors of all SHs in the register vs. the distribution of those that had actively consented (i.e. official SH landscape).

The analysis includes quantitative and qualitative data about the SH

Table 1

Overview of workshops (WS) carried out and planned (italics) including the aim of the workshop, their location, and date.

No. of Workshop	Aim	Case Study	Country	Workshop took place in	Date
WS 1	Start the stakeholder engagement process, triggering awareness and building trust on the nexus approach	CS1	Greece	Chrysoupoli (GR)	4 March 2022
			Bulgaria	Gotse Delchev (BG)	7 April 2022
		CS2	Latvia	Online	27 January 2022
			Lithuania	Online	10 February 2022
		CS3	Romania	Craiova (RO) & Online	19 May 2022
WS2	Facilitate analyzing the WEF Nexus in the CS context by discussing with the stakeholders about resources flows, nexus connections and public policies in all WEF sectors, relevant for the current situation and future plans for local development	CS1	Greece	Chrysoupoli (GR)	18 November 2022
			Bulgaria	Gotse Delchev (BG)	24 November 2022
		CS2	Latvia	Riga (LV)	02 November 2022
			Lithuania		
		CS3	Romania	Craiova (RO) & Online	13 October 2022
WS3	Present a preliminary assessment of nexus governance and policy coherence and advance discussions on policies instruments to be included in the NXG tool, involving the input of stakeholders, refining and validating the project research	CS1	Greece	Chrysoupoli (GR)	28–29 March 2023
			Bulgaria		
		CS2	Latvia	Vilnius (LT)	15 June 2023
			Lithuania		
		CS3	Romania	Craiova (RO) & Online	23 May 2023
WS 4	Advance based on the co-created understanding of the Nexus situations in each case study to determine what information is relevant in	All CS	Countries TBD	Format TBD	Planned for Jan - March 2024

(continued on next page)

Table 1 (continued)

No. of Workshop	Aim	Case Study	Country	Workshop took place in	Date
WS 5	order to measure the Nexus footprint and its assessment via the NEPAT tool Share with stakeholders the results on the trade-offs and synergies between the Nexus systems, discussing results of the NEPAT pilot presentations, and the re-assessment and acceptability of policies	All CS	Countries TBD	Format TBD	Planned for Sept-Dec 2024
WS 6	Present and discuss with stakeholders the final results of the engagement process, i.e., the developed NEPAT tool, validation of policies and the achieved agreements	All CS	Countries TBD	Format TBD	Planned for March - July 2025

distribution across WEFE sectors and SH categories, considering (1) the number of SHs (identified and consenting), and (2) the level of power and interest. In a first step, we compared the number of SHs per sector and category before and after consent using data from the SH categorization and calculated the percentage change for each CS (with a 5 % tolerance to consider increase or decrease). Following this, we determined changes in distribution of the power-interest maps using data from the SH differentiation.

3.3.2. Effect of the stakeholder engagement activities on the consent form response rate

The number of SHs that participated at the workshops, interviews and focus groups were collated along with the resulting consent rates and information about the engagement modalities was included. We

Table 2

Number of stakeholders identified and share of stakeholders consenting to engagement after one year of the project (Sept 2022) and 6 months intervals thereafter (March 2023 and September 2023).

	CS1	CS2	CS3	CS4	CS5	TOTAL
Preliminary list	63	75	94	150	153	535
With verified consent by September 2022	12	23	25	10	9	79
With verified consent [% of p-list]	19 %	30.7 %	26.6 %	6.7 %	5.9 %	14.8 %
Preliminary list	71	82	96	173	176	598
With verified consent by March 2023*	25	30	28	14	19	116
With verified consent [% of p-list]	35.2 %	36.6 %	29.2 %	8.1 %	10.8 %	19.4 %
Preliminary list	91	96	108	189	178	662
Consented by Sept. 2023	29	30	34	17	33	143
%	31.9 %	31.3 %	31.5 %	9 %	18.5 %	21.5 %

*Data of signed PPCFs that was crosschecked with the preliminary listing until March 2023. Additional consenting PPCFs were received from stakeholders that were not preliminary listed. They were added afterwards.

P-list: Preliminary list; PPCF: Privacy Policy Consent Form.

contrasted the number of SHs that consented over time as per the time stamp in the EUSurvey tool and related this visually with the engagement activities. This allowed for a qualitative assessment of the effect of certain activities on consent rate increase.

4. Results

4.1. Relation between consent and stakeholder landscapes

4.1.1. Changes in stakeholder numbers

Following the first year of the project, in September 2022, a total of 535 SHs were identified with consent rates varying between 6 % and 31 % across CSs and averaging around 15 % (Table 2). In March 2023, almost 600 SHs were identified by CS leads which increased to almost 700 by mid-2023. Relative consent rates increased in all CSs in March 2023 but dropped again in some CSs in September 2023. The absolute number of SHs that consented to being placed in the stakeholder register increased in all CSs over time. CS5 showed a significant increase in SHs that consented between September 2022 (9) and September 2023 (33). Reaching a stable base of around 30 consenting SHs was considered a success in this context.

Since the SH base can be considered as stable for most CSs in March 2023, the next subsections describe the changes in SH distribution between the identified and the consenting SHs at that time according to their categorization and differentiation.

4.1.2. Changes in categories

4.1.2.1. Nexus sector. Overall, SHs mainly belonged to the water and ecosystem-related sectors. After consent, the general distribution of SHs across sectors and CSs remained roughly the same as before consent, with a predominance of the water and ecosystem sectors over food and energy (Fig. 3). When looking into the specific CSs, the share of these predominant sectors increased in at least three out of the five CSs. The percentage change results (Table 3) showed that the SH distribution across WEFE sectors substantially changed in most CSs. Results indicate that in 85 % of the cases there was a difference greater than 5 % (increase and decrease) in the SH distribution between the before and after consent status (see more in SM4). CS2 and CS5 showed the highest change in sector distribution: in CS2 the representation of the water and energy sectors almost doubled, whereas the food sector share decreased by around 45 %; and in CS5 the energy, food and ecosystem sectors substantially decreased, while the water sector share increased by almost 30 %.

4.1.2.2. Stakeholder tiers and categories. In most cases, identified SHs belong to tier 1, except in CS2 and CS3, where SHs from tier 2 prevail (data in SM5). Distribution of SHs after consent did not substantially change, with tiers 1 and 2 still prevailing in the same CSs, except in CS5,



Fig. 3. Share of each sector within the stakeholder register of each case study in the preliminary list and resulting consenting list. The numbers above the bars indicate number of consenting stakeholders per case and per sector. One stakeholder may belong to more than one sector, thus, percentages do not sum 100 % across sectors; 100 % is the total number of stakeholders in each case study – in the preliminary list and in the consenting list. CS: Case study.

Table 3

Percentage change of the distribution of stakeholders before and after consent.

Sector	Case study				
	CS1	CS2	CS3	CS4	CS5
Water	-0.83% —	93.61% ▲	60.00% ▲	9.84% ▲	29.68% ▲
Energy	-29.00% ▼	98.79% ▲	37.14% ▲	-54.23% ▼	-42.11% ▼
Food	-33.73% ▼	-45.33% ▼	-31.43% ▼	-22.77% ▼	-62.95% ▼
Ecosystem	3.77% —	36.67% ▲	-4.76% —	59.45% ▲	-34.77% ▼

where the share of SHs from tier 3 considerably decreased – in all other CSs, the share of this tier increased. Before and after consent, SHs from tier 1 had the highest share in CS1, CS4 and CS5, whereas for CS3, tier 2 accounted for most of the SH distribution. For CS2, there was a similar distribution of SHs belonging to tiers 1 and 2. In 80 % of the cases there was a change greater than 5 % (Table 4). However, in CS2 there was an

increase in the distribution of tier 3 SHs of above 50 %. As for the decrease in the shares, only two cases (tiers 2 and 3 for CS4 and CS5) presented a negative percentage change, meaning that the shares of these tiers reduced after consent.

Regarding SH categories (Table 5), the only available and complete results for analysis came from CS1, CS3 and CS5. SH categories from the

Table 4

Overview of the percentage change in the distribution of stakeholder tiers for each case study.

Tier	Case study				
	CS1	CS2	CS3	CS4	CS5
Tier 1	-1.22% —	-49.65% ▼	14.29% ▲	8.57% ▲	37.57% ▲
Tier 2	0.24% —	26.15% ▲	-10.56% ▼	-100.00% ▼	2.92% —
Tier 3	6.50% ▲	173.33% ▲	6.40% ▲	48.05% ▲	-80.70% ▼

Table 5

Overview of the percentage change in the distribution of stakeholder categories for CS1, CS3 and CS5.

Stakeholder category	Case study		
	CS1	CS3	CS5
1. Civil society	-	23.21% ▲	-100.00% ▼
2. Public initiatives	-	-	-100.00% ▼
3. Policy makers at local level/municipalities	-21.11% ▼	-70.13% ▼	57.89% ▲
4. Policy makers at national level	-	26.37% ▲	-9.92% ▼
5. Agricultural authorities and representatives	184.00% ▲	-17.86% ▼	-100.00% ▼
6. Energy authorities and representatives	-100.00% ▼	228.57% ▲	-100.00% ▼
7. Water management authorities and representatives	26.22% ▲	-100.00% ▼	128.95% ▲
8. River basin authorities and representatives	-	119.05% ▲	161.65% ▲
9. Environmental protection authorities and representatives	89.33% ▲	46.03% ▲	14.47% ▲
10. Business/private or public enterprises	6.50% ▲	-100.00% ▼	-67.29% ▼
11. Media/science communicators	-100.00% ▼	-100.00% ▼	30.83% ▲
12. Research and academia	70.40% ▲	-	-
13. Other	-	-17.86% ▼	-

policy-making categories (categories 3 and 4) and authorities from the water and environmental sectors (7 and 9) accounted for more than half of the SH pool.

After consent, how the official SH landscape looked like depended on the CS's specific foci. For instance, CS1 and CS2 involve transboundary river basins, striving for optimal coordination between the SHs directly involved in the river basin. In such cases, policy makers at the local level, water management and environmental authorities, as well as public initiatives were among the predominant categories in the respective SH pools. In the other 3 CSs, a common pattern was not that evident. Although policy makers, both at national and local level, and water and environmental authorities were the main categories (CS3 and CS5), SHs belonging to agricultural authorities and civil society also manifested their interest in participating (CS3).

The percentage change results showed that in 46.2 % of the instances the change in distribution was greater than 5 %. With 12.3 % of the cases related to an increase greater than 50 %; and 16.9 % of the cases related to a decrease greater than 50 %. This means that in almost half of the cases there was a substantial change in distribution of the SH categories from before to after consent; with a tendency to decrease (see full data in SM5).

4.1.3. Differentiation: power-Interest maps

Tables 6 and 7 present a summary of the resulting power-interest categorization per CS. It is possible to infer that mainly SHs with high interest gave their active consent. In around 85 % of the cases there was a change from before to after consenting greater than 5 %, almost equally pointing to a decrease in power and an increase in interest distribution. However, these changes were then buffered, in most cases,

resulting in no change of the overall power-interest category; except for CS3 where the landscape before consent reflected a majority of HP-HI SHs that change to LP-HI SHs after consent. Overall, in all cases, both before and after consent, the cross-cutting characteristic of the SH landscapes was a high interest one (see full data in SM6).

4.1.3.1. Nexus sectors, stakeholder tiers and categories. The power-interest maps of the official SH landscape (Fig. 4) showed a general shift towards the bottom right, exhibiting lower power but higher interest SHs than in the overall SH landscape. While the interest level of the food sector SHs remained similar, the interest level of the energy, water and ecosystem sectors increased. With regards to the tiers, tier 3 SHs remained largely the same, however tier 2 SHs shifted to higher interest and less power. The distribution of SHs from tier 1 showed a higher interest with no considerable decrease in power. In terms of categories, the new distribution of policy makers at local level (3), energy authorities (6), environmental protection authorities (9) and business entities (10) showed a decrease in power, while the environmental protection authorities and the business sector SHs were perceived as more interested. Conversely, the media (11) proved to be of high interest and high power, much more than initially expected (see full data in SM7 and SM8).

Overall, the level of power was lower in the official SH landscape across sectors by 10–20 % compared to the overall SH landscape (Table 8). There was a decreasing trend in CS1, CS2, and CS3, with specific decreases of more than 60 % for the food sector in CS2, and an almost 50 % decrease for the energy sector in CS3. However, in CS4, the level of power increased more than 50 % in the energy sector, and in CS5, it increased in all sectors. Across all CSs, in more than 70 % of the

Table 6

Distribution of PI-Levels across case studies, according to the perception of case study teams before (BC) and after consent (AC). Numbers in bold highlight the predominant PI-level for each case study.

PI-Level	CS1		CS2		CS3		CS4		CS5	
	BC	AC	BC	AC	BC	AC	BC	AC	BC	AC
% HP-HI	77.5 %	68.0 %	61.0 %	33.3 %	64.6 %	67.9 %	85.0 %	71.4 %	67.0 %	73.7 %
% HP-LI	0.0 %	0.0 %	0.0 %	0.0 %	15.6 %	0.0 %	1.2 %	0.0 %	0.6 %	5.3 %
% LP-LI	0.0 %	0.0 %	11.0 %	13.3 %	8.3 %	3.6 %	4.6 %	0.0 %	5.7 %	0.0 %
% LP-HI	22.5 %	32.0 %	28.0 %	53.3 %	11.5 %	28.6 %	9.2 %	28.6 %	26.7 %	21.1 %

HP-HI: High power – High interest; HP-LI: High power – Low interest; LP-LI: Low power – Low interest; and LP-HI: Low power – High interest;

Table 7

Overview of the percentage change in the power-interest distribution of stakeholders.

Power Interest level	Case study				
	CS1	CS2	CS3	CS4	CS5
% HP-HI	-12.22% ▼	-45.33% ▼	5.07% ▲	-15.94% ▼	9.90% ▲
% HP-LI	-	-	-100.00% ▼	-100.00% ▼	826.32% ▲
% LP-LI	-	21.48% ▲	-57.14% ▼	-100.00% ▼	-100.00% ▼
% LP-HI	42.00% ▲	90.14% ▲	149.35% ▲	208.93% ▲	-21.16% ▼

cases there was a substantial change towards a less powerful official SH landscape – except in CS5 – and a higher interest official SH landscape – except for the food sector in CS2.

In 50 % of the cases across all CSs and tiers the level of power was considerably lower in the official SH landscape and only in 25 % of the cases it was higher; with the last 25 % remaining roughly the same (Table 9). Specifically, the level of power of tier 1 SHs of the overall SH landscape was higher than that of the official SH landscape, whereas tier 3 showed the reverse. Regarding interest levels, in 65 % of the cases interest levels of the official SH landscape was higher than that of the overall SH landscape, whereas in only 5 % it was lower – the rest remained largely the same. Overall, the main increase in interest corresponded to tier 2 SHs; whereas this tier also presented the greatest decrease in the level of power.

There was a general tendency of power levels to be lower across all categories in the official SH landscape (Table 10), however this was mainly the case for the environmental protection authorities and representatives category, while only in CS5 the media and science communications category showed a higher level of power. The level of interest remained broadly the same or increased, especially for the categories of media and science communication, and environmental and river basin authorities and representatives. These results aligned with the general tendency of a decrease in power level and an increase in the level of interest from before to after consent (see full data in SM8).

4.2. Effect of the stakeholder engagement activities on the response rate to the consent forms

4.2.1. Workshops and interviews

Table 11 summarizes the number of workshop attendees that completed the PPCF after each workshop. Overall, SH workshop attendance varied between 8 and 41 people and was lowest in the face-to-face and hybrid workshops. Attendance rates in workshops 1 and 3 had on average 10 more participants across all cases and were held mostly online. The share of workshop attendees that consented to being placed in the SH register varied between 2 % and 83 %, being on average highest in workshop 2 (60 %). The highest relative consent rates were obtained at workshop 2 (face-to-face) in South Africa (83 %), and the lowest ones in workshop 3 (online) in Italy (25 %). CS3 achieved on average the highest consent rates across all workshops (73 %), with other cases varying between 32 % and 57 %. The highest absolute consent was achieved at the hybrid workshop 1 in CS3 (29) and the lowest absolute consent was recorded at the workshop 2 (face-to-face) in Latvia/CS2 (3).

4.2.1.1. Timeline of change. Fig. 5 shows a timeline of the different engagement events and the respective increases in consent rates. Each CS had different peak periods in which more consent forms were signed. CS1 had its peak by the end of November 2022, CS2 during mid-June 2022, CS3 during mid-May 2022, CS4 during end-May 2022, and CS5 in end-October 2022. Results show a first peak in consent rates for CS2 and CS4 after the interview and workshop activities, respectively.

Consent rate increases were observed mostly around the occurrence of workshops, with moderate increases around WS1 (roughly 5 SHs), somewhat higher rates around WS2 (around 10) and again lower rates around WS3 (around 5). An interesting exception was that CS3 reached a high consent rate early in the project (around 20 SH in mid-May 2022) and subsequently only added a few more SHs with each engagement activity. In contrast, CS5 added many SHs with each workshop (around 6, 10 and 11 for WS1, 2 and 3, respectively). For CS2 (and to some degree also CS1 and CS4), the interviews had the largest effect on consent rates. A lag effect can be observed in all cases where most consents come in after the event. The lag effect could be related to the task of manually adding inputs from printed consent forms into the EUSurvey Tool a few days or weeks after the event. Another reason for the lag is that email reminders are sent to participants with the request to complete the consent form following the event.

5. Discussion

5.1. General findings

In this article, we aimed to assess the influence of consenting to data protection rules on the SH landscape, i.e. the distribution of identified SHs across WEFE Nexus sectors, SH tiers and categories, and the characterization of SHs according to power and interest. The data revealed that SHs that complete the PPCF and thus actively consent to be placed in the NXG SH register shift the SH landscape:

- (1) Towards the water and ecosystems sectors and away from the agricultural/food and energy sectors.
- (2) Towards environmental authorities, water management authorities and river basin authorities.
- (3) Towards high interest SHs in general and HP-HI SHs in particular, and away from HP-LI SHs.
- (4) Towards LP-HI tier 2 SHs, i.e. those interested in applying the project results and products.

The need to consent to a PPCF does not exclude particular groups of SHs. The majority of contact information was taken from the public realm (webpages) thus making their storage and use legal without any particular consent form the actual SH. All SHs, consented or not, were invited to all project activities. Thus, consenting may be perceived as an unnecessary step in these kinds of research projects with SH information that is largely available in the public domain (in contrast to participatory projects with citizens whose information is private). Consenting was perceived by SHs as an act of showing explicit interest in the project activities, results and outputs, almost as a subscription to it.

The resulting official SH landscape, that is active and engaged, is therefore largely (LP-)HI and predominantly from the water sector. Since this is a WEFE Nexus project with a focus on river basins and their (transboundary) management, this is logical but not necessarily desirable. These low power SHs may see an opportunity in EU projects to become visible and have their voices heard, especially in countries where regional and local actors have limited resources and capacity. The

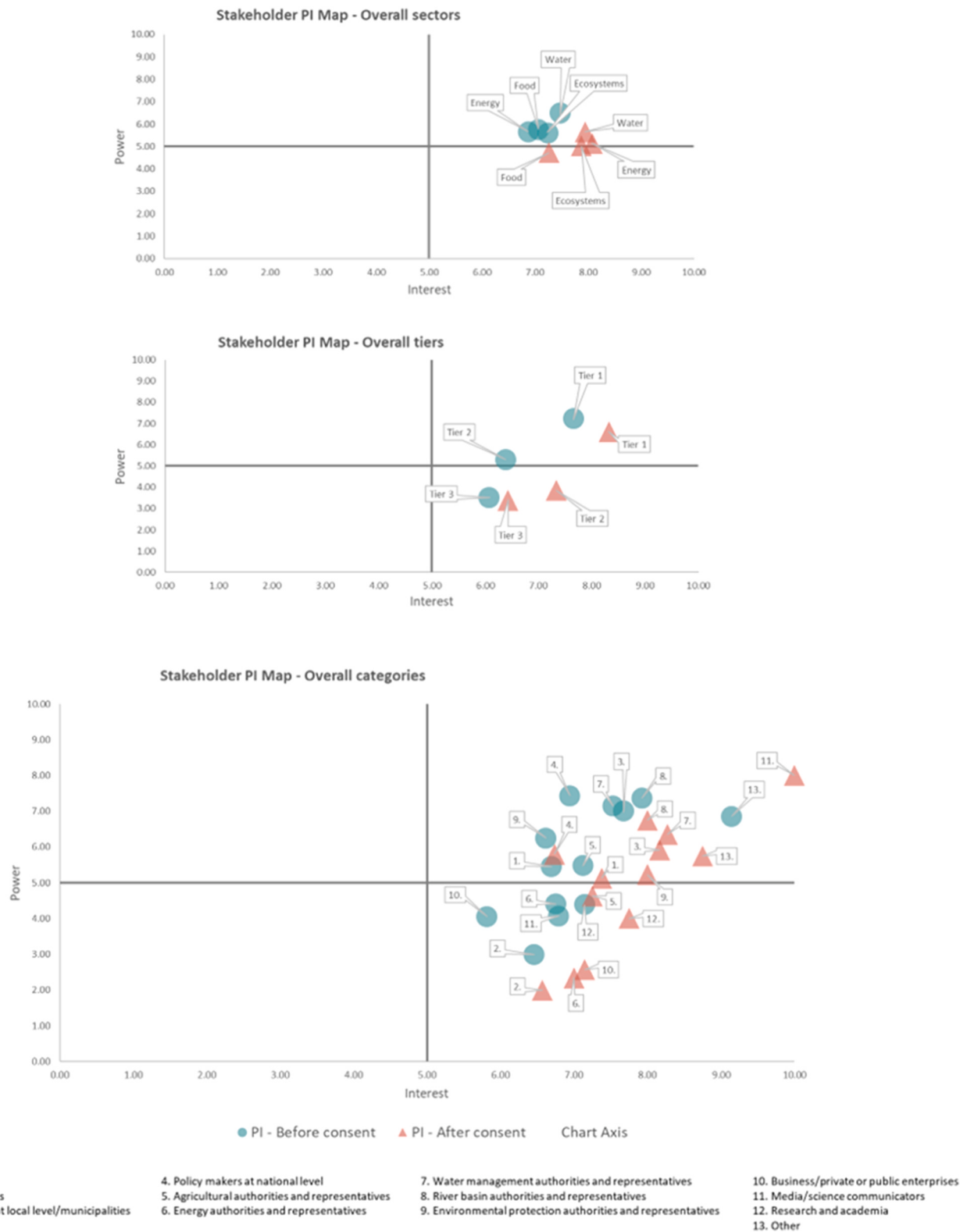


Fig. 4. Overview of the average PI level across all case studies, per sector, tier and category (blue dots – PI before consent; red triangles – PI after consent).

loss of HP-LI SHs and those from the agricultural sector as well as in some cases also the energy and ecosystem sectors limits the possibility of breaking up silos and fostering intersectoral collaboration that is critical for Nexus work. And while the overall SH landscape is always invited to all project activities it is often a subset of the official SH landscape that engages actively, thus reducing the possibility for exchange and mutual

learning.

All CSs exhibit a SH base that is largely HP-HI and consenting drives the SH base further into LP-HI. This is also felt by the current SH group that repeatedly requests high(er) power SHs (mostly HP-LI) to be engaged actively in the project (e.g. national level policymakers) as they perceive that only these high(er) level actors can drive change towards

Table 8

Overview of the percentage change of the power-interest across sectors.

Sector	Power					
	CS1	CS2	CS3	CS4	CS5	Total
Water	-5.92% ▼	-1.18% —	-10.91% ▼	-5.78% ▼	5.63% ▲	-12.67% ▼
Energy	2.44% ▲	-3.75% —	-48.98% ▼	52.11% ▲	12.59% ▲	-9.53% ▼
Food	-15.18% ▼	-62.37% ▼	-29.03% ▼	-2.04% —	14.58% ▲	-17.81% ▼
Ecosystem	-6.85% ▼	-5.66% ▼	-25.28% ▼	2.57% —	6.96% ▲	-10.48% ▼
	Interest					
	CS1	CS2	CS3	CS4	CS5	Total
Water	1.30% —	5.64% ▲	20.82% ▲	10.05% ▲	6.64% ▲	6.22% ▲
Energy	6.27% ▲	9.60% ▲	95.95% ▲	37.96% ▲	6.99% ▲	17.59% ▲
Food	2.79% —	-42.11% ▼	4.05% —	-4.95% —	5.42% ▲	2.89% ▲
Ecosystem	0.04% —	2.70% —	15.71% ▲	11.74% ▲	25.82% ▲	8.81% ▲

Table 9

Overview of the percentage change in the level of power-interest across tiers.

Tier	Power					
	CS1	CS2	CS3	CS4	CS5	Total
Tier 1	-9.08% ▼	-42.75% ▼	-9.35% ▼	3.86% —	-4.18% —	-8.59% ▼
Tier 2	7.94% ▲	0.78% —	-34.00% ▼	-	-30.77% ▼	-26.88% ▼
Tier 3	26.32% ▲	0.00% —	-29.95% ▼	-14.93% ▼	132.26% ▲	-3.78% —
	Interest					
	CS1	CS2	CS3	CS4	CS5	Total
Tier 1	-2.03% —	-5.67% ▼	2.72% —	8.21% ▲	7.66% ▲	8.66% ▲
Tier 2	6.71% ▲	7.41% ▲	37.94% ▲	-	20.62% ▲	14.90% ▲
Tier 3	12.82% ▲	0.00% —	4.41% —	17.09% ▲	-32.16% ▼	5.85% ▲

more integrated working and allow for the required breaking up of silos. The currently consented and engaged SHs feel that such a change is needed and would willingly facilitate its implementation, but currently feel hampered to change procedures and processes due to existing institutional structures.

5.2. Case study specific findings

Particularities exist for certain cases and are context specific. Different cultural backgrounds, socio-economic contexts, climatic conditions and administrative schemes across the five case studies of the project are present. As such, for instance, while in CS2 and 3 consenting SH were mostly tier 2 SHs, in CS1, 4 and 5 these were mostly tier 1 SHs. No clear rationale for these differences can be given. The sizes of the basins in CS2 and 3 are largely different, the maturity of the CSs also diverges with CS1 and 2 having been studied already in previous projects than any of the other, and the distribution of SH sectors also does not provide a clear distinction. The most distinctive feature lies in the common heritage of belonging to the former Soviet Union (albeit part of CS1 also falls into this category). Nonetheless, some context specificities were identified and are described below.

In CS1, the main existing pressures are related to conflicting water uses, especially between the agricultural and energy sectors. Such pressures become even worse taking reduced precipitation and snowfall into consideration, which entails less water available for irrigating crops affecting agricultural income. This is critical for environmental authorities, belonging to tier 1, as the estuary of the Nestos/Mesta River

basin is a protected area (NATURA 2000 and Ramsar Convention) and a sensitive ecosystem where its preservation is a priority. Farmers, categorized under tier 1, are a key stakeholder group directly affected by water shortage while municipal authorities, also categorized under tier 1, represent local decision makers responsible for implementing and monitoring relevant policies at local scale. These SH groups are thus strongly interested in being actively involved in the project and in exploiting its outcomes as their activities are directly linked to core local priorities and the management of vital future challenges.

Representatives of two municipalities of the basin are participating directly as partners in the NXG project. This is crucial in terms of their access to the various levels of governance where final decisions are made. Municipalities constitute the administrative structure responsible for designing strategic plans for local development and mediating between local populations and regional/national authorities. However, the Nestos/Mesta River basin and consequently the two municipalities, are located relatively far from the central administration. In the case of Bulgaria, the Gotse Delchev municipality is one of the most economically underdeveloped regions of the country, which, despite joining the EU in 2007, still has the organizational structure of the previous regime where all decisions were made centrally with little consultation at the local level. Regarding the Greek side, the requirements of European directives and funding have created a principled understanding of the necessity of participating in consultation processes, however, citizens are aware that final decisions are political and are taken centrally, therefore all efforts are aimed at accessing central administration. Finally, it should be mentioned that it is the first time that such kind of

Table 10

Overview of the percentage change in the power and interest across stakeholder groups per CS.

Stakeholder category	Power					Total
	CS1	CS2	CS3	CS4	CS5	
1. Civil society	-	0.00% —	-4.76% ▼	-10.44% ▼	-	-23.40% ▼
2. Public initiatives	-	0.00% —	-	-	-	-69.01% ▼
3. Policy makers at local level/municipalities	-7.39% ▼	0.00% —	-52.17% ▼	-	-15.53% ▼	-22.90% ▼
4. Policy makers at national level	-	0.00% —	-24.04% ▼	-	0.64% —	-16.41% ▼
5. Agricultural authorities and representatives	0.00% —	0.00% —	-23.18% ▼	-	-	-35.06% ▼
6. Energy authorities and representatives	-	0.00% —	0.00% —	-	-	-65.43% ▼
7. Water management authorities and representatives	10.82% ▲	0.00% —	-	5.20% ▲	-9.09% ▼	-15.51% ▼
8. River basin authorities and representatives	-	-	-10.00% ▼	-	10.00% ▲	-14.84% ▼
9. Environmental protection authorities and representatives	5.00% ▲	-	-37.50% ▼	1.12% —	-50.00% ▼	-20.95% ▼
10. Business/private or public enterprises	-40.00% ▼	-	-	-33.90% ▼	0.00% —	-55.74% ▼
11. Media/science communicators	-	-	-	-	51.35% ▲	17.89% ▲
12. Research and academia	0.00% —	-	-	-10.68% ▼	-	-44.00% ▼
13. Other	-	0.00% —	-33.33% ▼	0.00% —	-	-37.11% ▼
Stakeholder category	Interest					Total
	CS1	CS2	CS3	CS4	CS5	
1. Civil society	-	0.00% —	2.56% —	4.72% —	-	10.23% ▲
2. Public initiatives	-	0.00% —	-	-	-	1.81% —
3. Policy makers at local level/municipalities	0.80% —	0.00% —	113.89% ▲	-	8.75% ▲	6.41% ▲
4. Policy makers at national level	-	0.00% —	-16.51% ▼	-	3.35% —	-2.96% —
5. Agricultural authorities and representatives	0.00% —	0.00% —	-0.58% —	-	-	1.79% —
6. Energy authorities and representatives	-	0.00% —	0.00% —	-	-	3.70% —
7. Water management authorities and representatives	0.00% —	0.00% —	-	-2.27% —	-6.67% ▼	9.83% ▲
8. River basin authorities and representatives	-	-	-6.60% ▼	-	-3.13% —	0.93% —
9. Environmental protection authorities and representatives	0.00% —	-	36.05% ▲	16.36% ▲	63.27% ▲	20.90% ▲
10. Business/private or public enterprises	-3.70% —	-	-	30.00% ▲	26.55% ▲	22.95% ▲
11. Media/science communicators	-	-	-	-	27.27% ▲	47.37% ▲
12. Research and academia	-4.76% —	-	-	1.90% —	-	8.50% ▲
13. Other	-	0.00% —	-5.26% ▼	0.00% —	-	-4.30% —

participatory events take place in both countries at local scale, limiting the possibilities for the project team to display the full range of deep interactive activities.

In the case of the Lielupe River basin (CS2), SHs are quite familiar with the formal participatory processes such as requests for public consultations for laws and development plans. In addition, the participatory frameworks usually support the collective forms of participation by e.g., representation at consultative boards. Individual consent from stakeholders thus can require time for trust building and for assessing the value of individual contributions. Workshops conducted in the remote settings at the initial stage of the project fostered a distant communication environment which resulted in low engagement and commitments from participants. A personalized approach through face-to-face interventions resulted in a much larger success in signing the PPCF and commitments to participate in project activities. Thus, the limited number of consented stakeholders may suggest the formation of

a key group of active stakeholders that is interested in the co-creation process and addressing the nexus challenges which may allow for sustained activities on water quality improvement of the river basin.

In the case of the Inkumati-Usuthu River in South Africa (CS5), the stakeholder's decision not to sign the PPCF can be attributed to several factors. This includes the current political climate in which actors are cautious about taking responsibility for actions that could negatively impact their reputation in any way. Actors may have also previously committed to certain actions, however due to limitations (e.g., financial and resource constraints) were unable to fulfill these commitments, which may have had an impact on their reputation. Stakeholders may therefore hesitate to sign the PPCF due to the perceived responsibility associated with the project, fear of committing to specific actions, and concerns about how their involvement may be viewed in their respective sectors. Another contributing factor could be limited time to complete the survey, particularly for public entities within South Africa, who

Table 11

Share of workshop attending stakeholders that consented to being placed in the stakeholder register and type of form in which the PPCF was administered during the workshop. ¹ A physical paper with the QR code was distributed during the WS, 2the link was sent by personalized email to those participants who were not in the stakeholder register.

No. of Workshop	Case Study	Workshop modality	No. of stakeholders that participated	Type of PPCF administered (physical, link, both)	No. of stakeholders that signed the PPCF	Share of workshop attendees that consented
WS 1	CS1	F-t-F	41	link	18	44 %
	CS2	Online	11	link	6	55 %
	CS3	Hybrid	39	link	29	74 %
	CS4	Online	24	link	10	42 %
	CS5	Online	27	link	13	48 %
WS2	Average		28,4		15,2	53 %
	CS1	F-t-F	27	link	18	67 %
	CS2	F-t-F	8	link	3	38 %
	CS3	Hybrid	18	link	15	83 %
	CS4	Hybrid	27	link ¹	8	30 %
	CS5	F-t-F	11	both	9	82 %
	Average		18,2		10,6	60 %
	CS1	F-t-F	37	link	10	27 %
	CS2	F-t-F	10	link ²	5	50 %
	CS3	Hybrid	21	link	13	62 %
WS3	CS4	Online	28	link	7	25 %
	CS5	Online	38	link	16	42 %
	Average		26,8		10,2	41 %

With regards to the interviews, 145 SHs were interviewed across 7 countries (Table 12). Interviews were carried out over a period of nine months.

Table 12

Overview of the dates and number of participants of the interview and focus group activities in each case study.

Case study	Country	Activity: Interview		Activity: Focus group	
		Date	No. of stakeholders	Date	No. of stakeholders
CS1	Bulgaria	14–15 July 2022	13	27 Mar. 2023	3
	Greece	11–13 July 2022	14	31 May 2023	3
CS2	Latvia	6–10 June 2022	19	15 Jun. 2023	6
	Lithuania	14–17 Sep. 2022	18	15 Jun. 2023	4
CS3	Romania	17–21 Oct. 2022	31	23 May 2023*	23
CS4	Italy	4–12 Oct. 2022	27	3 July 2023	3
CS5	South Africa	13–24 Feb. 2023	23	5 June 2023	3

*Policy coherence activity carried out at workshop 3 of the case study.

often face capacity challenges. Furthermore, given that this type of cross-sector project is relatively new in the catchment, stakeholders may not fully understand the project goals or benefits. As a result, they may refrain from signing the PPCF due to uncertainty around its relevance to their own work and objectives.

5.3. Methodological remarks of complying with GDPR for stakeholder landscape knowledge

The fields of biomedical sciences, education, and software and

product development and evaluation have involved SH consent and participation for a long time (Anderson et al., 2017; Daigneault, 2014; Hujainah et al., 2018; Sela, 2018; Sutter et al., 2020; Haddara et al., 2023). Common challenges refer to changes in GDPR rules (Sela, 2018; Stabauer, 2019), properly informed consent (e.g., (Jao et al., 2015; Anderson et al., 2017), and the involvement of relevant SHs (e.g., Hujainah et al., 2018). We addressed these challenges as follows. First, Sela (2018) and Clarke et al. (2019) report challenges in re-collecting individual consent (i.e., asking for consent again) when changing GDPR conditions in education and biomedical sciences, respectively. Additionally, Stabauer (2019) reports that after GDPR conditions change, contrary to their hypothesis, there is no substantial change in the participation of SHs. Since in our case there is no change in GDPR regulations and because studies have not evaluated it, we wondered if and how the stakeholder landscape varies between before (overall landscape) and after (official landscape). Our results indicate that there are changes in the composition of the number and type of stakeholder; hence, the importance of constantly revising the stakeholder engagement plan and adjusting the ways of communicating with SHs. These results align with the recommendations for SH engagement in research of Reed et al. (2009) and Hollmann et al. (2022), highlighting the relevance of identifying stakeholders and adjusting the approach and activities according to the (a) aim, opportunities and challenges of the project, (b) the type and number of stakeholders (filed in a SH register compliant with privacy policies), and (c) SH feedback.

Second, for an informed consent, various strategies have been tested, finding value in digital formats to share information (e.g., via hyperlinks) striving for a concise but comprehensive delivery of information (De Sutter et al., 2020). Both digital and printed versions of the NXG consent form have been used, and, in line with the recommendations of Anderson et al. (2017), our results show the importance of personal interactions with the SHs for consent. Furthermore, Jao et al. (2015) highlight the importance of clearly communicating the aim of the project and how data will be processed to raise awareness and participation of the community – if the community does not understand the project their engagement is unlikely. In our case, even though we used various means of communication and approached stakeholders in

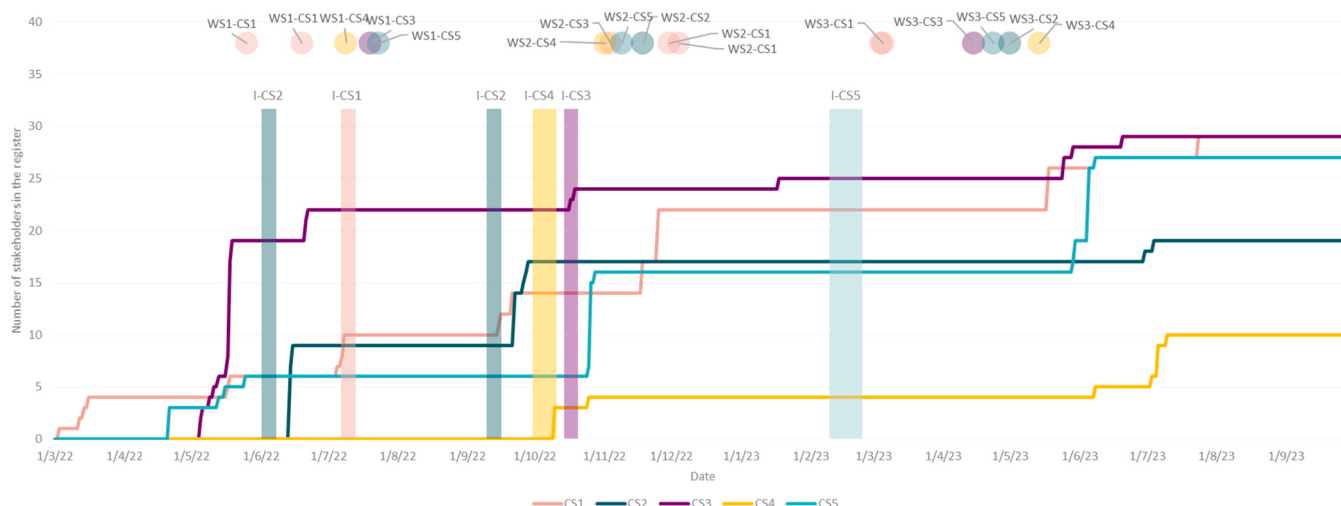


Fig. 5. Number of consenting stakeholders per case study during the first nine months after publishing the consent form. Case Studies 1 and 2 had more than one workshop 1 (WS1) to involve all the transboundary countries. The WS1 of case study 2 took place on February 2022, before the beginning of this timeline. The interview period of CS-5 took place in February 2023, no new consents were received. CS: Case study; I: Interview; WS: Workshop.

workshops and face-to-face activities, having various requests on supporting the description of complex systems such as the WEFE Nexus, may have influenced the interest of stakeholders.

Third, for the identification and later prioritization of SHs, power and interest are commonly used and recommended (Hollmann et al., 2022), and while there are various well-known prioritization methods the description of the quantification methods is vague (Hujainah et al., 2018). Aligned with the findings of Bendtsen et al. (2021) we did find challenges to systematize and represent power-interest results. We addressed these issues by involving local researchers in the estimation of power and interest level, and, while we still rely on their biased perception – also an issue mentioned by Bendtsen et al. (2021) – we (1) provided a clear definition of power and interest, and (2) kept the scoring constant and analyzed the change of that same scoring before and after consent based on the number and type of SHs that consented. This is a first attempt to map the impact of consent on the stakeholder engagement, but we agree that although SH analyses are a flexible tool (Franco-Trigo et al., 2020), clearer guidelines on the application of such methods are needed (Bendtsen et al., 2021).

Additionally, given the heterogeneous SH landscapes and consent rates in this project, sometimes resulting in a low number of SHs, it was challenging to find a method applicable to all CSs for the comparability of the results. One alternative approach for the quantification of the changes in participation, would be to use a participation index, as proposed by Al-Qadi (2020), that separates a project into stages (e.g., planning, implementation) aggregating the possibilities for SH participation in each stage into one index. However, changes in these index results would not have evidenced the impact on consent, as it focuses on the participation instances rather than the number of participants and SHs participating in all stages (not accounting for non-consenting SHs). Thus, given the aim of the paper and the fact that percentage change quantifies changes in rates, the use of this method was chosen.

5.4. Perceptions about consenting, barriers and opportunities towards stakeholder specific engagement forms

In discussion with CS leads several perceptions and observations about the interactions with SHs emerged that we present here. The current portion of SHs that have consented can be considered as a core group of people that have the success of the project and the implementation of its outputs at heart. SHs that filled in the PPCF generally consider this step as a commitment to the project, reaffirming their interest. Some SHs see the interactions within the project activities as

possibilities for open, unpolitical conversations and to brainstorm about opportunities for change without being tied to formal roles and responsibilities. River basin committees, for instance, are perceived as political instruments with many vetted interests around the table, which hamper the possibilities to discuss potentially needed systemic and/or radical changes to procedures. In contrast, the project is perceived as a non-political space for collective visioning. The project also allows SHs to recommend the inclusion of specific SH groups, such as faith communities, that may not usually fall into their remit of interaction thus offering a broader exchange of ideas than would be possible within their daily duties. Similar to the findings of Andersen et al. (2021), we see a more sustained interest from administrative SHs than from private entities or NGOs. As one of the CS leads put it, farmers get bored and are not interested in this kind of scenario planning exercise because it is too abstract for them.

The act of active consent is considered by less interested SHs as a hurdle. It is not seen as a mere administrative checkbox, like when purchasing a product or using an app. Consenting is also perceived as challenging to some due to their institutional role. They may be willing to consent out of personal interest to the project but are unsure about the institutional implications consenting may have. Do they have the authority to engage in this project or do they need consent to engage from higher levels? Are they the right person for the engagement in the project or should it rather be a colleague or a supervisor? What kind of commitment is expected? Participation in all workshops, provision of data, etc? What time commitment is expected? And so forth.

What then drives consent rates? In the NGX project early SH engagement was largely driven by the engagement activities. The workshops showed that higher relative consent rates were attained at face-to-face workshops even if effective attendance rates were generally lower. Nonetheless, high absolute consent rates were observed in hybrid workshops. Thus, going forward hybrid workshops may help reach a wider and more varied range of SHs. Nonetheless, care has to be taken to reduce the risk of SH fatigue. Workshops are considered as intensive and not very rewarding – SHs are asked to provide their input but have the perception of receiving little information or practical knowledge for their daily use. Response rates to the consent form and other administered surveys are low. This is in line with the findings of engagement strategies in other EU projects, where workshops, interviews and surveys were the most prominent engagement strategies and exhibited the same barriers encountered in this project (Andersen et al., 2021).

Workshops were in general more useful in increasing consent rates than interviews and focus groups even though the number of SHs that

were interacted with was not significantly different between the two types of activities. Nonetheless, the strategies chosen to secure the consent of SHs varied. While CS3 secured consent early on prior to any engagement activities, CS2 mostly secured consent through the direct interactions during interviews, and CS5 obtained increasing consent rates largely through workshops. CS leads report that they had best results for consenting when directing personalized emails to SHs either in preparation or as thank you notes to activities. Group emails by sector or SH category were also deemed as useful and had the positive side effect of putting SHs in contact that may not have had interactions before fostering networks.

6. Conclusions

Our study provides evidence supporting the fact that the need to fill in a consent form results in an altered official SH landscape, reduction in actor diversity and difficulty in achieving an inclusive participatory process. However, using data protection mechanisms as an investigative tool allowed the project team to see the biases in the official SH landscape more clearly and raised awareness to the fact that certain SH groups were not engaging in the project as desired. Since most, if not all, information used and stored in the SH register is gained from public sources, the project team is not necessarily required to inform SHs about the existence or use of the information stored in the SH register. However, for transparency purposes the modality of an active consent was chosen.

Methodologically this article showed how tracking consent rates and SH types that fill in the PPCF can help assess the SH base that one is actively interacting with in comparison to the overall SH landscape that one intends to reach, based on their preliminary identification. SH engagement processes are prone to be reduced to 'false' or 'strawman' participation by working only with a limited, often highly interested or interest driven group of stakeholders (Reed et al., 2018). Avoiding and actively curtailing limited participation is difficult and researchers, often leading the SH engagement process in research projects, may be unconsciously biased (Andersen et al., 2021). Therefore, while producing the consent form, translating it to all project languages, and continuously sharing it with SHs throughout the project can be considered as tedious and tiresome to all parties involved, it provided the project team with valuable information to uncover biases and help steer the SH engagement process towards 'deep' or 'real' participation.

Going forward, the current SH base needs to be, and is, reassessed and cross-checked against the needs and aims of the sustainment of project results post-project. The current type of engagement activities chosen in NXG clearly do not reach High Power – Low(er) Interest SHs in a way that encourages them to fill in the PPCF. To reach high(er) power actors, different engagement modalities such as one-on-one conversations, integration of research outputs into existing high level political fora or pitches to members of parliament and similar may be more effective. The planned NXG policy briefs can help provide a hook to interact with said actors. And the use of HP-HI media actors in the current, active, consented SH base may be a strategy to follow also in the other cases.

To the best of our knowledge this is the first article quantifying the change in the SH landscape before and after consent to comply with GDPR. As Andersen et al. (2021) highlight, details on ethical issues and protocols are rarely mentioned, and the effect of GDPR on SH inclusion is yet to be reported. Thus, our study paves the way of quantifying the effect of GDPR on the SH landscape; and although results evidence what common sense would indicate, an official SH landscape involving only highly interested SHs, the visualization and quantification of the landscape change related to different SH sectors, tiers and categories can guide the engagement process towards targeting missing SHs and/or maintaining already interested ones in nexus projects such as NXG.

Author statement

All authors agree with the content of the manuscript and with the order of authorship. This article has not been submitted or published elsewhere, also not parts of it. I will be serving as the corresponding author and will take the responsibility for informing my coauthors in a timely manner of any correspondence regarding the manuscript

CRedit authorship contribution statement

Blicharska Malgorzata: Writing – review & editing, Funding acquisition. **Nanu Florentina:** Writing – review & editing, Funding acquisition, Data curation. **Avellan Tamara:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Kristensen Daniella:** Writing – review & editing, Data curation. **Müller Andrea B.:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation. **Papadopoulou Maria P.:** Writing – review & editing, Writing – original draft, Funding acquisition. **Papadopoulou Chrysaida-Aliki:** Writing – review & editing, Writing – original draft, Data curation. **Munaretto Stefania:** Writing – review & editing, Writing – original draft, Investigation, Data curation. **Breme Ingrida:** Writing – review & editing, Funding acquisition, Data curation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

This project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 101003881.

We thank all CS leads and their groups, particularly the team at Eurac Research including Silvia Cocuccioni and Beatrice Sambo, and Galena Veleva of the Municipality of Gotse Delchev in Bulgaria and Emilia Doncheva of the Municipality of Nestos in Greece.

We thank the anonymous reviewer for their extremely constructive and valuable feedback which helped clarify and improve the manuscript.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.envsci.2025.104029](https://doi.org/10.1016/j.envsci.2025.104029).

Data availability

The data that has been used is confidential.

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